Justifying Practical Reasoning

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Abstract. In this paper we discuss arguments embodying practical reasoning — arguments as to what it is sensible for someone to do in a given situation. We draw attention to differences between practical reasoning and reasoning about beliefs, and suggest that practical arguments should be treated as a species of presumptive reasoning, best handled using argumentation schemes and associated critical questions. We extend the argument scheme for practical reasoning and its critical questions proposed by Walton, and relate this to our previous work. We discuss an implementation of this approach, and then describe a particular application which makes use of the lessons learned.

1 INTRODUCTION

Although many of the arguments that are deployed in everyday life are concerned with what it is sensible or practical to do, the topic of practical reasoning has been rather neglected by philosophers. Practical reasoning has, of course, been addressed (see, e.g.. [7] for a collection of essays and [8] for a recent monograph), but it has received nothing like the attention that has been paid to reasoning about beliefs. When action has been considered, it has most often been in the context of ethics, considering what is morally right or wrong, rather than what is prudentially or practically useful. It has been similarly neglected in Computer Science, where practical reasoning has been treated as little different from deduction, standard backward chaining techniques being applied to rules with goals as consequents and preconditions and actions as antecedents. The academic discipline which has perhaps focused most attention on the selection and justification of actions is Economics. However, there the widespread adoption of an overly narrow definition of rationality[2] has hindered understanding of practical reasoning and even impeded progress in the discipline, as, for example, Nobel Memorial Laureate Amartya Sen has recently argued [9].

In this paper we first discuss some of the differences between reasoning about belief and reasoning about action which cause problems with approaches based on the practical syllogism. We then discuss the treatment of practical reasoning in [10] which makes use of an argumentation scheme and associated critical questions. We elaborate this scheme and extend the critical questions, and relate this to our previous work. We then describe two implementations based on this approach.

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[2] Oscar Lange, for example, defined *rationality* as the maximization of some quantity [6].

2 PROBLEMS WITH THE PRACTICAL SYLLOGISM

Practical reasoning in computer science can predominately be seen as based on a form of the practical syllogism. An example from [5] is:

K1 I'm to be in London at 4.15.
If I catch the 2.30, I'll be in London at 4.15
So, I'll catch the 2.30

This, however, cannot be quite right. It may well be possible to accept both the premises and deny the conclusion. There are at least three bases for criticism:

C1 K1 represents a species of abduction, and so there may be alternative ways of achieving the goal.

C2 Performing an action typically excludes the performance of other actions, which might have other desirable results; these may be more desirable than the stated goal.

C3 Performing an action typically has a number of consequences. If some of these are undesirable, they may be sufficiently bad to lead us to abandon the goal.

In order to act on the basis of an argument such as K1 therefore, we need to consider alternative actions, alternative goals and any additional consequences, and then choose the best of these alternatives. Note the element of choice: we can choose our goals and actions in a way in which we cannot choose our beliefs, and different people may rationally make different choices. As Searle puts it:

"Assume universally valid and accepted standards of rationality, assume perfectly rational agents operating with perfect information, and you will find that rational disagreement will still occur; because, for example, the rational agents are likely to have different and inconsistent values and interests, each of which may be rationally acceptable." [8, xv]

In a sense therefore any practical argument is directed to a specific person at a specific time, to encourage them towards a particular choice and the objectivity that we can find in factual matters cannot in general be attained in practical reasoning. An attempt to modify K1, similar to one put forward by Searle in [8] (although not regarded by him as satisfactory) is:

S1 I want, all things considered, to achieve E
The best way, all things considered, to achieve E is to do M
So, I will do M.

There are problems with this: we cannot in general consider all things, because we have limited reasoning resources and imperfect information. Nor is it easy to say what is meant by "best" here. In computer science there are often attempts to define best using some

kind of utility function but, as Searle points out, any preference ordering is more often the *product* of practical reasoning than an input to it. Coming to understand what we think is best is part of what we do in practical reasoning.

One way of addressing these problems is to regard practical reasoning as a species of presumptive argument. Given an argument like K1, we have a presumptive reason for performing the action. This presumption can, however, be challenged and withdrawn. Subjecting our argument to appropriate challenges is how we hope to identify and consider the alternatives that require consideration, and determine the best choice for us, in the particular context.

One account of presumptive reasoning is in terms of argument schemes and critical questions, as given in [10]. The idea here is that an argument scheme gives a presumption in favour of its conclusion. Whether this presumption stands or falls depends on satisfactory answers being given to the critical questions associated with the scheme.

