BURDEN OF PROOF IN A MODIFIED HAMBLIN DIALOGUE SYSTEM

In his book on fallacies, Hamblin built a very simple system for argumentation in dialogue he called the Why-Because System with Questions. In his discussion of this system, he replaced the concept of burden of proof with a simpler concept of initiative, which could be described as something like getting the upper hand as the argumentation moves back and forth in the dialogue between the one party and the other. No doubt he realized that the concept of burden of proof was too complex a matter to be dealt with in the limited scope of his chapter on formal dialogue systems. In this paper is shown how an extended version of Hamblin's dialogue system provides a nice way of modeling the phenomenon of shifting of burden of proof in a dialogue, yielding with a precise way of distinguishing between different kinds of burden of proof, and dealing with fallacies like the *argumentum ad ignorantiam* (argument from negative evidence).

Over forty years has gone past since the publication of Hamblin's book *Fallacies* (1970), and there has been much written on the subject of argumentation since that time. One might think that such a book would have long ago ceased to have much value in contributing to the latest research. Such is not the case, however, especially with regard to Hamblin's remarkably innovative chapter 8 on formal dialogue systems, a chapter that provided the basis for much subsequent work. To give an example of a formal dialogue system of the kind he recommended in chapter 8, he built a Why-Because System with Questions. A leading feature of this system is that it has a speech act representing a move in a dialogue in which one party asks the other party to prove, or give an argument to support a claim made by the first party. The Hamblin system has several rules for managing dialogues in which such support request questions are asked, and need to be responded to. For many years these rules have intrigued me, because I feel they are fundamentally important in attempting to build any formal dialogue system designed to be a framework for rational argumentation. But there are many puzzles about these rules, about what the rationales are for them, and about how they should fit in to the specific kinds of dialogues that have been developed since Hamblin's time. This paper is an attempt to solve these puzzles, or at least to throw enough light on them so we can come to better understand how Hamblin's rules should work in the formal dialogue systems that are currently being constructed and studied.

The project will be carried out by examining a simple example of a seven-step dialogue in which one party tries to avoid taking his proper turn by making a clever move that backfires. The dialogue contains an attempt to evade of burden of proof of the kind that has been associated with the *ad ignorantiam* fallacy. It also turns out to be an interesting example for testing the extended version of Hamblin's system. Nowadays we have more sophisticated systems for analyzing burden of proof, for example in legal argumentation (Prakken and Sartor, 2009). However one problem is that now we have such a multiplicity of different complex systems for modeling different kinds of dialogues in different special contexts (for example legal argumentation and scientific argumentation), that there has been a tendency to lose sight of the basics. The nice thing about Hamblin system is that it is simple, and meant to be flexible, because all these more specialized types of formal dialogue systems were in the future in 1970. Also, one can see from the way Hamblin designed the system to be simple, basic and flexible, so that it could be adapted to different kinds of rules about matters like burden of proof that need to be formulated in different ways to be tailored to the specific needs of a given procedural context. The puzzles are solved in this paper by extending Hamblin's system to set up the basic kinds of moves in a dialogue in a general way that is adaptable to more specialized needs and requirements. Thus there are still many foundational questions about formal dialogue systems

that can be answered by examining Hamblin's simple system and his discussions of how the basic rules of making assertions and responding to them should be formulated.

In section 1 a summary of the basic structure of the Why-Because System with Questions is given, and in section 2 a simple example of a disputation is presented that is used to test the extension of Hamblin's dialogue system built in section 5. The argumentation in the example is analyzed in section 6 and evaluated in section 7, using the new dialogue system. The solution to the problem is given in section 7 and the conclusions are summarized in section 8.

1. Hamblin's Why-Because System with Questions

Hamblin (1970, 265-276) built a simple dialectical system, called a Why-Because System with Questions, designed to show that problems of organizing commitments can be solved. There are two participants called White and Black. By convention, White moves first, and then the two parties must take turns making moves. The language is that of propositional calculus, but it could be any other logical system with a finite set of atomic statements (265). As each party moves, statements are either inserted into or retracted from the commitment set of the party who made the move. A record of each party's commitments is kept throughout the dialogue and updated at each move. On Hamblin's definition, "a speaker is committed to a statement when he makes it himself, or agrees to it as made by someone else, or if he makes or agrees to other statements from which it clearly follows" (Hamblin, 1971, 136). On Hamblin's view, a commitment is not necessarily a belief, although a speaker's commitment to a proposition can often be an important indicator that he or she believes that this proposition is true. Acceptance can be treated for our purposes in this paper as equivalent to commitment. Commitment is a function of the moves each party has made in a dialogue.

At each move in a dialogue, a participant is allowed to say various things called locutions by Hamblin, but nowadays we would call them speech acts used in a dialogue. The names given below for the types of locutions are mine, but reflect Hamblin's intent. In this paper a careful distinction is drawn between the notion of statement and assertion. The concept of a statement will be taken to be equivalent to the concept of a proposition. Only propositions, or statements if you like, are the bearers of truth values. An assertion is treated as a kind of speech act. More precisely the making of an assertion is described as an action taking place in a dialogue when a participant puts forward as an assertion is a claim made. In this paper, therefore, the speech act of going forward with an assertion will often be described equivalently as the making of a claim by asserting a particular proposition. An assertion, in other words, has three elements: the party who made the assertion, the proposition that was asserted, and the move in an orderly dialogue at which the assertion was made.

Assertion: 'Assertion A' is the speech act of putting forward a statement. When a party asserts a statement, it goes into his commitment set. In special instances a party can also say 'Assertions A, B'.

Retraction: 'No commitment A' is the speech act of retracting a commitment, assuming that the party was previously committed to A. If he was not committed to A when he said 'No commitment A', he could simply be making it clear that he is not committed to A, even though in the simplest dialogue system of this sort, both parties can see all the statements in both their own commitment set and the other party's.

Yes-No Question: 'Question A, B, …, Z' is the speech act of asking whether the hearer thinks that selected statements are true or not.

Support Request: 'Why A' is a request for the other party to supply an argument that would

give reason for him to accept A. Such an argument needs to have A as its conclusion and it needs to have one or more premises.

Resolution Request: 'Resolve A' is a request for the addressee to make clear where he stands with respect to some instance where he has committed himself to both A and not-A.

This last type of move is important for Hamblin, as he is interested in modeling a Socratic-style discussion where the questioner leads the respondent to commitment to an inconsistency.

Hamblin defines his general notion of a dialogue containing moves and locutions more precisely in his 1971 paper. He begins (130) with a set of participants *P* and a set of locutions *L*. He defines a locution-act, which amounts to a speech act used by a participant in the dialogue, as a set of participant-locution pairs (1971, 130). For example, $\langle P_0, L_4 \rangle$ is a locution act where P_0 is the first participant and L_4 is the fourth type of locution allowed in the dialogue. For example, L_4 may be the asking of a why-question. A dialogue of length *n* is defined as a member of a set of sequences of location acts. He illustrates this definition by giving an example of a small dialogue of length 3: $\{\langle 0, P_0, L_4 \rangle, \langle 1, P_1, L_3 \rangle, \langle 2, P_0, L_2 \rangle\}$. In this example, participant P_0 starts the dialogue at move 0 by uttering a locution of type 4. At move 1, participant P_1 replies by putting forward a locution of type 3. At a move 2, participant P_0 replies using a locution of type 2. Generally a dialogue is an ordered sequence of moves of this sort. In Hamblin's view, how any particular type of dialogue is defined depends on what locutions are allowed and how these locutions or speech acts are defined.

