

AN ARGUMENTATION MODEL OF DELIBERATIVE DECISION-MAKING

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Argumentation has been mainly concerned with finding or assessing reasons to prove a statement is true or false, but recently there has been some attention paid to the kind of arguments used in deliberative decision-making. Van Gelder (2009, 5), contrasts intuitive decision-making, where decisions are made on the basis of what seems right without any systematic review of options, with technical decision-making, where qualitative argumentation is replaced by calculation. He argues (2009, 6) that although many important decisions go wrong, deliberative decision-making cannot be replaced by either intuitive or technical decision-making. The aim of this paper is to apply some tools recently developed in argumentation, like argument mapping, that show promise of being helpful to improve both intuitive and technical deliberative decision-making.

The traditional technical method of decision-making weighs the expected costs of a set of alternative courses of action against its expected benefits, and decides the outcome by selecting the alternative with the greatest expected utility. In this chapter, an alternative is proposed called the argumentation approach. This new approach uses argumentation schemes, defeasible forms of reasoning representing common kinds of arguments, and applies these schemes within contextual frameworks called dialogues, in which both sides (pro and contra) of an argument are taken into account (Bench-Capon and Dunne, 2007). One type of dialogue, called the deliberation, is shown to be especially important in this regard, and one scheme, called practical reasoning (Searle, 2001; Bench-Capon, 2003) is chosen to show how the approach works.

After introducing the reader to the basic methods of argumentation, the exposition proceeds by applying them in an example. The example chosen is extensive enough that every reader can see how it represents a common kind of decision-making that we are all familiar with on a daily basis. The argumentation in the example is also extensive enough that there is not enough space to analyze all the arguments in it. However, the goal of the chapter is not to provide a complete analysis or evaluation of the argumentation in the example, but only to illustrate some argumentation tools to the reader and give a general idea of how these tools can be applied to realistic cases of deliberative decision-making. The hope is to convince the reader that the argumentation approach has some advantages over intuitive methods and some technical methods alone.

1. Basic Methods of Argumentation

The emerging methodology in argumentation theory is to study an argument not only as a set of premises and conclusion, but also as statements that can be challenged and that may require support in a context of dialogue in which two or more parties reason together in order to achieve some common goal (Walton, 2007). A dialogue is a structure in which two parties (in the simplest case) take turns making moves that take the form of speech acts, like asking a question, making an assertion, or putting forward an argument. Dialogue rules define what types of moves are allowed (Walton and Krabbe, 1995). As each party makes a move, statements are inserted into or retracted from his/her commitment store. Other dialogue rules determine such insertions and retractions

(Walton and Krabbe, 1995). Still other dialogue rules determine which side has won or lost, once the closing stage of the dialogue is reached. Each party has an individual goal and the dialogue itself has a collective goal. Several different types of dialogue are defined, explained and classified in (Walton, 2007, chapter 1) that represent familiar kinds of goal-directed conversations in which argumentation is used to contribute to the goal of the dialogue. Some dialogues are composites that combine features of the basic types.

During the argumentation stage of a dialogue, two parties (in the simplest case) take turns making moves that take the form of speech acts, like asking a question, making an assertion, or putting forward an argument. Dialogue rules define what types of moves are allowed (Walton and Krabbe, 1995). As each party makes a move statements are inserted into or retracted from his/her commitment store. The six basic types of dialogue previously recognized in the argumentation literature are persuasion dialogue, inquiry, negotiation dialogue, information-seeking dialogue, deliberation, and eristic dialog. Discovery dialogue has been added in new list of the properties of the basic types of dialogue in Table 1.

TYPE OF DIALOGUE	INITIAL SITUATION	PARTICIPANT'S GOAL	GOAL OF DIALOG
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

Each type of dialogue is a normative model that is meant to provide standards for judging how a given argument should be correctly used in a given case. Using any of the normative models to analyze or evaluate a real argument found in a given text of discourse is not in itself a trivial step. Evidence needs to be gathered from the given text of discourse to indicate which normative model is applicable to the case. The normal assumption is that the text of discourse in the given case will provide enough evidence to warrant viewing the argument as supposedly being meant to be a contribution to a particular type of dialogue. Each type of dialogue has three stages, an opening stage, an

argumentation stage and a closing stage, where the outcome is determined, in some instances by a third party, like a judge (Walton, 2007).

Of the types of dialogue, the one that has been most thoroughly studied in the argumentation literature so far is the persuasion dialogue. Persuasion dialogue is a term now also commonly used in argumentation studies (see Walton and Krabbe 1995; Walton 2007) and artificial intelligence (Bench-Capon, 2003; Prakken, 2006; Bench-Capon and Dunne, 2007). As stated by Prakken (2006, 1), persuasion is a model of dialogue in which two or more participants try to resolve a difference of opinion by means of arguments, in order for each party to lead the other participants to change their commitments. 'Persuasion' in this normative sense means rational persuasion, where a proponent gets a respondent to accept a proposition by presenting an argument that has a valid form (that of an argumentation scheme) and premises that the respondent has already accepted. Persuasion, in this technical sense of the term, refers to rule-governed changes in a party's commitments as a dialogue proceeds (Walton and Krabbe, 1995). The simplest way to explain the basic structure of a persuasion dialogue is to use the diagram of (Walton, 1989, p. 6) shown in figure 1.