3 ARGUMENT SCHEMES FOR PRACTICAL REASONING

In [10] Walton gives two schemes for practical reasoning: the necessary condition scheme:

W1 G is a goal for a
Doing A is necessary for a to carry out G
Therefore a ought to do A.

and the sufficient condition scheme:

W2 G is a goal for a
Doing A is sufficient for a to carry out G
Therefore a ought to do A.

He associates with them four critical questions:

CQ1: Are there alternative ways of realising G?
CQ2: Is it possible to do A?
CQ3: Does a have goals other than G which should be taken into account?
CQ4: Are there other consequences of doing A which should be taken into account?

Here we will consider only W2: W1 is a special case in which CQ1 is answered in the negative. CQ1, CQ3 and CQ4 relate respectively to the criticisms C1, C2 and C3 identified above. We believe, however, that the argument scheme, and the critical questions need elaboration. Firstly, we believe that the notion of a goal is ambiguous.

Consider the following situation. I am in Liverpool. My friend X in London is about to go to Australia indefinitely, and I am eager to say farewell to him. To catch him before he leaves London, it is necessary that I arrive in London before 4.30. So I may say:

AS1 I want to be in London before 4.30
The 2.30 train arrives in London at 4.15
So, I shall catch the 2.30 train.

Here I am justifying my action in terms of one of its consequences. Alternatively I may say:

AS2 I want to see X before he leaves London
The 2.30 train arrives in London at 4.15
So, I shall catch the 2.30 train.

Here the action is not justified by its direct consequences, but by something else that follows from it. I do not really desire to be in London at all, except in so far as it is a means to the end of seeing X. Alternatively there is a third justification:

AS3 Friendship requires that I see X before he leaves London
The 2.30 train arrives in London at 4.15
So, I shall catch the 2.30 train.

Now I justify my action not in terms of its direct consequences, nor in terms of a state of affairs which will result from the action, but in terms of the underlying social value which I hope to promote by the action.

In general we may write instead of

W1a G is a goal for a

P1 a wishes to achieve S so as to bring about G which promotes a value V

Note that the answers to CQ1 are different in the cases AS1-3:

- In the case of AS1, I must propose other ways of arriving in London on time, perhaps by driving;
- In the case of AS2 I need not go to London at all; for example I could drive to Heathrow and say goodbye at the airport;
- In the case of AS3 I need not meet with X at all; perhaps a telephone call and an apology will be enough to promote friendship.

Given this more refined notion of a goal we can extend CQ1 to

CQ1a Are there alternative ways of realising the same consequences?
CQ1b Are there alternative ways of realising the same goal?
CQ1c Are there alternative ways of promoting the same values?

We can also elaborate CQ3, in that it may be that doing A realises some other goal which promotes some other value, or it may be that doing A prevents some other goal from being realised:

CQ3a Would doing A promote some other value?
CQ3b Does doing A preclude some other action which would promote some other value?

Also CQ4 has two aspects:

CQ4a Does doing A have a side effect which demotes the value V?
CQ4b Does doing A have a side effect which demotes some other value?

Secondly, apart from the possibility of the action, Walton does not consider other problems with soundness of W2, presupposing that the second premise is to be understood in terms of what a knows or reasonably believes. In [4] we proposed an argument scheme which incorporates P1 and makes the factual context explicit:

G1 In the current situation R
Performing action A

Will result in the new situation S.
G is true in S.
The truth of G promotes some value V.

It could be that:

- A is not sufficient to bring about G; either because the current circumstances are not as presupposed, or because, although the beliefs about the current situation are correct, A does not have the believed effects.
- G is not a goal for a; either because there is some problem with the link between the circumstances brought about by doing A with the value a assumes them to promote, or because G is not in fact a possible state of affairs.

We can therefore add the critical questions:

CQ5: Are the circumstances such that doing A will bring about G?
CQ6: Does G promote V?
CQ7: Is G possible?