For our purposes, as noted above, we can treat the speech act of making an assertion as equivalent to the act of making a claim. The important things about making a move fitting this speech act are that (i) it commits the speaker to the statement made, and (ii) it represents a strong form of commitment that commits the speaker to defending the claim, if asked to do so (Walton and Krabbe, 1995). So for our purposes we can work with what we will call a Why-Because System, a simpler system that has only assertions, retractions and support requests, but that can be made more complex by the addition of other speech acts and rules.

Hamblin (1970, 166) also has a number of syntactical rules for his Why-Because System with Questions. One of these rules is especially significant. When simplified into a form suitable for a Why -Because System, it is the rule that when one party asks the question 'Why A?', the other party must reply by putting forward one of the following three speech acts: Assertion A; No commitment A; Statements B, B $\rightarrow$ A (where $\rightarrow$ represents the material conditional of propositional calculus). Let's call this rule the Three Responses Rule. It is this particular rule that appears to be most closely related to the notion of burden of proof. However, it is not the same thing as the standard rule for burden of proof that requires any party who has made a claim to back up that claim with support if challenged to do so by the other party in the dialogue. It is a different rule because it allows the party to whom the why question is addressed the two other options of saying 'Assertion A' or 'No commitment A'.

This rule also brings in a number of other complications in that it relates to two other rules for formal dialogue systems that Hamblin (1970, 271) considers, even though he does not require them as mandatory rules for the Why-Because System with Questions. One is the rule that 'Why A?' may not be asked unless A is a commitment of the hearer and not of the speaker. This rule would obviously affect the three response rule. Indeed it would even conflict with it, because there is no need to allow the replies 'Assertion A' and 'No commitment A' if 'Why A?' may only be asked if A is not a commitment of the hearer. The second rule relates to the support answer to a why question, and it relates to the commitments of the two parties. This rule (Hamblin, 1970, 271) requires that the answer to a why question, if it is not 'Assertion A' or 'No

commitment A', must be in terms of statements that are already commitments of both speaker and hearer. Let's call this rule the Commitment to Premises (CtP) Rule. Hamblin does not advocate CtP. Indeed, he describes it as "an unnecessarily strong rule" (271). However, it is useful to take this rule into account, because it closely relates to the support request speech act for the Why-Because System formulated above, as will be shown when we go on to discuss how to more precisely formulate this rule.

2. An Example Argument

The following dialogue is a disputation between two parties, Alfred and Dana, on the issue of whether Bob stole Kathy's garden rake. Alfred has made the allegation that Bob stole Kathy's rake. Dana claims that Bob did not steal Kathy's rake. Thus there two sides to the dialogue, and each side makes a claim that is the negation of the claim put forward by the other side. The two parties take turns engaging in argumentation. The seven moves in the dialogue are shown in table 1. Dana opens the dialogue at move 1 by asking Alfred to prove that Bob stole Kathy's rake. He poses a why question asking Alfred to prove his claim. At move 2, Alfred responds by offering some evidence to support his claim. Alfred replies that Bob took the rake from Kathy's yard. At move 3, Dana follows up with another why question, asking Alfred to support his assertion made at move 2. A move 4 Alfred responds to Dana's request by offering some evidence that supports his previous claim that Bob took the rake from Kathy's Yard. He offers some witness testimony, saying that a third-party, Mary, saw Bob take the rake from Kathy's yard.

DANA	ALFRED
1. WHY [Bob stole Kathy's rake]?	2. Bob took the rake from Kathy's yard.
3. WHY [Bob took the rake from Kathy's yard]?	4. Mary saw Bob take the rake from Kathy's yard.
5. Mary has lied in the past.	6. WHY [Bob did not steal Kathy's rake]?
7. Bob has a bill of sale showing he bought the rake.	

Table 1: The Rake Theft Dialogue

Up to move 4, Alfred seems to be winning the argument. At move 5, however, Dana puts forward an argument that attacks Alfred's argument made at a move 4. This argument may not be strong however, because Alfred could easily respond to it in various ways. For example, he could argue that even though Mary has lied in the past, that fact is not a good reason to think that she might be lying in this instance. Or he could question whether Mary has lied in the past, and challenge Alfred to prove that claim. But instead of making either of these moves, Alfred has taken a radically different step in the dialogue by asking Dana to prove that Bob did not steal Kathy's rake.

This move can be described as an attempt to shift the burden of proof to the other side. Some might say that this move is improper, even amounting to committing of the fallacy of argument from ignorance (the *ad ignorantiam* fallacy), because Alfred is merely trying to avoid taking his proper turn by responding to Dana's previous argument that Mary has lied in the past. It seems to be a clever move, but in this instance it backfires. For at move 7, Dana makes the surprising claim that the rake was not Kathy's property. At move 7, when Alfred asks Dana to prove this

claim, Dana replies with an argument that could still be open to critical questioning or attack, but in the absence of a convincing refutation looks like persuasive evidence.

The rake theft example is only a very simple one, made up of seven moves. But it has three Hamblin-style why questions among the seven moves, and the dialogue presents some other interesting features because it contains what appears to be an attempt to evade of burden of proof of the kind that has been associated with the *ad ignorantiam* fallacy. It contains other interesting features of argumentation, as will be shown below, and it will turn out to be an interesting specimen for us to try to analyze using the tools presented in Hamblin's Why-Because System with Questions. It is important to note that the example is not an instance of legal argumentation, but looks similar in outline to the kind of argumentation that could take place in a criminal case of theft. Is not meant to represent a case that has gone to court, or where a criminal charge has been made.

3. Burden of Proof

In Hamblin's Why-Because System with Questions, any assertion made by either party can be challenged, and when an assertion is challenged, the party who made the assertion is obliged to either prove it at his next move or give it up. This way of handling burden of proof is common in many other approaches. The rule that when challenged to defend an asserted proposition, one must either defend it or else retract it is widely but not universally, held by philosophers (Rescorla, 2009, 87-88). Some philosophers, for example Brandom (1994, 177), claim that there are exceptions, like the propositions 'There have been black dogs' and 'I have ten fingers'. The rule governing burden of proof in (van Eemeren and Grootendorst, 1992, 208) requires that "a party that advances the standpoint is obliged to defend it if the other party asks him to do so". This rule initially appears to be similar to rule 8a of the dialogue system PPD of Walton and Krabbe (1995, 136), which says, "If one party challenges some assertion of the other party, the second party is to present, in the next move, at least one argument for that assertion". There may be important differences between these two rules, however, once we try to specify more precisely what each rule is intended to do in a dialogue system.

