TYPES OF DIALOGUE AND BURDENS OF PROOF

Burden of proof has recently come to be a topic of interest in argumentation systems for artificial intelligence (Prakken and Sartor, 2006, 2007, 2009; Gordon and Walton, 2007, 2009), but so far the main work on the subject seems to be in that type of dialogue which has most intensively been investigated generally, namely persuasion dialogue. The most significant exception is probably deliberation dialogue, where some recent work has begun to tentatively investigate burden of proof in that setting. In this paper, I survey work on burden of proof in the artificial intelligence literature on argumentation, and offer some thoughts on how this work might be extended to the other types of dialogue recognized by Walton and Krabbe (1995) that so far do not appear to have been much investigated in this regard.

1. Types of Dialogue and Dialectical Shifts

The six basic types of dialogue previously recognized in the argumentation literature (Walton and Krabbe, 1995) are inquiry, negotiation dialogue, information-seeking dialogue, deliberation, and eristic dialogue. Discovery dialogue (McBurney and Parsons, 2001) has been added in new list of the properties of the basic types of dialogue in Table 1. These dialogues are technical artifacts called normative models, meaning that they do not necessarily correspond exactly to real instances of persuasion or negotiation, and so forth, that may occur in a real conversational exchange. Each model of dialogue is defined by its initial situation, the participants' individual goals, and the aim of the dialogue as a whole.

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	Need to Find an Explanation of Facts	Find and Defend a Suitable Hypothesis	Choose Best Hypothesis for Testing
Negotiation	Conflict of Interests	Get What You Most Want	Reasonable Settlement Both Can Live With
Information-Seeking	Need Information	Acquire or Give Information	Exchange Information
Deliberation	Dilemma or Practical Choice	Co-ordinate Goals and Actions	Decide Best Available Course of Action
Eristic	Personal Conflict	Verbally Hit Out at Opponent	Reveal Deeper Basis of Conflict

Table 1: Seven Basic Types of Dialogue

A dialogue is formally 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). Dialogue rules (protocols) define what types of moves are allowed by the parties during the argumentation stage (Walton and

Krabbe, 1995). At the opening stage, the participants agree to take part in some type of dialogue that has a collective goal. Each party has an individual goal and the dialogue itself has a collective goal. The initial situation is framed at the opening stage, and the dialogue moves through the opening stage toward the closing stage. The type of dialogue, the goal of the dialogue, the initial situation, the participants, and the participant's goals are all set at the opening stage. In some instances, a burden of proof, called a global burden of proof, is set at the opening stage, applies through the whole argumentation stage, and determines which side was successful or not at the closing stage. In some instances, another kind of burden of proof, called a local burden of proof, applies to some speech acts made in moves during the argumentation stage (Walton, 1988).

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. Each party has a commitment set (Hamblin, 1971), and to win, a party must present a chain of argumentation that proves its thesis using only premises that are commitments of the other party. One very well known type of dialogue that can be classified as a type of persuasion dialogue is the critical discussion (van Eemeren and Grootendorst, 1992). The goal of a critical discussion is to resolve a conflict of opinions by rational argumentation. The critical discussion has procedural rules, but is not a formal model. However, the term 'persuasion dialog' has now become a technical term of argumentation technology in artificial intelligence and there are formal models representing species of persuasion dialogue (Prakken, 2006).

Inquiry is quite different from persuasion dialogue because it is cooperative in nature, as opposed to persuasion dialogue which is highly adversarial. The goal of the inquiry, in its paradigm form, is to prove that a statement designated at the opening stage as the *probandum* is true or false, or if neither of these findings can be proved, to prove that there is insufficient evidence to prove that the *probandum* is true or false (Walton, 1998, chapter 3). The aim of this type of inquiry is to draw conclusions only from premises that can be firmly accepted as true or false, to prevent the need in the future to have to go back and reopen the inquiry once it has been closed. The most important characteristic of this paradigm of the inquiry as a type of dialogue is the property of cumulativeness (Walton, 1998, 70). To say a dialogue is *cumulative* means that once a statement has been accepted as true at any point in the argumentation stage of the inquiry, that statement must remain true at every point in the inquiry through the argumentation stage until the closing stage is reached. However, this paradigm of inquiry represents only one end of a spectrum where a high standard of proof is appropriate. In other inquiry settings, where there are conflicts of opinion and greater uncertainty, cumulativeness fails, but cooperativeness is a characteristic of inquiry. The model of inquiry dialogue built by Black and Hunter (2009) is meant to represent the cooperative setting of medical domains. Black and Hunter (2009, 174) model two subtypes of inquiry dialogue called in argument inquiry dialogues and warrant inquiry dialogues. The former allow to agents to share knowledge to jointly construct arguments, whereas the latter allow agents to share knowledge to construct dialectical trees that have an argument at each node in which a child node is a counterargument to its parent.