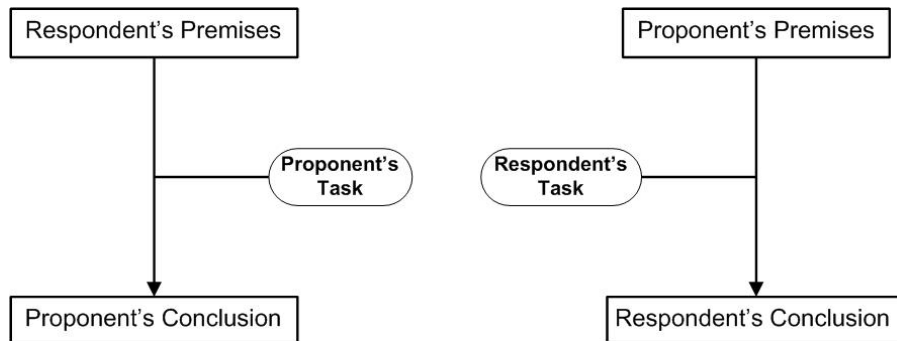


Figure 1: Structure of Rational Persuasion in Persuasion Dialogue

The proponent's task is to rationally persuade the respondent to come to accept her (the proponent's) thesis. The respondent's task is to rationally persuade the proponent to come to accept his (the respondent's) thesis. The thesis to be proved is a specific statement designated at the opening stage. Each party has a thesis to be proved, or in some instances, only the proponent has a thesis to prove and the job of the respondent is to cast enough doubt on the proponent's attempts to prove her thesis so that the attempts are shown to have failed.

It may seem initially that we can distinguish between the two types of dialogue by saying that deliberation is about actions and persuasion dialogue is about the truth and falsity of propositions. Deliberation is different from persuasion dialogue, because the goal is to solve a problem posed by a choice of actions that needs to be made in a given set of circumstances (Atkinson, Bench-Capon and McBurney, 2005). However, both deliberation and persuasion dialogues can be about actions, and hence the dividing line between the two types of dialogue is not so simple.

Unlike persuasion dialogue, in deliberation dialogue the burden of proof is not set at the opening stage. During the argumentation stage of a deliberation, each party makes a proposal for a course of action, and these proposals may be modified, accepted or

rejected as the argumentation stage proceeds (Walton, 2006). The best proposal, selected at the closing stage, is the one that has the strongest arguments supporting it and that meets the burden of proof. Information seeking-dialogue both seeks information and tries to judge how reliable it is as information to be accepted as factual. Inquiry, in contrast has a high standard of proof, and uses argumentation so that, ideally, there should never be any need to retract a statement once it has been verified and accepted.

Persuasion dialogue can be classified as a truth-directed type of dialogue, 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, given a need to take action. While persuasion dialogue is centrally 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 dialogue or a deliberation type of dialogue, one has to arrive at a determination of what the goals of the dialogue 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, and its central role is to resolve a conflict of interests by arriving in a compromise that both parties can live with (Tang and Parsons, 2006). In contrast, in a deliberation dialogue the participants evaluate proposed courses of action according to standards that may be contrary to their personal interests. An important property of deliberation dialogue is that an action-option that is optimal for the group considered as a whole may not be optimal from the perspective of an individual participant (McBurney, Hitchcock and Parsons, 2007, 98). In a deliberation dialogue, a participant must be willing to share both his/her preferences and also information with the other participants. The initial situation of deliberation is the need for action arising out of a choice between two or more competing courses of action that are possible in a given situation. The ultimate goal of deliberation dialogue is for the participants to collectively decide on what is the best available course of action for them to take.

Discovery dialogue has been added to the six basic types of dialogue found in (Walton, 2007). On the account given by (McBurney and Parsons, 2001, 4), the properties of discovery dialogue and inquiry dialogue are different. In inquiry dialogue, the proposition that is to be proved true is designated at the opening stage, whereas in discovery dialogue the hypotheses to be tested are only formulated during the argumentation stage (Black and Hunter, 2007). A discovery dialogue 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. In inquiry dialogue, the proposition that is to be proved true is designated prior to the argumentation stage, but in discovery dialogue the hypothesis only emerges during the course of the dialogue itself.

When confronting an argument used in a text of discourse, a rational critic needs to decide whether it belongs to one type of dialogue or another, using the evidence from the

text as the basis for the decision. Figure 2 (Walton and Krabbe, 1995, 81) offers a key for arriving at this sort of decision.