The concept of formulating a standpoint in a critical discussion refers to the initial conflict of opinions set in place at the opening stage of the dialogue where the fundamental issue of the dialogue is stated and agreed upon by both parties. When we say that the fundamental issue of the dialogue has to be stated and agreed upon by both parties at the opening stage, are stating that the unsettled issue to be discussed as to be formulated in order for normative judgments to be made on matters like whether an argument is relevant. In other words, the parties must agree on what the dialogue is supposed to be about. It is possible, nevertheless, to have discussions between parties who disagree even on what the fundamental issue of the dialogue should be. This kind of discussion needs to take place at the opening stage, and what the issue is needs to be settled at that stage, before the dialogue can properly proceed to the argumentation stage. There is also an interesting kind of exception coming out. The dialogue can shift to a different level called a metadialogue (Krabbe, 2003), in which the parties, perhaps assisted by a mediator, a judge or some other third party, can sort out procedural matters, for example whether the issue was correctly formulated at the opening stage. Another problem that sometimes needs to be sorted out by shifting to a metadialogue is the burden of proof. However, in this paper, we shall be exclusively concerned with problems of the shifting of burden of proof that take place during the argumentation stage itself, and were no shifting to a metadialogue is being considered.

Given that the fundamental issue of the dialogue has been stated and agreed upon by both parties at the opening stage, the rule that the party is obliged to defend its standpoint if the other party asks him to do so seems to refer to a kind of burden of proof set at the opening stage that then governs the various moves that are made during the argumentation stage. It is helpful now to bring forward a broader distinction applies not only in legal argumentation but that can be applied to conversational argumentation generally. This is the distinction between global and local burdens of proof (Walton, 1988). Global burden of proof is set at the opening stage of a dialogue, applies through the whole argumentation stage, and is used to determine which side was successful or not when a ruling needs to be made when it is determined who won or lost at the closing stage. In contrast, local burden of proof applies to speech acts made in moves during the argumentation stage of a dialogue. For example, if one party makes a particular assertion during the argumentation stage and the other party challenges that assertion, then the normal rule is that the party who made the assertion must supply some kind of support using an argument to back it up. Hamblin tells us (1970, 274) that the concept of burden of proof is replaced in his system with the simpler concept of initiative, which appears to coincide with the concept of local burden of proof. The burden of proof rule in the dialogue system PPD is local because it applies during the sequence of moves in the argumentation stage where one party challenges some specific assertion made by the other party at a previous move. The concept of formulating a standpoint in a critical discussion is one of global burden of proof that applies over the whole sequence of dialogue from the opening stage to the closing stage.

There is a growing literature on burden of proof in argumentation (Kauffeld, 2003) and in work on formal dialogue models in artificial intelligence (Prakken, Reed and Walton, 2005; Gordon, Prakken and Walton, 2007; Prakken and Sartor, 2009). Importantly, this work has distinguished several types of burdens in persuasion dialogue, as opposed to the widely accepted traditional assumption that there is a single concept of burden of proof. In legal argumentation in a trial there is a burden of persuasion set at the opening stage of the trial, and a burden of production of evidence is set as argumentative moves are made back and forth by the two sides during the argumentation stage. The burden of persuasion specifies which party has to prove some proposition that represents the ultimate claim to be proved in the case. The judge is supposed to instruct the jury on what proof standard has to be met. Whether this burden has been met or not is determined at the end of the trial. The burden of persuasion never shifts from the one side to the other during the whole proceedings. The burden of production specifies which party has to offer evidence on some specific issue that arises during a during the argumentation stage of the trial. According to recent work in artificial intelligence and law (Prakken and Sartor, 2009, 228), there is also a tactical burden of proof that is decided by the party putting forward an argument at some stage during the proceedings. The tactical burden is not ruled on or moderated by the judge. It pertains only to the two parties contesting on each side, enabling them to plan their argumentation strategies. The arguer must judge the risk of ultimately losing on the particular issue being discussed if he fails to put forward enough evidence to fulfill his tactical burden of proof. In legal argumentation, the burden of persuasion is a global burden of proof, whereas the burden of production and tactical burden are both local burdens of proof.

4. Situating Support Requests in Types of Dialogue

One can see from Hamblin's (1970, 256) distinction between formal and descriptive dialectic that he envisaged the advent of diverse formal dialogue models that can be applied to different

kinds of discussions formats like those found in a legal trial or legislative debate. But he did not go so far as to make a systematic attempt to define or classify these different types as goal-directed structures. Since then, the literature has gone on to build formal models of different types of dialogue. A formal dialogue is defined as an ordered 3-tuple ⟨O, A, C⟩ where O is the opening stage, A is the argumentation stage, and C is the closing stage (Gordon and Walton, 2009, 5). At the opening stage, the participants agree to take part in an identifiable type of dialogue that has a collective goal.

One might raise the objection here is that it is improper to speak about the collective goal of a dialogue type, because neither dialogues nor dialogue types are sentient entities. Only participants may have goals, and it is improper to speak of the dialogues themselves as having goals. This point is disputable, but it is not at all obvious that only sentient beings can have goals. Activities can also have goals. Also, collective bodies, like corporations or states, are not sentient beings (even though sentient beings belong to them) can have goals over and above the individual goals of their members. For example, it is typical for organizations, like corporations for example, to formulate a "mission statement" that explicitly asserts what the founders or members have agreed upon to be the collective goal of the organization.

In formal dialogue systems the goal of the dialogue needs to be distinguished from the individual aims of the participants, and even from their shared purposes, in order to address the problem that in real conversations, some people engage in apparently purposeful interactions merely to distract or waste the time of the other participants. It is precisely for this reason that the goal of an activity needs to be distinguished from the individual aims of the participants. In a deliberation dialogue, for example, the goal of deliberation, namely reaching a decision on how to act, is recognized, independently of whether any or all of the participants are seriously deliberating in order to fulfill the goal of reaching a rational collective decision on what to do.[1]

During the argumentation stage, the two parties, just as illustrated by the Hamblin Why-Because System with Questions, take turns making moves containing a speech act, like asking a question, making an assertion, or putting forward an argument to support a claim. Just as in Hamblin's dialogues, when each party makes a move, statements are inserted into or retracted from his/her commitment store. Dialogue rules (called protocols in AI) define what types of speech acts are allowed, when each type of speech act is allowed as move by a party, and how each speech act made in a move can be replied to at the next move by the other party (Walton and Krabbe, 1995). The type of dialogue is determined by its initial situation, the collective goal of the dialogue shared by both participants, and each individual participant's goal.

The seven basic types of dialogue recognized in the argumentation literature are shown in table 2.

TYPE OF DIALOGUE	INITIAL SITUATION	PARTICIPANT'S GOAL	GOAL OF DIALOGUE
Persuasion	Conflict of Opinions	Persuade Other Party	Resolve or Clarify Issue
Inquiry	Need to Have Proof	Find and Verify Evidence	Prove (Disprove) Hypothesis
Discovery	Find an Explanation	Find Suitable Hypothesis	Discover Best Hypothesis
Negotiation	Conflict of Interests	Get What You Most Want	Reasonable Settlement
Info-Seeking	Need Information	Acquire or Give Information	Exchange Information
Deliberation	Practical Choice	Co-ordinate Goals/Actions	Decide Best Action
Eristic	Personal Conflict	Hit Out at Opponent	Reveal Deeper Conflict

---

[1] I would like to thank Erik Krabbe for bringing out these helpful points in answer to my questions about dialogues having collective goals in an email dialogue on October 15, 2011.