Inquiry dialogue can be classified as a truth-directed type of dialog, as opposed to deliberation dialogue, which is not aimed at finding the truth that matter being discussed, but at arriving at a decision on what to do, where there is a need to take action. While persuasion dialogue is highly

adversarial, deliberation is a collaborative type of dialogue in which parties collectively steer actions towards a common goal by agreeing on a proposal that can solve a problem affecting all of the parties concerned, taking all their interests into account. To determine in a particular case whether an argument in a text of discourse can better be seen as part of a persuasion dialog or a deliberation type of dialogue, one has to arrive at a determination of what the goals of the dialog and the goals of the participants are supposed to be. Argumentation in deliberation is primarily a matter of identifying proposals and arguments supporting them and finding critiques of other proposals (Walton et al., 2009). Deliberation dialogue is different from negotiation dialogue, because the negotiation deals with competing interests, whereas deliberation requires a sacrifice of one's interests.

Deliberation is 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. A key property of deliberation dialogue is that proposal that is optimal for the group may not be optimal for any individual participant (McBurney et al. 2007: 98). Another property is that a participant in deliberation must be willing to share both her preferences and information with the other participants. This property does not hold in persuasion dialogue, where a participant presents only information that is useful to prove her thesis or to disprove the thesis of the opponent. In the formal model of deliberation of McBurney et al. (2007, 100), a deliberation dialogue consists of eight stages: open, inform, propose, consider, revise, recommend, confirm and close. Proposals for action that indicate possible action-options relevant to the governing question are put forward during the propose stage. Commenting on the proposals from various perspectives takes place during the consider stage. At the recommend stage a proposal for action can be recommended for acceptance or non-acceptance by each participant (Walton et al., 2010).

A dialectical shift is said to occur in cases where, during a sequence of argumentation, the participants begin to engage in a different type of dialogue from the one they were initially engaged in (Walton and Krabbe, 1995). In the following classic case (Parsons and Jennings, 1997, 267) often cited as an example, two agents are engaged in deliberation dialogue on how to hang a picture. Engaging in practical reasoning they come to the conclusion they need a hammer, and a nail, because they have figured out that the best way to hang the picture is on a nail, and the best way to put a nail in the wall is by means of a hammer. One knows where a hammer can be found, and the other has a pretty good idea of where to get a nail. At that point, the two begins to negotiate on who will get the hammer and who will go in search of a nail. In this kind of case, we say that the one dialogue is said to be embedded in the other (Walton and Krabbe, 1995), meaning that the second dialogue fits into the first and helps it along toward achieving its collective goal. In this instance, the shift to the negotiation dialogue is helpful in moving the deliberation dialogue along towards its goal of deciding the best way to hang the picture. For after all, if somebody has to get the hammer and nail, and they can't find anyone who is willing to do these things, they will have to rethink their deliberation on how best to hang the picture. Maybe they will need to phone a handyman, for example. This would mean another shift to an information-seeking dialogue, and involvement of a third party as a source of the information. This example of an embedding contrasts with an example of an illicit dialectical shift when the advent of the second type of dialogue interferes with the progress of the first. For example, let's consider a case in which a union-management

negotiation deteriorates into an eristic dialogue in which each side bitterly attacks the other in an antagonistic manner. This kind of shift is not an embedding, because quarreling is not only unhelpful to the conduct of the negotiation, but is antithetical to it, and may very well even block it altogether, by leading to a strike for example.