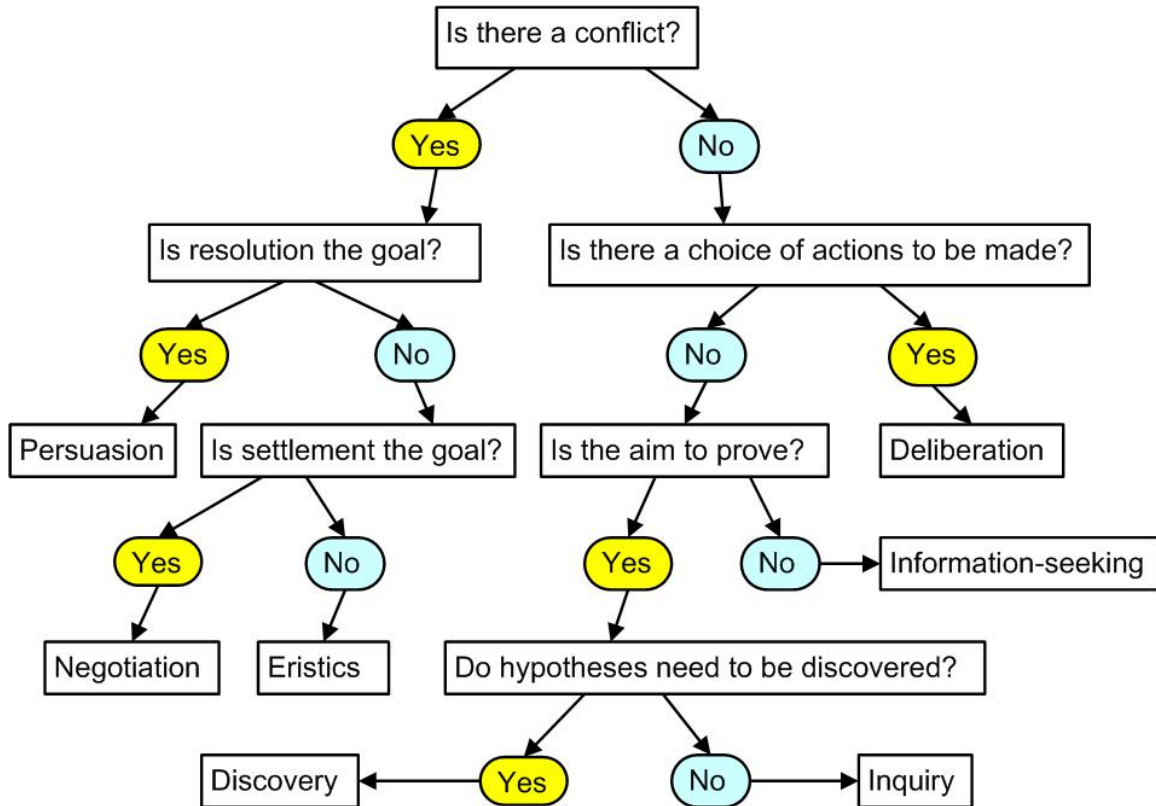


Figure 2: Key for Determining Type of Dialogue in a Case

In some instances it may be difficult to identify the type of dialogue. In everyday conversational argumentation, participants may be unclear, when putting an argument or criticizing it, what type of conversation they are supposed to be engaging in.

There can be shifts from one type of dialogue to another during the same sequence of argumentation (Walton and Krabbe, 1995, 100-116), for example, there can be a shift from a deliberation dialogue to an information-seeking dialogue. Consider the case where a debate in a legislative assembly is on the question of whether to pass a bill to install a new dam. Before the participants arrive at their decision, they need find out many facts about the plan for the dam, including considerations of what its ecological consequences are likely to be, and what the estimated costs are. They will call in experts, and possibly even people affected by the dam, to collect relevant information. In this case the dialectical shift would be classified as an embedding (Walton and Krabbe, 1995, 102), meaning that the goal of the deliberation dialogue is supported by the information-seeking dialogue. In other instances, shifts can be illicit, and even deceptive.

2. Computational Literature on Argumentation Models of Deliberation

Research in multi-agent systems in AI is based around the idea of agents performing tasks using their capability to communicate in order to carry out ordinary actions. This

need to structure agent communication has proved to be especially vital in the field of AI called planning. Planning utilizes a sequence of reasoning from an initial state to a goal state. Early formal systems for planning used formal deductive inferences similar to the models of deductive reasoning used in theorem-proving. The operation of planning was described as the process of searching for the sequence of transformations starting from the initial state that will end in the goal state (Carberry, 1990). The classic example is blocks world. In blocks world the initial situation is a pile of numbered blocks on a table. The goal state is to put them in several stacks, so that the blocks in each stack are in a certain order. This kind of reasoning has now been recognized as different from deductive reasoning, and requiring a different model of rationality based on defeasible reasoning of a kind that leads to or justifies actions (Searle, 2001).

The planning system called TRACK (Carberry, 1990) uses a framework of dialogues to verify or falsify inferences about plan recognition: “TRACK assimilates utterances from an ongoing dialogue and incrementally updates and expands the system’s beliefs about the underlying task-related plan motivating the information-seeker’s queries.” Carberry (1990, p. 75). TRACK works as a method of testing and evaluating the defeasible inferences drawn in plan recognition by means of a dialogue between the two agents. Partly it is an information-seeking type of dialogue in which one participant is “seeking information” and the other is “attempting to provide that information” Carberry (1990, p. 3). However, the one agent is trying to get information from the other agent in relation to some actions. In addition to information-seeking dialogue, deliberation is also involved. The deliberation dialogue is important, because the plan recognizer must have the capability of grasping how sequences of actions make sense as routine ways of carrying out a goal. The plan recognizer must be able to ask the right questions and to fill in the gaps in a sequence of reasoning.