Table 2: Seven Basic Types of Dialogue

Persuasion dialogue is adversarial in that the goal of each party is to win over the other side by finding arguments that defeat its thesis or casts it into doubt. 'Persuasion dialogue' has now become a technical term in artificial intelligence, and there are formal computational models of it (Prakken, 2006). Critical discussion (van Eemeren and Grootendorst, 1992) is classified (Walton and Krabbe, 1995) as a type of persuasion dialogue.

One needs to raise the question of what the rationale is for having a burden of proof in a persuasion dialogue. The aim of each party in a persuasion dialogue is to try to get the other party to make assertions, and then use these assertions as commitments to prove one's ultimate conclusion. The best defensive strategy is to make as few commitments as possible yourself, and the best offensive strategy is to try to get the other party to make as many commitments as possible. But once a proponent has made such a claim, and it has been challenged by the other side, it is generally in her interests to support it as strongly as possible by convincing arguments. Thus there would seem to be no strategic reason to have back up your assertion in a persuasion dialogue if you see the persuasion dialogue as a zero-sum game in which the goal of each party is to persuade the other, and the winner is the party who first accomplishes this aim. For example, in the critical discussion type of dialogue of van Eemeren and Grootendorst, each party has the ultimate goal of persuading the other to accept his or her thesis. The first party to do this wins, and the other party loses. The goal of resolving the conflict of opinions is accomplished when one party produces an argument that proves his or her thesis. In this type of dialogue both parties have plenty of incentive to support their assertions needed to prove their final thesis. No further incentive, in the form of a burden of proof rule, is needed.

For example, Hahn and Oaksford (2007, 47) agree that it makes sense to have a global burden of proof at the opening stage of a critical discussion, but they question why it we need to have a local burden of proof for each individual claim in an argumentative exchange. In their opinion the risk of failing to persuade by not providing proof of some particular claim that has been questioned is a relatively small factor in the outcome of the dialogue. They see the local burden of proof as "entirely external to the dialogue and not a burden of proof in any conventional sense" (Hahn and Oaksford, 2007, 47). This questioning of what function burden of proof has in a persuasion dialogue is quite legitimate.

Inquiry is quite different from persuasion dialogue because it is cooperative in nature, unlike persuasion dialogue which is much more adversarial. The goal of the inquiry is to prove that a statement designated at the opening stage as the hypothesis is true, using a high standard of proof. A central goal of inquiry is to prove a hypothesis to a sufficiently high standard so there will be no need to reopen the inquiry once it has been closed. Thus meeting a burden of proof is fundamentally important in an inquiry.

Deliberation is also a collaborative type of dialogue in which parties collectively steer group actions towards a common goal by agreeing on a proposal that can solve a problem affecting all of the parties concerned while taking their interests into account (McBurney et al. 2007, 98). At the opening stage, the governing question cites a problem that needs to be solved cooperatively by the group taking part in the deliberation, a problem that concerns choice of actions by the group. During a later stage, proposals are put forward that offers answers to the governing question. The goal of the dialogue is not to prove or disprove anything, but to arrive at a decision on which is the best course of action to take.

Hamblin's remark (1971, p. 137) that his dialogue systems are "information-oriented" suggests that they should be classified as information-seeking dialogues where the collective goal of the dialogue is the exchange of information between the participants. But his discussions of rules for his Why-Because System with Questions strongly suggest a persuasion type of dialogue. A persuasion dialogue is one where the proponent has the goal of getting the respondent to commit to a thesis designated at the opening stage of the dialogue. She can only accomplish this goal by presenting an argument that fits a valid form of inference and has premises that the respondent is committed to. This aspect of persuasion dialogue is particularly strongly suggested by Hamblin's formulation of the CtP Rule. If one party is going to justify a statement, surely she needs to use an argument with premises that are commitments of the other party. Otherwise the argument will not be useful to rationally persuade the speaker to come to accept the statement that needs justification. Persuasion, in this sense (referring to rational persuasion), refers to the effecting of a change in the respondent's commitment set (Walton, 1989). If the proponent can carry out this designated task, called the burden of persuasion by Prakken and Sartor (2009), she wins the dialogue as a whole. However, she typically has to use a lengthy chain of arguments to persuade the respondent one step at time, and the respondent has possibilities for retracting his commitments along the way.

5. Specifications for a Why-Because System

Hamblin's approach of discussing rules of dialogue in a flexible way, instead of going ahead to build precise systems with rigid rules, seems wise in retrospect. It is a precursor of the approach of Reed (2006), who has advocated assisting with the computational work of building a multiplicity of dialogue systems for many diverse applications in computing through what he calls a DSS (dialogue system specification). This approach provides a more convenient method for setting up formal dialogue systems of kinds that are useful for modeling argumentation. For our purposes we don't need to worry about resolution requests or yes-no questions, and we can work with an even simpler specification system that lacks these speech acts. We are primarily interested in burden of proof, so we mainly need to be concerned with support requests and assertions.

The problem taken up taken up in this section is how to build a DSS that is an extension of Hamblin's system and that has capabilities for dealing with argumentation structures that were unknown in 1970. What is needed to cope with burden of proof is a support response mechanism that is more inclusive than the one considered by Hamblin. He used a deductive system of propositional calculus, or some comparable deductive system of classical logic, as his language for the Why-Because System with Questions. But at this point in the development of formal dialogue systems, it is necessary to take defeasible reasoning into account. The rake theft dialogue illustrates this need very well, for nearly all of the arguments put forward in it are defeasible. We need to allow a participant who responds to a request for support of a claim to use defeasible rules of inference as well as deductive rules of inference.

In this new system, support requests have to take a special form. There is only one rule of inference, modus ponens (MP), but it can take two forms, strict MP and defeasible MP. Strict MP, familiar in deductive logic, has a conditional premise that is not open to exceptions. Defeasible MP has a conditional premise that is open to exceptions (Verheij, 1999, 115; Walton, 2002, 43). The strict MP form of argument that we are familiar with in deductive logic has one premise that is a material conditional $\rightarrow$. It has this form: $A \rightarrow B$; A; therefore B. Defeasible MP

has the following form, where A => B is the defeasible conditional: A => B; A; therefore B. For example, if something is a bird then generally, subject to exceptions, it flies; Tweety is a bird; therefore Tweety flies. This argument is the canonical example of defeasible reasoning used in computer science. If we find out that Tweety is a penguin, the original defeasible MP argument defaults. It is shown in (Bex, Prakken, Reed and Walton, 2003) how defeasible conditionals of these kinds can be treated as generalizations in legal reasoning, and the same point applies in a case of ethical reasoning like the rake theft example.