1. Burden of Proof in Persuasion Dialogue

In all three versions of their set of rules for the critical discussion van Eemeren and Grootendorst set down a particular rule that governs burden of proof. In the 1992 version (van Eemeren and Grootendorst, 1992, 208), the rule governing burden of proof is simple. It only requires that “a party that advances the standpoint is obliged to defend it if the other party asks him to do so”. For example, rule 8a of the formal dialogue system PPD (Walton and Krabbe, 1995, 136) 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”. Hahn and Oaksford (2007, 47) have questioned whether van Eemeren and Grootendorst need to have rule 3 requiring burden of proof in a critical discussion. They think it makes sense to have a burden of proof for a participant's ultimate thesis set forth at the opening stage of the critical discussion, but they question why it is useful for each individual claim in the argumentative exchange to have an associated burden of proof. They concede that although there is a risk of non-persuasion in not responding to a challenge by putting forward an argument to defend one's claim, this risk is a relatively small factor in the outcome of the dialogue and “is entirely external to the dialogue and not a burden of proof in any conventional sense” (Hahn and Oaksford, 2007, 47). They have a point. It is worth asking what function the requirement of burden of proof has in a persuasion dialogue.

The addition of a third party audience to the persuasion dialogue affects brings out the utility of this function. If a party in a persuasion dialogue puts forward an argument, and then fails to defend it when challenged to do so, this failure will make his side appear weak to the audience who is evaluating the argumentation on both sides. They will ask why he put forward this particular claim if he can’t defend it, and he may easily lose by default. This can come about because the audience has the role of being a neutral third party in the dialogue, and is not merely one of the contestants who is trying to get the best of the opposed party. It helps the audience to judge which side had the better argument if each side responds to challenges by putting forward arguments to support its claims. Law is an area where there is such a third party trier (a judge or jury) in addition to the opposed advocates on each side.

In legal argumentation of the kind found in a common law trial setting (a species of persuasion dialogue), there is a burden of persuasion set at the opening stage of a dialogue, and a burden of production of evidence is set during the argumentation stage. But there is also a tactical burden of proof that plays an important role in the formal system for modeling burden of proof of Prakken and Sartor (2009, 228). On their account, the burden of persuasion specifies which party has to prove some proposition that represents the ultimate probandum in the case, and also specifies to what proof standard has to be met. The judge is supposed to instruct the jury on what proof standard has to be met and which side estimated at the beginning of the trial process. Whether this burden has been met or not is determined at the end of the trial. The burden of persuasion remains the same throughout the trial, once it has been set. It 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 particular point during the argumentation in the trial itself as it proceeds. The burden of production may in many instances only have to meet a low proof standard. If the evidence offered does not meet the standard, the issue can be decided as a matter of law against the burden party, or decided in the final stage by the trier. Both the burden of persuasion and the burden of production are assigned by law. The tactical burden of proof, on the other hand is decided by the party putting forward an argument at some stage during the proceedings. The arguer must judge the risk of ultimately losing on the particular issue being discussed at that point if he fails to put forward further evidence concerning that issue. 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.

2. Burden of Proof in the Inquiry

The type of dialogue where use of the expression 'burden of proof' is most clearly appropriate is the inquiry. The aim of the inquiry is to collect sufficient evidence to either definitively prove the proposition at issue, or to show that it can be proved, despite the exhaustive effort was made to collect all the evidence that was available. The central aim of the inquiry is proof, where this term is taken to imply that a high standard of proof has been met. The negative aim of the inquiry is to avoid later retraction of the proposition that has been proved. And so the very highest standard of proof is appropriate. The inquiry is therefore the model of dialogue in which the expression 'burden of proof' has a paradigm status.

The inquiry as a type of dialogue is somewhat similar to the type of reasoning that Aristotle called a demonstration. On his account (1984, *Posterior Analytics,* 71b26), the premises of a demonstration are themselves indemonstrable, as the grounds of the conclusion, and must be better known than the conclusion and prior to it. He added that (1984, *Posterior Analytics,* 72b25) that circular argumentation is excluded from a demonstration. He argued that since demonstration must be based on premises prior to and better known than the conclusion to be proved, and since the same things cannot simultaneously be both prior and posterior to one another, circular demonstration is not possible (at least in the unqualified sense of the term 'demonstration'.