Note that an answer to CQ5 needs to address four points:

a) Whether the believed circumstances are possible
b) Whether the believed circumstances are true
c) Assuming both of these, whether the action has the stated consequences
d) Assuming all of these, whether the action will bring about the desired goal

Similarly, if we take the more articulated view of G expressed as P1, CQ6 needs to address both

a) Whether G does realise the value intended; and
b) Whether the value proposed is indeed a legitimate value

Also, taking G in terms of P1, CQ7 needs to address both

a) whether the situation S believed by a to result from doing A is a possible state of affairs
b) whether the particular aspects of S represented by G are possible

We thus have an elaborated set of critical questions: four variants of CQ5; three variants of CQ1; two variants of each of CQ3, CQ4, CQ6 and CQ7; and CQ2, making sixteen in all. These critical questions correspond to the fifteen attacks on the argument scheme G1 identified in [4] and used in [2], with CQ5a and CQ7a treated as a single attack in those works as both declare a state of affairs to be impossible. Table 1 lists our characterisation of the attacks, together with the corresponding critical questions. Note that the emphasis of our earlier work is on attack rather than questioning: this is because we take a more dialectical view in which the critical question is accompanied by a proposed negative answer which needs to be rebutted by the proponent.

We therefore believe that in an argument about a matter of practical action, we should expect to see one or more prima facie justifications advanced stating, explicitly or implicitly, the current situation, an action, the situation envisaged to result from the action, the features of that situation for which the action was performed and the value promoted by the action, together with negative answers to critical questions directed at those claims.

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Table 1. Attacks in Previous Work and Critical Questions

Attack	Characterisation	Critical Question
1	Disagree with the description of the current situation	CQ5b
2	Disagree with the consequences of the proposed action	CQ5c
3	Disagree that the desired features are part of the consequences	CQ5d
4	Disagree that these features promote the desired value	CQ6a
5	Believe that the consequences can be realized by some alternative action	CQ1a
6	Believe that the desired features can be realized through some alternative action	CQ1b
7	Believe that an alternative action realizes the desired value	CQ1c
8	Believe that the action has undesirable side effects which demote the desired value	CQ4a
9	Believe that the action has undesirable side effects which demote the desired value	CQ4b
10	Agree that the action should be performed, but for different reasons	CQ3a
11	Believe that the action will preclude some more desirable action	CQ3b
12	Believe that the action is impossible	CQ2
13	Believe that the circumstances or consequences as described are not possible	CQ5a, CQ7a
14	Believe that the desired features cannot be realized	CQ7b
15	Disagree that the desired value is worth promoting	CQ6b

4 NATURAL ARGUMENTS AND PRACTICAL REASONING

When we examine natural arguments about practical reasoning we find that in practice many of them are elliptical, omitting one or more elements of the justification. For example, in the case of discussion of the proposed invasion of Iraq in 2003, one argument was

IW1 We should invade Iraq to depose Saddam

Here we have an action and the resulting situation, but the current situation is presupposed and the reasons for deposing Saddam and the value promoted by so doing are left implicit. There is a pragmatic reason for this: because persuasion relies on the value preferences of the audience rather than the speaker (see [3] for a fuller account of this), the speaker can hope that the audience will recognise some desirable consequences and acceptable values for themselves. In this way there may be agreement on the action, without the need to agree on the specific goals achieved and values promoted. There is also a problem: many of the critical questions depend on these components of the justification. Thus only critical questions CQ5 and CQ7 can be posed without making some assumption about the goals and values of the proponent. If we reply, for example,

IW2 Saddam has no weapons of mass destruction,

assuming the removal of the weapons to be the desired goal, we may be drawing the argument into a irrelevant discussion: the proponent may have had quite other reasons for deposing Saddam. Thus, in addition to posing critical questions, it must be possible to make the proponent elaborate his position by supplying the missing

pieces. Also it must be possible to state alternative positions, such as

IW3 We should not invade Iraq as it would breach international law.

We have implemented a Java program which mediates a dialogue game based on this model to be played by two human opponents ([1]). In this game players may advance elements of justifications, deny elements advanced by their opponents (in other words, supply negative answers to critical questions), request additional elements, and accept elements advanced by their opponents. This game is intended to allow the capture of the various moves that can be made in a natural argument. This implementation did indeed allow the reconstruction of a wide range of natural arguments concerning a number of topics. We are therefore content that our model does suffice to give an account of practical argumentation. Our overall aim, however, was to provide computer support to improve the quality of such argumentation. Here we felt that the implementation identified three major problems, which will become more severe if the intention is to allow computers to participate in such dialogues.