For this new Why-Because System (WB System) we need to use a defeasible logic. Defeasible logic (Nute, 1994; 2001) is a rule-based non-monotonic formal system that models reasoning used to derive plausible conclusions from partial and sometimes conflicting information. A conclusion derived using defeasible logic is subject to retraction if new information that comes in showing there is an exception to the general rule. The basic units of any system of defeasible logic are facts and rules. There are two kinds of rules, strict rules and defeasible rules. Facts are atomic statements that are accepted as true or not within the confines of a type of dialogue. To prove a conclusion using defeasible logic you have to carry out three steps (Governatori, 2008): (1) give arguments for the conclusion to be proved, (2) consider all the possible counter-arguments that can be offered against the conclusion, and (3) defeat these counter-arguments by either showing that some premises in them do not hold or by producing stronger counter-arguments against them. Defeasible logic moves forward in a dialectical fashion by bringing forward the pro and contra arguments relevant to a claim at issue. The conclusion at issue is proved if the arguments supporting it are stronger than the arguments against it. In the dialogue system ASD (Reed and Walton, 2007) defeasible argumentation schemes can be used as inference rules.

These considerations take us back to the support request speech act in the WB System formulated in section 1. In this system, the speech act 'Why A' is taken as a request for the addressee to supply an argument that would give the speaker a reason for him to accept A. What is requested is an argument with A as its conclusion and it needs to have one or more premises. In the WB System there are only two rules of inference that the addressee can use for this purpose, deductive MP and defeasible MP. This approach is broader than Hamblin's dialogue system, which had no provision for use of defeasible inference rules. One might ask whether other rules of inference can be added. For the present, there are controversies about which rules can be added. The current trend in applications of defeasible logic in artificial intelligence is to use defeasible MP, but not to use other forms of inference like contraposition and modus tollens (Caminada, 2008, 111). Two systems of defeasible logic of this sort are (Reiter, 1980) and (Prakken and Sartor, 1997).

Hamblin's system has the rule that any assertion made by one party is open to challenge by the other party. This rule is appropriate for certain types of dialogue, like the Socratic style of dialogue where all assumptions are subject to critical questioning. However, it has been emphasized by van Eemeren and Grootendorst (1992) that resolving a conflict of opinions by a critical discussion depends on both parties agreeing to common starting points. They agree at the opening stage not to dispute these propositions because challenging them during the argumentation stage would a waste of resources. An example would be the proposition 'Los Angeles is in California'. Continually challenging such propositions could well hinder the goal of resolving the issue at stake. A proposition accepted by both parties as common knowledge should not have to be proved, and cannot be disproved, at least within the confines of the critical discussion that is underway.

In law, as well, propositions that any reasonable person would say that there is no doubt about do not need to be proved. They are accepted by judicial notice. Propositions admitted into evidence in a trial need to be proved, but if every single assumption needed to be proved, it might take years to solve even the simplest case. Judicial notice is a rule in the law of evidence that allows a proposition to be introduced as evidence in a trial if its truth so well known that it is acceptable as common knowledge.

Common sense systems in artificial intelligence also contain many examples of common knowledge. The open mind common sense system (OMCS) includes such propositions as 'If you hold a knife by its blade then it may cut you.' and 'People pay taxi drivers to drive them places.' under the heading of common knowledge (Singh, Lin, Mueller, Lim, Perkins and Zhu, 2002, 3). Freeman (1995, 269) classified a proposition as a matter of common knowledge if many, most or all people accept it.

Hamblin (1970, 278) recognized the need to have "popular beliefs" in a dialogue system for representing debates and other real instances of argumentation. He proposed having a list of statements in the dialogue representing commonly accepted beliefs (278). Accordingly, in the new WB system, each participant has a subset of its commitment set called a common knowledge set. This set contains propositions accepted as common knowledge by both parties at the opening stage of the dialogue. These commitments are different from the other commitments in a participant's commitment set because they cannot be retracted once each participant has agreed to them at the opening stage. Another feature they have is that when one of them is asserted, it does not have to be proved, and is even immune from challenge by the other party. Hence there are limits on burden of proof in the WB System. A first party does not have a burden of proof to support his assertion with an argument when a second party challenges it if the proposition asserted is in the common knowledge commitment set in the dialogue. A stronger version of the WB system, which I call WB+, even has a rule forbidding such challenges. WB and WB+ are not presented as complete formal dialogue systems, but as dialogue system specifications following the style of Hamblin's discussion of rules summarized in section 1.

6. Analysis of the Argumentation in the Rake Theft Example.

A dialogue representing a very simple analysis of the arguments on both sides in the rake theft example is represented in figure 1.
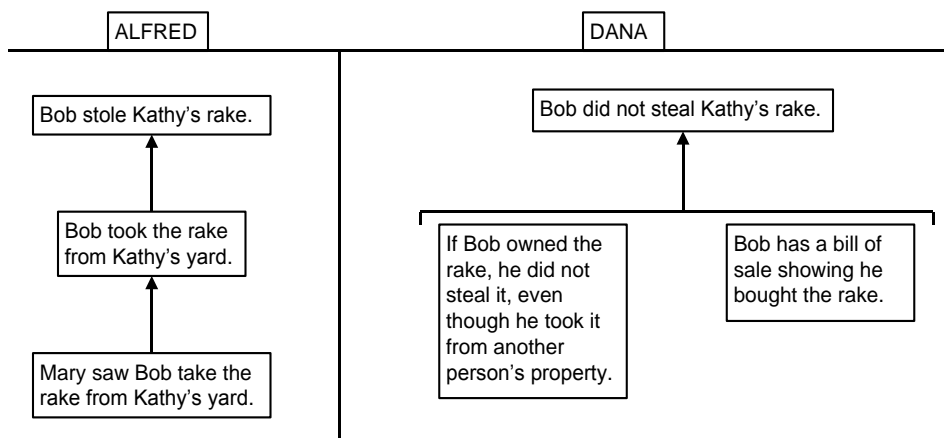

Figure 1: Dialogue-style Argument Map of the Rake Theft Example

The premises and conclusions are shown as text boxes containing statements (propositions), and the arrows represent inferences from premises (or from a single premise) to a conclusion. The argument on the two sides is presented in a format of two columns, each representing the sequence of argumentation attributed to a particular participant. This initial analysis of the structure of the argument is meant to be only a very simple representation. Subsequently a more refined analysis will be offered.

On the left we see Alfred's ultimate conclusion to be proved at the top, the statement that Bob stole Kathy's rake. In the right column at the top, we see Dana's ultimate conclusion, the statement that Bob did not steal Kathy's rake, the opposite (negation) of Alfred's conclusion to be proved. Each side has an argument to support its ultimate conclusion. Alfred brings forward the premise that Bob took the rake from Kathy's yard. This argument is clearly a defeasible one, and a fairly weak one at that, because there might be all kinds of reasons why Bob took the rake without stealing it. He might have been simply borrowing it, for example, and have had Kathy's permission to take it from the yard. Following that, Alfred uses an argument from witness testimony to back up his premise that Bob took the rake from Kathy's yard, claiming that Mary saw Bob take the rake. In the right column, we see an argument with two premises. Using the standard argument mapping notation, it is represented as a linked argument in which the two premises go together to support the conclusion. Clearly the argument has a defeasible modus ponens structure, but we do not represent this feature anywhere on the argument map in figure 1. It will be shown in the argument maps below.