In contrast, persuasion dialogues, as well as deliberation dialogues and discovery dialogues, have to allow for retractions. It is part of the rationality of argumentation in a persuasion dialogue that if one party proves that the other party has accepted a statement that is demonstrably false, the other party has to immediately retract commitment to that statement. It does not follow that persuasion dialogue has to allow for retractions in all circumstances but, the default position is that it is presumed that retraction should generally be allowed, except in certain situations. In contrast, in the inquiry, the default position is to eliminate the possibility of retraction of commitments, except in certain situations.

Cumulativeness appears to be such a strict model of argumentation that many equate it with the Enlightenment ideal of foundationalism of the kind attacked by Toulmin (1959). To represent any real instance of an inquiry, it is useful to explore inquiry dialogue systems that are not fully cumulative. Black and Hunter (2007) have built a system of argument inquiry dialogues meant to be used in the medical

domain to deal with the typical kind of situation in medical knowledge consisting of a database that is incomplete, inconsistent and operates under conditions of uncertainty. This kind of the inquiry dialogue they model represented by a situation in which many different health care professionals rule involved in the care of the patient and who must cooperate by sharing their specialized knowledge in order to provide the best care for the patient. To provide a standard for soundness and completeness of this type of dialogue, Black and Hunter (2007, 2) compare the outcome of one of their actual dialogues with the outcome that would be arrived at by a single agent that has as its beliefs that the union of the beliefs sets of both the agents participating in the dialogue. Their model assumes a form of cumulativeness in which an agent's belief set does not change during a dialogue, but they add that they would like to further explore inquiry dialogues to model the situation in which an agent has a reason for removing a belief from its beliefs at it had asserted earlier in the dialogue (Black and Hunter (2007, 6). To model real instances of argumentation inquiry dialogue, it would seem that ways of relaxing the strict requirement of cumulativeness need to be considered.

One difference between burden of proof in inquiry and persuasion dialogues is that the standard of proof generally needs to be set much higher in the inquiry type of dialogue. A similarity between the two types of dialogue is that the burden of proof, including the standard of proof, is set at the opening stage.

3. Discovery Dialogue

Discovery dialogue was first recognized as a distinct type of dialogue different from the any of the six basic types of dialogue by McBurney and Parsons (2001). On their account (McBurney and Parsons, 2001, 4), discovery dialogue and inquiry dialogue are distinctively different in a fundamental way. In an inquiry dialogue, the proposition that is to be proved true is designated prior to the course of the argumentation in the dialogue, whereas in a discovery dialogue the question was truth is to be determined only emerges during the course of the dialogue itself. According to their model of discovery dialogue, participants began by discussing the purpose of the dialogue, and then during the later stages they use data items, inference mechanisms, and consequences to present arguments to each other. Two other tools they use are called criteria and tests. Criteria, like novelty, importance, cost, benefits, and so forth, are used to compare one data item or consequence with another. The test is a procedure to ascertain the truth or falsity of some proposition, generally undertaken outside the discovery dialog.

The discovery dialog moves through ten stages (McBurney and Parsons, 2001, 5) called open dialogue, discuss purpose, share knowledge, discuss mechanisms, infer consequences, discuss criteria, assess consequences, discuss tests, propose conclusions, and close dialogue. The names for these stages give the reader some idea of what happens at each stage as the dialogue proceeds by having the participants open the discussion, discuss the purpose of the dialogue, share knowledge by presenting data items to each other, discuss the mechanisms to be used, like the rules of inference, build arguments by inferring consequences from data items, discuss criteria for assessment of consequences presented, assess the consequences in light of the criteria previously presented, discuss the need for undertaking tests of proposed consequences, pose one or more conclusions for possible acceptance, close the dialogue. The stages of the discovery dialogue may be undertaken in any order and may be

repeated, according to (2001, 6). They add that agreement is not necessary in a discovery dialogue, unless the participants want to have it.