Arguments with implicit premises or conclusions are called enthymemes in logic. They are often based on common knowledge of a kind that has become an important subject for investigation in artificial intelligence. Common knowledge is represented in computing by what is called a frame, a data structure for representing a stereotyped situation, like going to a child’s birthday party (Minsky, 1975, p. 2). Common knowledge is based on ordinary ways of doing things familiar to all of us in everyday life. According to Schank and Abelson (1977), common knowledge is based on what they call a *script*, a body of knowledge shared by language users concerning what typically happens in certain kinds of stereotypical situations. Scripts enable a language user to fill in gaps in inferences not explicitly stated in a text of discourse. Schank and Abelson (1977) used the restaurant story as an example. In this story, we are told explicitly that John went to a restaurant, the hostess seated John and gave him a menu, and John ordered hamburger. Later, John got up from his seat, paid the bill, and left the restaurant. Given the elements of this story as an explicit text of discourse, we can fill in many implicit statements needed to make sense of it as a script. Below, we will show using an example how this process requires the use of scripts to fill in missing steps in a sequence of reasoning.

As will be shown in the example below, one type of reasoning that is very common in deliberation, and even characteristic of it, is practical reasoning, or goal-directed, knowledge-based action-guiding reasoning carried out by an intelligent agent (Bratman, Israel and Pollack, 1988). This type of reasoning is not only fundamental to planning

technology, but is now proving to be very important in AI generally (Atkinson, Bench-Capon and McBurney, 2006).

Computational tools for electronic democracy to use the Internet to encourage public participation in deliberative decision-making have recently been built and implemented. One example is the Zeno argumentation framework (Gordon and Karacapilidis, 1997), described by its authors as a tool “designed to be used in mediation systems, an advanced kind of electronic discussion forum with special support for argumentation, negotiation and other structured forms of group decision making”. The Zeno system is built on a formal model of argumentation that gives structure to issues and allows pro and contra arguments used to be weighed against each other in a dialogue format.

Tolchinsky et al. (2003) have built a formal system that combines case-based reasoning (see Ashley, 2006) with argumentation schemes for evaluating argumentation used in deliberative decision-making dialogues. Their system, called *ProCLAIM*, provides a deliberation setting for agents to argue about a decision to be made, and uses a mediator agent that directs the deliberation and evaluates the submitted arguments. *ProCLAIM* uses a case-based reasoning engine to match the current case against previously decided cases. It has an argumentation scheme repository containing both argumentation schemes and their matching critical questions. The example used to illustrate the system is a case of decision-making on human organ transplanlation, where a team assembles to arrive at a decision on what to do in a specific instance. The argumentation is organized in a pro-contra structure on a graph.

Another argumentation-based tool to assist deliberative decision-making is the Parmenides system (Cartwright and Atkinson, 2008), specifically designed for a deliberative democracy setting in which the public can submit their opinions on a government policy being considered. This system explicitly adopts an argumentation framework in which argumentation schemes are used to structure the arguments, questions and objections put forward by both sides. When a policy proposal is presented through a webpage interface, an argument to the users supporting the adoption of the proposal can be attached. The user is then guided through a series of web pages that pose appropriate critical questions matching an argumentation scheme to determine which aspects of the proposal the users agree or disagree with. The scheme and critical questions themselves are in the background so that the structure is not visible to the user. Once the user’s opinion is sent to Parmenides it is downloaded to a database, where the arguments can be recorded and analyzed, enabling the administrator of the system to judge which parts of the policy justification the public participants agree or disagree with. The Parmenides system has been tested on political debates, including the justification for the 2003 war in Iraq, the UK debate over the legality of fox hunting, and a debate concerning the use of speed cameras on UK roads (Cartwright and Atkinson, 2008).

In the formal model of deliberation dialogue presented by McBurney, Hitchcock and Parsons (2007, 100), a deliberation dialogue consists of eight stages.

Open: In this stage a governing question is raised about what is to be done. A governing question, like ‘Where shall we go for dinner this evening?’ is posed.

Inform: This stage includes discussion of desirable goals, values, constraints on possible actions, evaluation criteria for proposals, and determination of relevant facts.

Propose: Proposals cite possible action-options relevant to the governing question

Consider: This stage concerns commenting on the proposals from various perspectives.

Revise: Goals, constraints, perspectives, and action-options can be revised in light of comments presented and information gathering as well as fact-checking.

Recommend: A proposal for action can be recommended for acceptance or non-acceptance by each participant.

Confirm: The participants can confirm acceptance of the recommended proposal according to some procedure.

Close: The termination of the dialogue.

The model set out in this chapter will follow this eight-stage model of McBurney et al., but three main stages will be distinguished: an opening stage, a closing stage, the six other sub-stages in between making up the argumentation stage. In contrast to the situation in persuasion dialogue, a burden of persuasion is not set at the opening stage. Instead, proposals are put forward during the argumentation stage, and the proposal best supported by the argumentation put forward during the argumentation stage is the one that is accepted at the closing stage.