What we do see from figure 1 is its dialogue structure, showing that the argument has two sides. Each of the two parties has a thesis to be proved, and the thesis to be proved by the one side is the opposite of thesis to be proved by the other side. Each side proceeds to present arguments to support its thesis. It would appear from the dialogue classification typology presented above that this argument fits the structure of a persuasion dialogue. It is a dispute, a conflict of opinions in which each side has a thesis that is opposed to the thesis of the other side. Each side tries to present the most convincing arguments to show the other side that the first side's thesis is acceptable.

The argument map in figure 2 shows a more detailed representation of the structure of the argument on one side in which some implicit premises are represented. This way of representing the argument reveals more of its structure, and in particular it shows how DMP is used to draw inferences from premises to a conclusion.
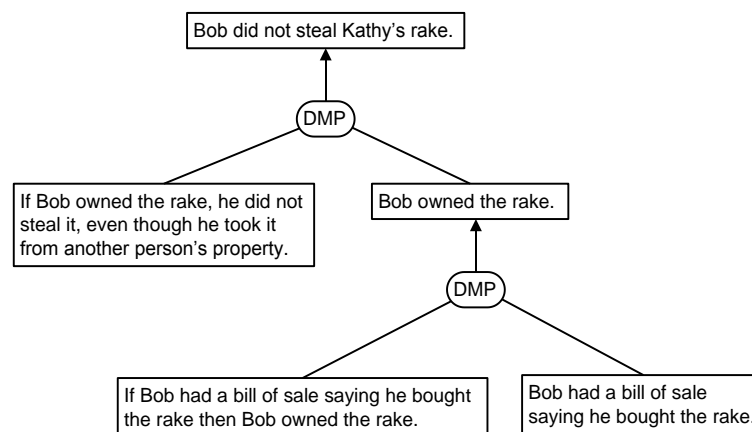
Figure 2: Map of Dana's Argument in the Rake Theft Example

Once again the premises and conclusions are shown as statements in text boxes, but each argument itself is shown as a node that is intermediary between the premises and the conclusion. A convergent argument is displayed as two separate arguments, each with its own separate node. A linked argument is shown as an argument with more than one premise leading to the same node that leads to the conclusion. For example in the top argument on the left, the conclusion is the statement that Bob did not steal Kathy's rake. It is a linked argument, because we can see that its two premises both lead to the node containing DMP, which in turn leads to the conclusion.

   In figure 2 we can see that two of the premises are implicit premises that have been inserted into the argument based on an interpretation of how the sequence of reasoning should run. In this instance, both conditional premises are implicit. A representation of the other side of the argument is given in figure 3.
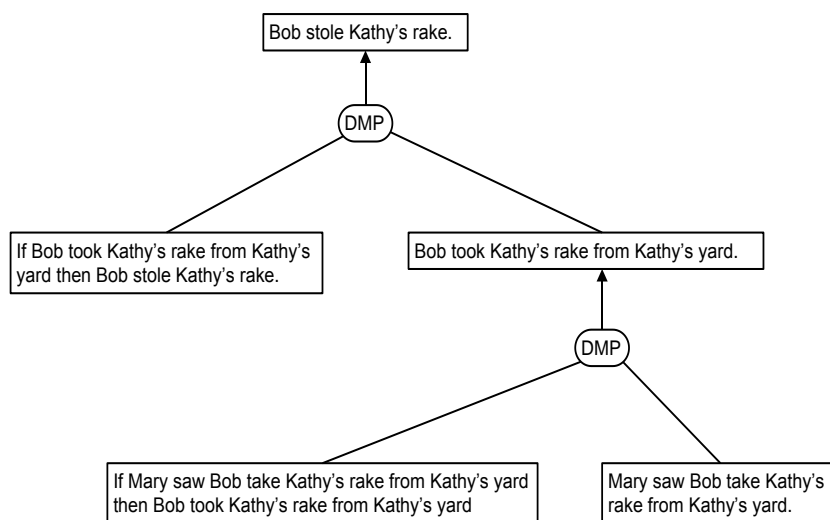
Figure 3: Map of Alfred's Argument in the Rake Theft Example

Another aspect of the argumentation in the rake theft example is that Dana attacked Alfred's argument from witness testimony by arguing that Mary has lied in the past. This part of the argumentation is shown in figure 4.
In figure 4, a pro argument (where the premises support the conclusion) is shown by using a normal arrow with a filled head that goes from the node to the conclusion. A con argument is represented by an arrow with an unfilled head.

   Now each party has good argument to support its contention that its thesis can be supported by evidence. But there is one other argument to be considered. Recall that at move 6 Alfred asked Dana to prove that Bob did not steal Kathy's rake, and Dana replied that the rake was not Kathy's property. To prove this claim he offered the argument that the rake was not Kathy's property, and supported it with the claim that Bob had a bill of sale showing he had bought the rake. This argument can be seen as a strong refutation, because it shows that given the premises, it is not possible that Bob stole Kathy's rake. The reason is that it was not Kathy's rake. You can't steal something that is yours. This generalization is true by definition if 'theft' can be

defined as stealing somebody else's property. As represented in figure 5, this argument is shown as being as based on the argumentation scheme for SMP, the deductive form of modus ponens.
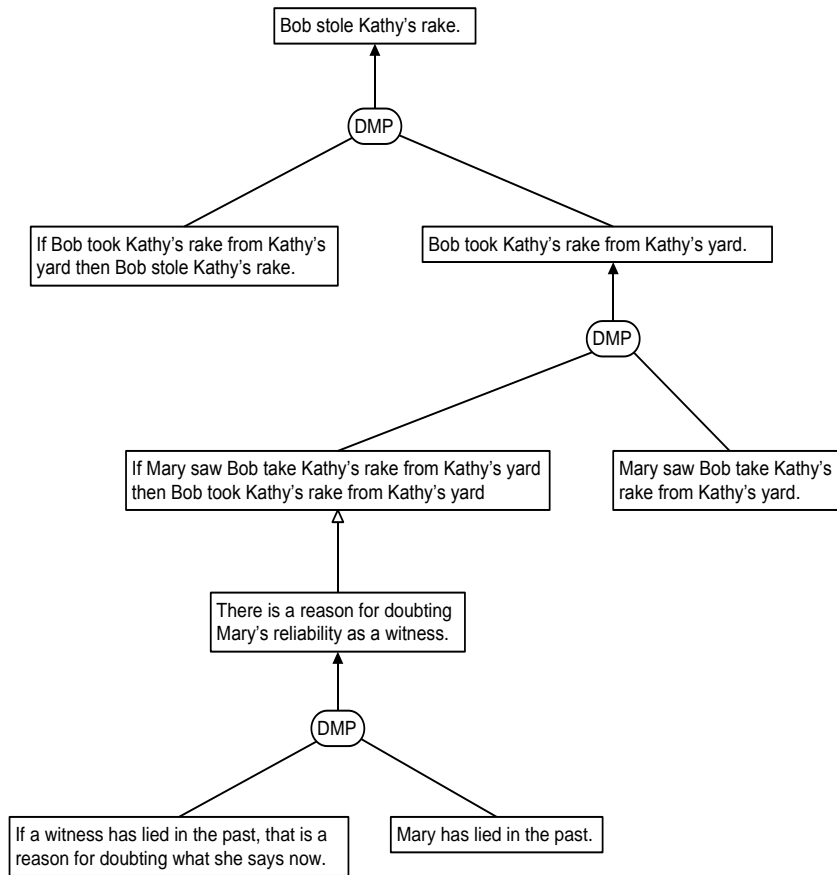
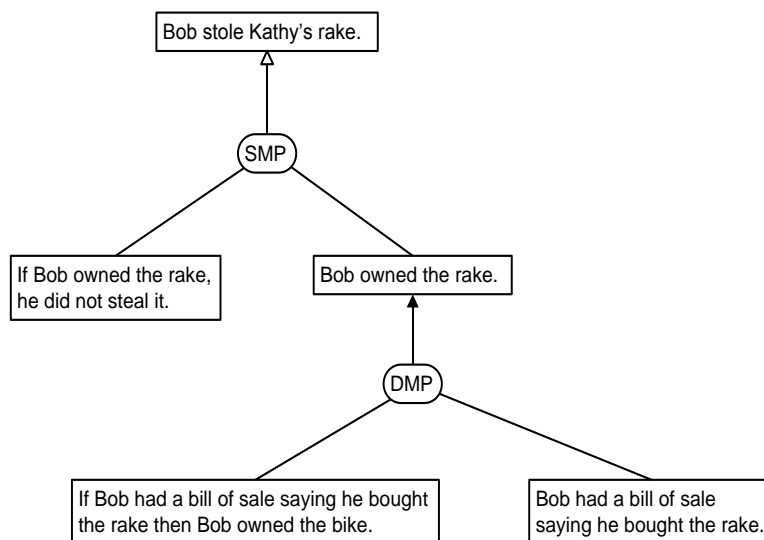Figure 4: Dana's First Counter-argument to Alfred's Argument