McBurney and Parsons also present of formal system for discovery dialogue in which its basic components are defined. A wide range of speech acts (permitted locutions) that constitute moves in a discovery dialog include the following: propose, assert, query, show argument, assess, recommend, accept, and retract. There is a commitment store that exists for each participant in the dialogue containing only the propositions which the participant has publicly accepted. All commitments of any participant can be viewed by all participants. They intend their model to be applicable to the problem of identifying risks and opportunities in a situation where knowledge is not shared by multiple agents.

To be able to identify when a dialectical shift from a discovery dialogue to an inquiry dialogue has occurred in a particular case, we first of all have to investigate how the one type of dialogue is different from the other. Most importantly, there are basic differences in how burden of proof, including the standard of proof, operates. In an inquiry dialogue the global burden of proof, that is operative during the whole argumentation stage, is set at the opening stage. In a discovery dialogue no global burden of proof is set at the opening stage that operates over both subsequent stages of the dialogue. McBurney and Parsons (2001, 418) express this difference by writing that in inquiry dialogue, the participants "collaborate to ascertain the truth of some question", while in discovery dialogue, we want to discover something not previously known, and "the question whose truth is to be ascertained may only emerge in the course of the dialogue itself". This difference is highly significant, as it affects how each of the two types of dialogue is fundamentally structured.

In an inquiry dialogue, the global burden of proof is set at the opening stage and is then applied at the closing stage to determine whether the inquiry has been successful or not. This feature is comparable to a persuasion dialogue, where the burden of persuasion is set at the opening stage (Prakken and Sartor, 2007). At the opening stage of the inquiry dialogue, a particular statement has to be specified, so that the object of the inquiry as a whole is to prove or disprove this statement. In a persuasion dialogue, this burden of proof can be imposed on one side, or imposed equally on both sides (Prakken and Sartor, 2006). However, in an inquiry dialogue there can be no asymmetry between the sides. All participants collaborate together to bring forward evidence that can be amassed together to prove or disprove the statement at issue. Discovery dialogue is quite different in this respect. There is no statement set at the beginning in such a manner that the goal of the whole dialogue is to prove or disprove this statement. The basic reason has been made clear by McBurney and Parsons. What is to be discovered is not known at the opening stage of the discovery dialogue. The aim of the discovery dialogue is to try to find something, and until that thing is found, it is not known what is, and hence it cannot be set as something to be proved or disproved at the opening stage as the goal of the dialogue.

4. Burden of Proof in Deliberation

Burden of proof is not the only type of burden one can have in the dialogue. Most of the types of dialogue that have been studied so far in the argumentation literature, like persuasion dialogue, concern claims that are put forward in the form of a proposition that is held to be true or false. The central aim

of the argumentation is to prove that such a proposition is true or false. But other types of dialogue, like deliberation and negotiation, do not have the central aim of proving that a particular proposition is true or false. Still other dialogues are not mainly about argumentation. Some are about the giving and receiving of explanations, for example. In this kind of dialogue, there is no burden of proof, because the central aim is not to prove something but to explain something that the questioner claims to fail to understand. However, in this type of dialogue when a questioner asks for an explanation, there is an obligation on the part of the other party to provide one, assuming he is in a position to do that. So generally, in all types of dialogue of the kind that provide normative structures for rational communication, there are obligations to respond in a certain way to a request made in a prior move by the other party. These obligations are quite general, but the notion of burden of proof is more restricted, and only applies where a response to an expression of doubt by one party as to whether some proposition is true or not needs to be made by offering an attempt to prove that the proposition is true or false. For obvious reasons, this type of dialogue exchange is centrally important in science and philosophy, but the problem is that the vocabulary used to describe its operation has a tendency to be carried over into other types of dialogue where the central purpose is not to prove or disprove something.