The initial situation of deliberation is the need for action arising out of a choice between two or more competing courses of action that are possible in a given set of circumstances. The goal of the deliberation dialogue is for the participants to collectively decide on what is the best available proposal for action for the group, based on the facts collected, the goals they share, and the pro and contra arguments that have been brought to bear on each proposal in turn. Each proposal is subjected to critical questioning by all the participants (or all those who speak up), and the arguments both for and against the proposal are articulated as fully as possible. The strengths and weaknesses of each proposal are brought out in the discussion, and it is this evidence that is used to judge which proposal is the best from the point of view of the deliberation. Argumentation in a deliberation is generally defeasible, because new information can come in as the circumstances change, perhaps calling for a reopening of the deliberation.

3. A Worked Example

Alice and Bob have moved from Edmonton to Windsor, and their real estate agent, Carol, has been showing them houses. They are under some pressure to make a decision within two months, as their furniture is then to be shipped from their previous house, and moving this amount of furniture to a storage unit, and then moving again to their new home, is a costly procedure. Their agent has provided them with a lot of information, and they have been looking through housing ads, and collecting as much information as they can about the housing situation in Windsor at the present time. Now they have narrowed the choice down to three homes, each of which would be suitable. The first is a condominium listed at \$200,000. The second is a two-story house listed at \$340,000. The third is a bungalow listed at \$270,000. Another option is to select none of the three and keep searching, but they hope to avoid the potentially costly consequences of this action.

Before they sit down to discuss which one they should choose, they began by discussing general goals and values that are important to them in making this kind of decision. Both agree that having a quiet atmosphere is an important goal, and both agree that not being too far from the downtown area where Bob works is a goal. These goals could, of course, conflict in some instances, since there tends to be more traffic and noise in the downtown area. Costs are always important in such a large investment, and they

agree that they want to buy a house that will keep its value, and to avoid buying a house that will lose value, for example because it is over-valued or might have problems that could be costly to fix. Having discussed these matters, they proceed to have the following conversation about how to proceed at this point.

Alice: The two-story house is only four years old. It would not need any renovations. I like it.

Bob: Me too. It's right on the river, and has a nice view. If it has a nice a view, that is good for resale value.

Alice: Yes, it would have good resale value, but since it's right next to the river, it could be susceptible to water problems in the basement. Even worse, flooding could be financial disaster, because it is not covered by insurance.

Bob: There has only been one serious flood in the recorded history of Windsor, a long time ago. Also, this house does have a sump pump that can prevent minor water problems in the basement.

Alice: The condominium also has a nice view, but it is on the seventh floor. There is no danger of flooding at that level.

Bob: The bungalow is 27 years old, and would need some renovating.

Alice: Yes, we want to avoid renovations if possible, but it has been kept in very good condition. The renovations required would not be too costly.

Bob: The bungalow has no view of the river, however. Watching the boats go down the river is so relaxing to the mind.

Alice: The condo is the least expensive of the three homes, and would require little or no renovations.

Bob: Of the three, the two story house is the most expensive. Even if we renovated the bungalow, it would still cost less than the two story house.

Alice: What about getting to work for you? That is a factor.

Bob: The condo and the bungalow are both are in the same area, where I can ride to work on my bike in 40 minutes. The bike path goes right along the river straight to my office.

Alice: The problem with the two story house is that it is twice as far away as the two other homes. It would take at least 40 minutes for you to ride in from there.

Bob: If we lived there, I would have to drive the car to work most days.

Alice: Riding the bike to work is more environmentally friendly. Also, you really like riding your bike to work, and it is good exercise.

Bob: Yes, and there is also the factor of the cost of gas. The cost of driving to work adds up to a significant amount over a year. Also, neither of us likes spending a lot of time in the car. It is wasted time, and spending that time outside getting exercise is really a good way to spend that time. When you spend your whole day working on a computer, it is really important to get some exercise to break up your day.

Alice: That is offset by the lower taxes of the two story house, because it is outside the city, even though it is a larger house.

Bob: I say let's make an offer on the condo.

Alice: I say we make an offer on the bungalow.

Bob: The bungalow does not have the view of the boats!

Alice: There might be noise in the condo. It is right on the main street. Also, your neighbors could be noisy. Not only are you closer to your neighbors in one of those condos, but it is also hard to predict who might be sharing your common wall.

Bob: I agree that either of the houses is more likely to be quiet.

Alice: In the condo there is a central fee, and that can go up.

Bob: The central fee in this condo \$180. That is not too high right now,

Alice: Yes, the central fee can go up in a condo, and setting the fee is out of our control. It could go up at any time.

Bob: But there are also maintenance costs in houses. If you need a new roof, you have to pay for it. Houses continually need a lot of repair and maintenance work.

Alice: Yes, that is true, but in a condo you do not have the same control over these things. Decisions about what upgrades you can do are voted on by the condo committee.

The example above represents only a short part of the deliberations that Alice and Bob have engaged in before they might finally arrive at decision to make an offer on some home. It is based on previous discussions and collecting of information at the opening stage. It will presumably be followed by the making of more specific proposals once the stage of making a specific offer has been reached. The part of the conversation shown above, however, represents a realistic enough case to give us some materials to work with. We can see that it is based on some existing information that Alice and Bob share, but that will change as the deliberations proceed. They each presented some arguments, and in some instances they put forward arguments against the previous arguments of the other party. Towards the end, each made a proposal and supported it with arguments. The two proposals are opposed to each other, since they only need to buy only one home. The possible option of buying both house and condo is not being considered.