- Successful conduct of an argument requires considerable goodwill on the part of the participants. The relevance of contributions and the avoidance of fruitless lines of arguments is ensured only by the cooperation of the participants.
- The rules rely on syntactic elements, but such dialogues often turn on semantic and pragmatic features of the utterances.
- The large number of moves available and the fact that they can be deployed at many different stages of the dialogue, means that it is hard to enlist the support of the computer in guiding the moves of the participants. Playing the game is no easier than conducting an argument verbally: thus the problems of quality are not addressed.

Indeed it is this flexibility that presents problems in natural dialogue. Correctly interpreting the force of particular utterances and deciding how best to respond are what leads to misunderstandings, arguments at cross purposes, and inefficiencies both in natural dialogue and in its computational representation.

5 CURRENT WORK

Given the problems indicated in the last section, we believe there is a better way to support the construction of arguments about action than by modelling natural dialogue. Instead, the insights drawn from a consideration of natural dialogue — the moves that are required and typical patterns of natural dialogues in particular contexts — can be used to provide a tool which instead of attempting to mimic natural dialogue provides a well defined and productive route through a dialogue capable of addressing a specific situation. In this way we hope that misunderstanding of the justification can be minimised, and the most pertinent critical questions posed.

We have taken this approach in the Parmenides system ([2]). The specific situation we have chosen is that one where a democratic Government wishes to solicit views on some particular policy. The key features of this situation are:

- it is essential that the statement of the particular policy be fully explicit, and unambiguous. This is so that the Government cannot fudge the issues, and so that criticisms are really directed against the policy as it is understood by the Government, rather than some possibly inaccurate interpretation of it;
- critics must be allowed to pose a sufficient range of critical questions;
- it must be clear for any criticism, exactly what element of the justification is being objected to.

Parmenides uses a simple web interface to solicit criticisms of a particular policy argument.[3] First the justification is stated in full. This is to give the critic an overview of the justification. Then a succession of screens solicit objections to the values pursued and alternative values that might be considered; the connections between goals and values; the connections between the consequences of the actions and the goals; the claimed consequences of the actions; any alternative actions claimed to lead to the same ends; and the description of the current fact situation.

In this way the critic can pose all the apposite critical questions in a systematic manner. Critical questions relating to the possibility of states of affairs are not supported: it is assumed that the original position will be correct in these respects. Moreover, since there is a database at the backend, the Government could collect a number of such responses and see which parts of its argument found favour and which did not, and the extent to which they did so.

We believe that this more structured approach holds out considerably more promise for effective computer support of argumentation than does a game intended to embrace all the richness of natural dialogue, where the flexibility is accompanied by too much scope for misunderstanding and ambiguity, and where it is often difficult to determine how best to proceed with the dialogue.

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REFERENCES

[1] K. M. Atkinson, T. J. M Bench-Capon, and P. McBurney, 'Implementation of a dialogue game for persuasion over action', Technical Report ULCS-04-005, Department of Computer Science, University of Liverpool, UK, (2003).
[2] K. M. Atkinson, T. J. M. Bench-Capon, and P. McBurney, 'Parmenides: Facilitating democratic debate', in *Electronic Government 2004*, ed., R. Traunmüller, Lecture Notes in Computer Science, Springer, Berlin, (2004). *To appear*.
[3] T. J. M. Bench-Capon, 'Agreeing to differ: Modelling persuasive dialogue between parties without a consensus about values', *Informal Logic*, **22**(3), (2003).
[4] K. M. Greenwood, T. J. M. Bench-Capon, and P. McBurney, 'Towards a computational account of persuasion in law', in *Proceedings of the Ninth International Conference on AI and Law (ICAIL-2003)*, pp. 22–31, New York, NY, USA, (2003). ACM Press.
[5] A. J. P. Kenny, *Practical Reasoning and Rational Appetite*, 1975. Reprinted in [7].
[6] O. Lange, 'The scope and method of economics', *The Review of Economic Studies*, **13**(1), 19–32, (1945-1946).
[7] *Practical Reasoning*, ed., J. Raz, Oxford University Press, Oxford, UK, 1978.
[8] J. R. Searle, *Rationality in Action*, MIT Press, Cambridge, MA, USA, 2001.
[9] A. Sen, *Rationality and Freedom*, Harvard University Press, Cambridge, MA, USA, 2002.
[10] D. N. Walton, *Argument Schemes for Presumptive Reasoning*, Lawrence Erlbaum Associates, Mahwah, NJ, USA, 1996.

[3] A prototypical example can be seen at http:www.csc.liv.ac.uk/∼katie/Parmenides.html.