There is no global burden of proof in a deliberation dialogue, because no thesis to be proved or disproved is set into place for each side at the opening stage (Walton, 2010). Deliberation is not an adversarial type of dialogue, and at the opening stage all options are left open concerning proposals that might be brought forward to answer the governing question. At the opening stage, the governing question cites a problem that needs to be solved cooperatively by the group conducting the deliberations, a problem that concerns choice of actions by the group. The goal of the dialogue is not prove or disprove anything, but to arrive at a decision on which is the best course of action to take. Hence the expression 'burden of proof' is not generally appropriate for this type of dialogue.

During a later stage, proposals for action are put forward, and what takes place during the argumentation stage is a discussion that examines the arguments both for and against each proposal, in order to arrive at decision on which proposal is best. Something like the standard of proof called the preponderance of the evidence in law is operative during this stage. The outcome in a deliberation dialogue should be to select the best proposal, even if that proposal is only marginally better than others that have been offered. A party who offers a proposal is generally advocating it as the best course of action to take, even though in some instances a proposal may merely be put forward hypothetically as something to consider but not necessarily something to adopt as the best course of action. In such instances is reasonable to allow one party in a deliberation dialogue to ask another party to justify the proposal that the second party has put forward, so that the reasons behind it can be examined and possibly criticized. Hence there is a place in deliberation dialogue for something comparable to burden of proof. It could be called a burden of defending or justifying a proposal. What needs to be observed is that this burden only comes into play during the argumentation stage where proposals are being put forward, questioned and defended. In contrast with the situation in persuasion dialogue, none of these proposals is formulated and set into place at the opening stage as something that has to be proved or cast into doubt by one of the designated parties in the dialogue. In this regard,

persuasion dialogue and deliberation are different in their structures. Since persuasion dialogue (the critical discussion type of dialogue) has been most discussed in the argumentation literature, it seems natural to think that there must be something comparable to burden of proof that is also operative in deliberation dialogue. But this expectation is misleading.

In deliberation dialogue, there is no burden of persuasion set the opening stage, because the proposals will only be formulated as recommendations for particular courses of actions at the later argumentation stage. A deliberation dialogue arises from the need for action, as expressed in a governing question formulated at the opening stage, like 'Where shall we go for dinner tonight?', and proposals for action arise only at a later stage in the dialogue (McBurney et al, 2007, 99). There is no burden of proof set for any of the parties in a deliberation at the opening stage. However, at the later argumentation stage, once a proposal has been put forward by a particular party, it will be reasonably assumed by the other participants that this party will be prepared to defend his proposal by using arguments, for example like the argument that his proposal does not have negative consequences, or the argument that his proposal will fulfill some goal that is taken to be important for the group. How burden of proof figures during the argumentation stage can be seen by examining some of the permissible locutions (speech acts allowed as moves). One of these is the *ask-justify* locution (McBurney et al., 2007, 103), quoted below.

The locution **ask_ justify** (*Pj* , *Pi* , *type*, *t*) is a request by participant *Pj* of participant *Pi* , seeking justification from *Pi* for the assertion that sentence *t* is a valid instance of type *type*. Following this, *Pi* must either retract the sentence *t* or shift into an embedded persuasion dialogue in which *Pi* seeks to persuade *Pj* that sentence *t* is such a valid instance.

What we see here is that one participant in a deliberation dialogue can ask another participant to justify a proposition that the second party has become committed to through some previous move of a type like an assertion or proposal. As long as the proposition is in the second party's commitment set, the first party has a right to ask him to justify it or retract it. But notice that when the second party offers such a justification attempt, the dialogue shifts into an embedded persuasion dialogue in which the second party tries to persuade the first party to become committed to this proposition by using a valid argument. So what we see here is that burden of proof is involved during specific groups of moves at the argumentation stage, but when the attempt is made by the respondent to fulfill the request for justification, there is a shift to persuasion dialogue. By this means the notion of burden of proof appropriate for the persuasion dialogue can be used to evaluate the argument offered.