4. The Factors List Method of Structuring Deliberation

One method that is commonly used where the deliberation is only between two choices of actions is to summarize the deliberations by writing down two columns, one citing all the reasons in favor of the one action and the other citing all the reasons in favor of the other action. But there can also be reasons for not doing something. Hence a variant would be to cite all pro and contra reasons on both sides. For example, suppose I am trying to decide whether to take my umbrella. On the one side, I might list reasons for taking the umbrella like 'It might rain.', 'If it rains and I don't take my umbrella, I will get my clothes wet.' On the other side, I might list reasons for not taking the umbrella, like, 'There is a good chance it will not rain', 'If it doesn't rain I won't need the umbrella.', and 'Carrying the umbrella is a nuisance'. Normally we wouldn't bother to build such an itemized list of all arguments for and against a proposed course of action in a case like the umbrella one, because the factors involved are fairly simple.

However, in a case like a decision to buy a house the factors could be more numerous and complex. What might help is to draw up a list of positive and negative factors under each option that is being considered. Factors have been used in case-based reasoning (CBR) in AI in an intelligent tutoring system called CATO (Ashley, 2006, 39-43). Tracking through the factors cited in the decision to buy a house example above, we could draw up such a list as in Table 1.

<i>Two-Story House</i>	<i>Condominium</i>	<i>Bungalow</i>
Needs no renovations.	Needs no renovations.	Needs some renovations.
Nice view of boats.	Nice view of boats.	No nice view of boats.
Expensive.	Inexpensive.	Moderately expensive.
Problem of water leaks.	No water leak problem.	No water leak problem.
No bike-riding to work.	Bike-riding to work.	Bike-riding to work.
Favorable for taxes.	Less favorable for taxes.	Less favorable for taxes.
Quiet atmosphere.	Less quiet atmosphere.	Quiet atmosphere.
Control over repair cost.	No control over repair cost.	Control over repair cost.
Outstanding resale value.	Lesser resale value.	Lesser resale value.

Table 1: List of Positive and Negative Factors in the House-Buying Example

The pro and contra list, of the kind shown in table 1, could be a simple method of arriving at a decision. We could pick the option that has the greatest number of positive factors and the least number of negative factors. Let's see by counting the factors under each option. The two-story house has six positive factors and three negative factors. The condo has five positive factors and three negative factors. Here we do not count the factor 'moderately expensive' as either positive or negative, because it falls between the positive factor of 'expensive' and the negative factor of 'inexpensive'. The bungalow has five positive factors and three negative factors. The winner is the two-story house, since it has the highest ratio of positive or negative factors.

Does this outcome reflect the best choice for Alice and Bob? It would seem not, for as the dialogue proceeds, Bob proposes making an offer on the condo and Alice proposes making an offer on the bungalow. Neither of them puts forward the proposal of making an offer on the two-story house, and the arguments they subsequently advance in support of their proposals suggest that the two-story house might not be the best choice for them. What has gone wrong here?

By simply counting the number of factors, we might be overlooking the importance of each factor. It might be helpful to try to see that we have taken all of the important reasons into account before making the decision. Summing them up with an itemized list of reasons pro and con could help when we come to review the factors and finally make the decision. It would be better if we could list not only all the arguments on both sides, but also give some account of how these arguments interact with each other. This is the method of argumentation, which analyzes all of the arguments on both sides of an issue under discussion, taking into account which arguments support each other and which arguments attack each other.

5. Applying the Method of Argumentation to the Example

There are plenty of examples of arguments put forward and criticized in the conversation between Alice and Bob. Indeed, there are too many to analyze them all, as would be required by a proper case study of the example. Still, some of the arguments can be analyzed in a way that would illustrate the method of argumentation works. The

second argument used in the example conversation can be expressed in the following format, with its premise and conclusion.

Premise: If a house has a nice a view that is good for resale value.

Premise: The two-story house has a nice view.

Conclusion (and premise in the next argument): The two-story house will keep its value.

Premise: Goal: to buy a house that will keep its value.

Conclusion: These are reasons in favor of buying the two-story house.

The first argument made up of the three statements at the top, and its conclusion is re-used as a premise in the second argument. This feature illustrates *chaining of arguments*, where two arguments are combined by sharing a common statement that is a conclusion in one and a premise in the other.

The second argument can be used to illustrate one of the most important types of argument used in deliberation, called practical reasoning. In practical reasoning one premise states a goal, and the other cites a course of action that could be used to fulfill the goal, or provide a means to obtain it. The conclusion states that it would be practically reasonable to carry out this course of action. This form of reasoning is defensible, meaning that it offers a reason for accepting the conclusion provisionally, but that might be defeated by new information that comes in. For example, if a better means of fulfilling the goal becomes evident, such new evidence would defeat the original argument. The argumentation scheme for practical reasoning has a list of critical questions matching it, and asking a critical question, or backing it with evidence, can defeat the argument.

The simplest form of practical reasoning, called practical inference, is represented by the following scheme (Walton, Reed and Macagno, 2008, 323).