Figure 5: Dana's Second Counter-Argument to Alfred's Argument

Dana wins the argument because it is a necessary condition of stealing something that the object stolen was not the property of the person claimed to have stolen it. Unless Alfred can refute Danas' premise that Bob had a bill of sale saying he bought the rake, Alfred's claim that Bob stole Kathy's rake is strongly refuted.

7. Solution to the Problem of Evasion and Shifting of Burden of Proof

There are two basic problems with burden of proof from a point of view of detecting argument abuses and unfair sophistical strategies (Ricco, 2011), evasion of burden of proof and shifting of burden of proof. However, whether such moves are reasonable or fallacious is to be determined in specific cases by examining the particulars of the case. The reason is that, as we have shown, in some cases, failing to give an argument to support one's claim when a why question is posed, is a reasonable response in a dialogue. For example, if the proposition queried is an item of common knowledge, no argument supporting it is required to be furnished. The analysis of the rake theft example shows that in any example of argumentation there is a sequence of arguments on each side of the dialogue. On White's side of the dialogue, there are arguments supporting White's claim and attacking Black's claim. On Black's side of the dialogue, there are arguments supporting Black's claim and attacking White's claim. The burden of proof set at the opening stage of the dialogue determines what thesis each party has to prove, and determines how the burden of proof is apportioned between them. It also sets the standard of proof in place that determines how strong a winning argument needs to be in order to prevail (Gordon and Walton, 2009). Once these elements are set in place, the argumentation stage runs through the speech acts put forward by both sides in their moves. Once the argumentation stage is finished and all the arguments are in, the closing stage is reached. At this stage the burden of proof (BoP) set in place at the opening stage is used to determine which side had the winning argument, or whether there is no winner, if that is the outcome.
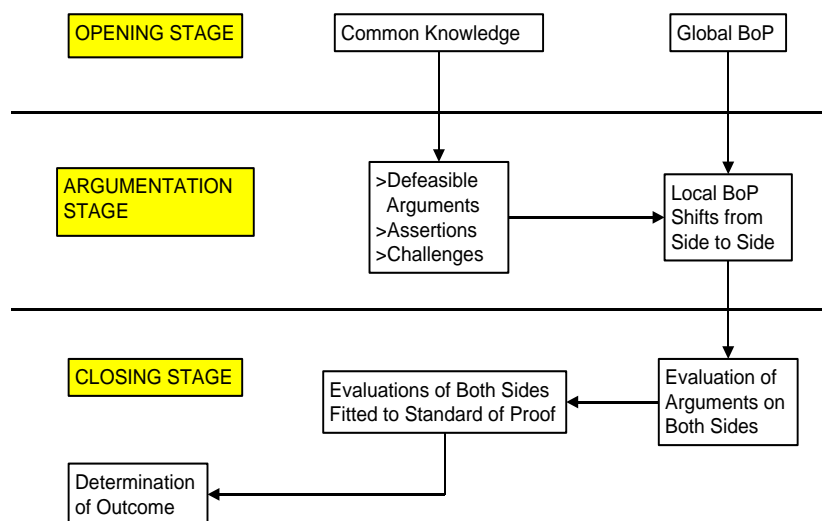

Figure 6: Outline of the Structure of the WB System

The arguments running through the argumentation stage can be represented as a large argument map in which all the premises and conclusions are connected to each other, and the argumentation schemes for the arguments that join them together in two specific arguments are labeled as SNP or DMP. In the analysis of the rake theft example, relatively specific arguments that display the chaining together of some premises and conclusions and larger chain of argumentation are represented in figures 2-5. Prakken and Sartor (2009) have shown how a formal dialogue model can be used to evaluate such argumentation chains and judge the outcome in legal cases based on burden of proof.

In a legal case, the burden of proof might be set higher on one side. For example, in a criminal case, the prosecution has to prove its claim beyond a reasonable doubt, whereas the defense wins if the prosecution's case is too weak to meet that standard of proof. Something like this setting of different burdens of proof for the ultimate claims of the two sides may also play a role in the argumentation in the rake theft example. Alfred has made a very serious allegation by claiming that Bob stole Kathy's rake and has therefore committed theft, an act that is (defeasibly) morally wrong. Dana has only made the claim that Bob did not commit theft, which seems like not such a serious allegation by comparison. Thus ethically speaking, it might be fair to set a higher standard of proof for Alfred's argument to be successful in proving its claim. If so, Dana's argument shown in figure 5 should prevail over Alfred's. It should be seen as a refutation of Alfred's argument, unless Alfred can introduce further evidence that would defeat it. Since Alfred has not done so at this point in the argument, Dana's side has the stronger argument and prevails in the dialogue. How much stronger it need to be depends on the standard of proof set for it at the opening stage. But if that standard is taken to be preponderance of the evidence, meaning that the stronger argument prevails even if it is only slightly stronger (Gordon and Walton, 2009), then Dana wins.

The rake theft example showed that making a support request move could backfire in some instances. In this example when Dana replied to Alfred's burden shifting question it provided an opportunity for Dana to produce an argument that proved to be so strong that it refuted Alfred's ultimate claim to be proved, thereby winning the dialogue for Dana. It shows that aggressively pursuing a sequence of why questions may not always be such a good idea in a persuasion dialogue.