A key factor that is vitally important for persuasion dialogue is that the participants agree on the issue to be discussed at the opening stage. Each party must have a thesis to be proved. This setting of the issue is vitally important for preventing the discussion from wandering off, or by shifting the burden of proof back and forth and never concluding. In deliberation dialogue however, the proposals are not formulated until a later stage. It makes no sense to attempt to fix the proposals at the opening stage, because they need to arise out of the brainstorming discussions that take place after the opening stage. Burden of proof only arises during the argumentation stage in relation to specific kinds of moves made during that stage, and when it does arrive there is a shift of persuasion dialogue which allows the

appropriate notion of burden of proof to be brought in from the persuasion dialogue. Hence we see that burden of proof please only a very small role in deliberation dialogue itself. The role it performs is best described not as a burden of proof but as a burden of justification.

6. Information-seeking Dialogue, Negotiation and Eristic Dialogue

There seems to be little to say about burden of proof in information-seeking dialogues at first sight, but there are at least two ways in which burden of proof might enter into this type of dialogue. Information dialogue is not exclusively taken up with the putting forward of *ask* and *tell* questions, or with the kind of searching for information one might do when using Google. One reason is that there is a concern not only with obtaining raw information, but with determining the quality of this information by judging its reliability. Judgments of reliability of collected information would seem to involve standards of proof, and therefore also may involve burdens of proof. Another reason is that in many instances of information seeking dialogue, the requesting agent needed to provide the responding agent with an argument in order to obtain access to the information requested. As noted in (Doutre et al. 2006), such dialogues may be viewed as consisting only of *ask* and *tell* locutions if this argument component of them is not considered. But if this argument component is considered as part of the information-seeking dialogue, then burden of proof is involved.

There also seems to be little to say, or that has been said, about burden of proof in either negotiation dialogue or eristic dialogue, at least that I am aware of, but the reason may be that burden of proof is not an appropriate requirement in either of these types of dialogue. Anyone who adopts the approach to proving something to the other party by means of evidence that fulfills a burden of proof would be likely to perform very badly in either of these types of dialogue. For proving something by using evidence to support your claims is, or should not be the central goal in either of these types of dialogue. However, in both types of dialogue there are typically intervals where there is a shift from one of them to another type of dialogue where burden of proof is important. For example a contractor in homeowner may be negotiating a price for installing a new basement in the house, and at some point in the dialogue may become important for the contractor to try to convince homeowner that the building code for walls in basements in that area specifies certain requirements that have to be met, for example discerning the thickness of the walls. In such a case, the notion of burden of proof may not play any direct role in the negotiation argumentation itself, but when there is a shift from it to a persuasion dialogue where the contractor tries to convince homeowner the walls of a certain minimum thickness are mandatory, burden of proof may be an important factor in evaluating his arguments. It may be, as well, that when agents argue about receiving permission to get information during an information-seeking dialogue, there has been a shift to some other type of dialogue like a persuasion dialogue.

7. Conclusions

Global burden of proof in a dialogue is defined as a set {*P*, *T*, *S*} where *P* is a set of participants, *T* is an ultimate *probandum*, a proposition to be proved or cast into doubt by a designated participant and *S* is the standard of proof required to make a proof successful. If there is no thesis to be proved or cast into doubt in a dialogue, there is no burden of proof in that dialogue, except where it may enter by a

dialectical shift. The local burden of proof defines what requirement of proof has to be fulfilled for a speech act, or move like making a claim, during the argumentation stage. The global burden of proof is set at the opening stage, but during the argumentation stage, as particular arguments are put forward and replied to, there is a local burden of proof for each argument that can change. This local burden of proof can shift from one side to the other during the argumentation stage as arguments are put forward and critically questioned. Once the argumentation has reached the closing stage, the outcome is determined by judging whether one side or the other has met its global burden of proof, according the requirements set at the opening stage.

It seems fair to conclude that although the bulk of the literature on burden of proof so far is on persuasion dialogue, it should also be important to investigate burden of proof in inquiry dialogue where it is a central concept. Burden of proof is only significant in deliberation dialogue when there has been a shift to a persuasion dialogue. Burden of proof is important in information seeking dialogue when arguments need to be brought forward to get permission to receive the information, or when the reliability of the information is a concern. Burden of proof is especially important in the study of scientific argumentation because of the characteristic shift in scientific research from the discovery stage to the inquiry stage.

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