Instrumental Practical Reasoning

Major Premise: I (an agent) have a goal G .

Minor Premise: Carrying out this action A is a means to realize G .

Conclusion: Therefore, I ought (practically speaking) to carry out this action A .

Below is the set of critical questions matching the scheme for instrumental practical reasoning (Walton, Reed and Macagno, 2008, 323).

CQ₁: What other goals do I have that should be considered that might conflict with G ?

CQ₂: What alternative actions to my bringing about A that would also bring about G should be considered?

CQ₃: Among bringing about A and these alternative actions, which is arguably the most efficient?

CQ₄: What grounds are there for arguing that it is practically possible for me to bring about A ?

CQ₅: What consequences of my bringing about A should also be taken into account?

The last critical question, CQ₅, is very often called the side effects question. It concerns potential negative consequences of a proposed course of actions. Just asking about

consequences of a course of action being contemplated could be enough to cast an argument based on practical reasoning into doubt.

It could be helpful to visualize the structure of the argument above, using a tool called Araucaria, based on an Argumentation Markup Language (Reed and Rowe, 2004). Available as free on the internet, Araucaria is a software tool for analyzing arguments that helps a user to reconstruct an argument map of a given argument using a point-and-click interface. The user moves the text of discourse containing an argument as a text file with a set of statements into a box in a left window, and then the user can put each statement in a text box and draw an arrow representing each inference from a set of premises to a conclusion. The outcome is a chain of argumentation that appears on the right as an argument diagram, as shown in the example below.

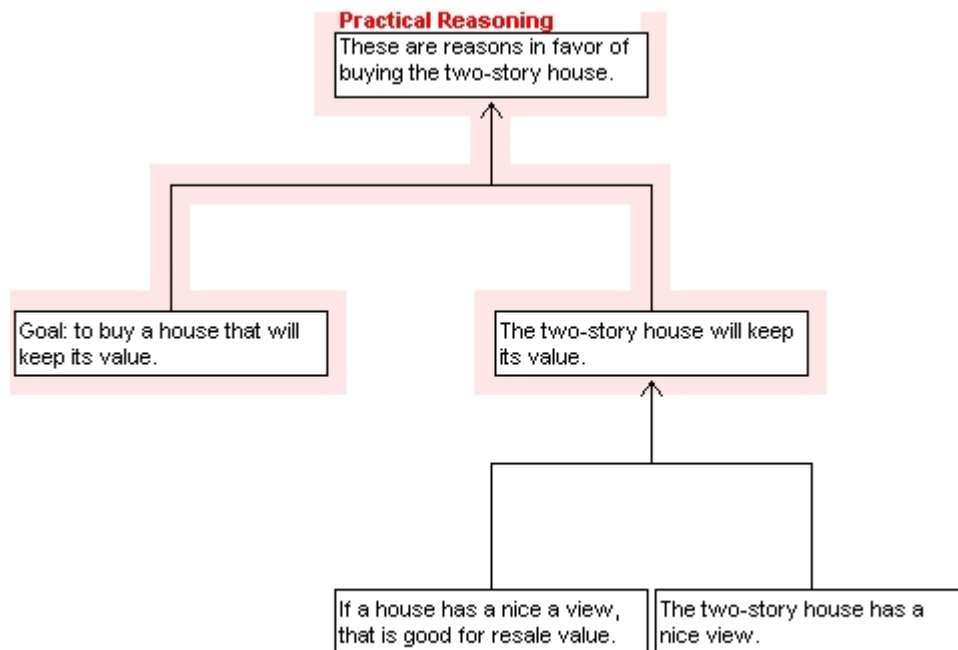


Figure 1: Argument Map of the Example

Araucaria was the first argument visualization tool to incorporate the use of argumentation schemes. The scheme for practical reasoning is shown in figure 1 surrounding the part of the argument that fits that scheme. The user can search through a menu of argumentation schemes, and apply a selected scheme to an argument, displaying how the premises are connected to the conclusion by an inference fitting the scheme. Araucaria supports a distinction between two basic types of arguments. Both arguments mapped in figure are shown as linked. In a linked argument, each premise goes together with another, or with others, to support a conclusion. All syllogistic arguments, or arguments that fit argumentation schemes, are linked, because the two premises work together to support the conclusion. In a convergent argument, each argument provides a separate reason to support the conclusion.

Ten lines before the end of the conversation Bob puts forward a proposal, saying that they should buy the condo. Alice replies by putting forward a counter-proposal, saying that they should make an offer on the bungalow. This is a crucial point in the deliberation. After this point each puts forward arguments supporting his/her proposal, but once each proposal has been made, we can see that all of the various before that point in the conversation become either pro or contra each proposal. Thus once the two proposals have been articulated, we could make a large argument map with a complex chain of argumentation leading into each proposal, or attacking each proposal. In order to determine which of these arguments is stronger, we will first have to do a lot of work to reconstruct these two chains of argumentation, draw an argument map for each, and annotate them to show which premises are acceptable, or have been accepted. We do not have space for this project here, but to give the reader a better idea of the method that needs to be used to carry it out, in figure 2 we present an argument reconstruction of one of the arguments put forward after the two proposals were made.