8. Conclusions

The concern in this paper has been to find out how Hamblin-style support requests work as speech acts when embedded in a persuasion dialogue structure, and to some extent in other dialogue settings as well. What was shown is that to bring the Hamblin system up to date and deal with problems of burden of proof discussed since his time, several features have to be added in for this purpose. One of these features is the capability for dealing with defeasible arguments, since as the rake theft example showed, all the arguments had a DMP structure, except for one that had an SMP structure. The example shows how the WB system handles both kinds of modus ponens arguments, and so can better deal with issues of burden of proof. Hamblin did not attempt to deal specifically with burden of proof in his writings on formal dialogue systems and fallacies, preferring instead to use the simpler concept of initiative (Hamblin, 1970, 274) to represent the phenomenon of the shifting of the burden of proof during kinds of arguments where claims are made and need to be defended. By incorporating not only the capability for defeasible reasoning, but also the capability for modifying speech act rules in a way that can throw light on problems

with burden of proof, the WB system reveals the power of the simple but flexible systems that Hamblin devised when it comes to analyzing fallacies and other highly significant phenomena of argumentation like the shifting of burden of proof. Building formal dialogue systems to provide models to represent the science of reasoning underlying the use of the notion of burden of proof as a way to analyze and evaluate argumentation has proved to be an extremely useful way of solving logical problems, like those represented by the fallacy of argument from ignorance.

Another feature of the WB system is the capability for managing arguments that depend on common knowledge. It is important to see that not all propositions have to be supported with arguments when challenged by the other side using a why request. If the proposition represents common knowledge, there is no obligation on the respondent to make any attempt to prove it. Also if the proposition queried by the speaker is not a commitment of the hearer, the hearer does not have to respond to why question by providing justification for it. Allowing for this possibility is accommodated by Hamblin's Three Responses Rule, and no doubt it was his awareness of the complications that can arise from matters of burden of burden of proof that led him to formulate his rule in the way he did.

The general conclusion of this paper is that different applications to specialized uses of argumentation, for example in legal reasoning, can still benefit greatly from looking back to the work of the founder of this field in modern times, Charles Hamblin, to get a better foundational grasp of how to specify the basic components of a dialogue system to be applied to argumentation, and other communicative activities like explanation as well.

References

Bex, F., Prakken, H., Reed, C. and Walton, D. (2003).Towards a Formal Account of Reasoning about Evidence, Argument Schemes and Generalizations, *Artificial Intelligence & Law*, 11, 125-165.

Brandom, R. (1994). *Making it Explicit*. Cambridge, Mass.: Harvard University Press.

Caminada, M. (2004). *For the Sake of Argument: Explorations into Argument-Based Reasoning*, PhD thesis, Free University of Amsterdam: http://icr.uni.lu/~martinc/publications/thesis.pdf

Caminada, M. (2008). On the Issue of Contraposition of Defeasible Rules. *Computational Models of Argument: Proceedings of COMMA 2008*. Ed. P. Besnard, S. Doutre and A. Hunter. Amsterdam: IOS Press, 109-115.

Freeman, J. B. (1995). The Appeal to Popularity and Presumption by Common Knowledge, *Fallacies: Classical and Contemporary Readings*, ed. Hansen, H. V. and Pinto, R. C., University Park, The Pennsylvania State University Press, 265-273.

Gordon, T. F. and Walton, D. (2009). Proof Burdens and Standards. *Argumentation and Artificial Intelligence*, ed. I. Rahwan and G. Simari. Berlin: Springer, 239-260.

Governatori, G. (2008). Defeasible Logic: http://defeasible.org

Hahn, U., and Oaksford, M. (2007). The Burden of Proof and its Role in Argumentation. *Argumentation*, 21, 39-61.

Hamblin, C. L. (1970). *Fallacies.* London: Methuen, 1970.

Hamblin, C. L. (1971). Mathematical Models of Dialogue. *Theoria* 37, 130-155.

Kauffeld, F. (2003). The Ordinary Practice of Presuming and Presumption with Special Attention to Veracity and Burden of Proof, *Anyone Who Has a View: Theoretical Contributions to the Study of Argumentation*, ed. van Eemeren, F. H., J. A. Blair, C. A. Willard and A. F. Snoek Henkemans, Dordrecht: Kluwer, 136-146.

Krabbe, E. C. W. (2003). Metadialogues, *Anyone Who Has a View*, ed. Van Eemeren, F. H. et al. Amsterdam: North Holland.

McBurney, P. Hitchcock, D. and Parsons, S. (2007). The Eightfold Way of Deliberation Dialogue, *International Journal of Intelligent Systems*, 22, 95-132.

Nute, D. (2001). Defeasible Logic: Theory, Implementation, and Applications. *Proceedings of INAP 2001, 14th International Conference on Applications of Prolog*, IF Computer Japan, Tokyo, 87-114.

Nute, D. (1994). Defeasible Logic. *Handbook of Logic in Artificial Intelligence and Logic Programming, volume 3: Nonmonotonic Reasoning and Uncertain Reasoning*, 353-395. Oxford: Oxford University Press.

Prakken, H. and G. Sartor (1997). Argument-based Extended Logic Programming with Defeasible Priorities, *Journal of Applied Non-classical Logics*, 7, 25-75.

Prakken, H. and Sartor, G. (2009). A Logical Analysis of Burdens of Proof. *Legal Evidence and Burden of Proof*, ed. Hendrik Kaptein, Henry Prakken and Bart Verheij. Farnham: Ashgate, 223-253.

Reed, C. (2006). Representing Dialogic Argumentation. *Knowledge-Based Systems*, 19(1), 22-31.

Reed, C. and Walton, D. (2007). *Argumentation Schemes in Dialogue, Dissensus and the Search for Common Ground: Proceedings of OSSA*, ed. Hans V. Hansen.

Reiter, R. (1980). A Logic for Default Reasoning, *Artificial Intelligence*, 13, 81-132.

Ricco, Robert, B. (2011). Individual Differences in Distinguishing Licit from Illicit Ways of Discharging Burden of Proof, *Journal of Pragmatics*, 43, 616-631.

Singh, P., Lin, T., Mueller, E. T. Lim, G., Perkins, T. and Zhu, W. L. (2002). Open Mind Common Sense: Knowledge Acquisition form the General Public. *Proceedings of the First International Conference on Ontologies, Databases, and Applications of Semantics for Large Scale Information Systems*, Lecture Notes in Computer Science, Heidelberg, Springer Verlag, 2002.

Van Eemeren, F. H. and Grootendorst, R. (1992). *Argumentation, Communication and Fallacies*. Mahwah, N. J.: Erlbaum.

Verheij, B. (1999). Logic, Context and Valid Inference, *Legal Knowledge Based Systems. JURIX 1999*, eds. H.J. van den Herik et al. Nijmegen: Gerard Noodt Instituut, 109-121.

Walton, D. (1988). Burden of Proof, *Argumentation*, 2, 233-254.

Walton, D. (1989). *Informal Logic*. Cambridge: Cambridge University Press, 1989.

Walton, D. (2002). Are Some Modus Ponens Arguments Deductively Invalid?, *Informal Logic*, 22, 19-46.

Walton, D. and Krabbe, E. C. W. *Commitment in Dialogue*, Albany: State University of New York Press.