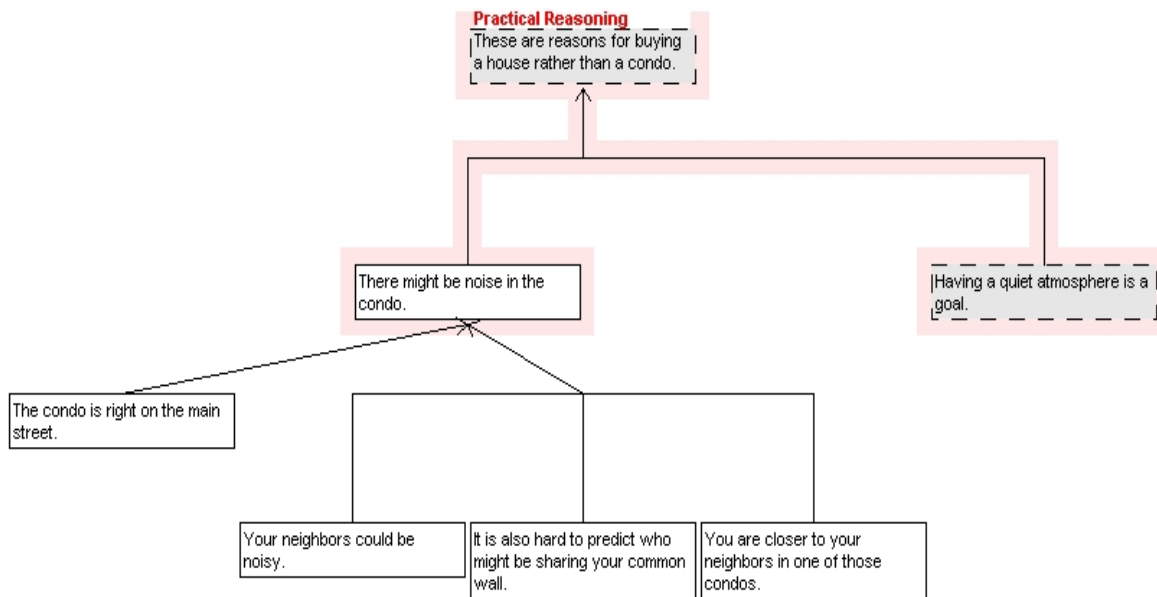


Figure 2: Argument Map of the Second Argument

What figure 2 shows is that in order to reconstruct an argument like this from a deliberation that took place in a natural language conversation, we may have to fill in some implicit premises and conclusions. These are shown in the two text boxes at the top that are shaded and have dotted borders. The reader will recall that before the conversation in the example, Alice and Bob had a prior conversation in which they agreed on some shared goals with regard to the project of buying a home. The argument could be analyzed in even finer detail by inserting other implicit premises. For example, alongside the premise on the far left, an implicit premise, 'If a condo is right on the main street, there might be noise in it', forming a linked argument.

6. Conclusions and Glimpses Beyond

In the traditional method of decision-making in classical decision theory, the expected utility of an outcome state is calculated on the basis of the likelihood of reaching states by applying a utility function to the transitions between states. The outcome is decided quantitatively by attaching numerical weights to the states by the utility function. The argumentation method of deliberative decision-making compares the arguments on both sides, using argumentation schemes to identify their premises and conclusions and to find missing assumptions. The arguments are evaluated by testing them against critical questions and posing counter-arguments. Practical reasoning is the main scheme most often used in deliberation dialogues. The acceptability of the premises and the structure of the scheme can be used in a given to determine the acceptability of the conclusion. The argumentation approach is to construct an argument map that represents the chained argumentation on each side, and shows how critical questions and attacks are related to each argument. A new tool that illustrates the methodology is worth mention.

There is a new argumentation system called Carneades (named after the Greek skeptic), that represents critical questions as premises of an arguments. An argument is said to have three kinds of premise: Ordinary premises, assumptions and exceptions. Assumptions, like ordinary premises, are assumed to hold, while exceptions are assumed not to hold (Gordon, Prakken and Walton, 2007). Carneades is not only a formal model of argumentation but an argument visualization tool for it is under development as well. Premises in an argument can have various kinds of weight. They can be stated, acceptable or accepted, and Carneades has standards of proof an argument can be weighed against (Gordon and Walton, 2009). So far Carneades has only been applied to argumentation in persuasion dialog, but a possible future research project is to apply it to modeling argumentation in deliberative decision-making.

In this chapter, it has been suggested that argumentation can provide a method of summing up the reasoning process of the participants in a deliberation dialog that has some advantages over drawing up a list of factors on either side or calculating expected utilities. This approach takes advantage of feature of practical reasoning identified in (Searle 2001) to the effect that that our preferences are typically determined as a product of practical reasoning rather than given as an input to it (Walton et al., 2009). A choice can be made at the opening stage on the questions of which goals are shared and which goals have priority, but during the argumentation stage, such preferences can be modified as the application of practical reasoning brings out the consequences of carrying goals, reveals conflicts between goals, and so forth. As critical questions are raised, as new information comes in, and as counter-arguments are put forward to attack a given argument, reasons for a proposal can be supported or undercut.

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