Value-Based Arguments in the Dictator Game

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Abstract

In this paper we use an approach to modelling reasoning in a simple scenario from experimental economics, called the Dictator Game, using preferences over social values to provide transparent justification of actions. Our approach to decision making here does not require estimation of utilities and weights for different factors and can thus allow preferences to emerge from the reasoning. Using this model we can explain the behaviour of subjects in such experiments, and, in particular, gain insight into the framing effect observed by some experimenters, which is difficult to explain in terms of maximising expected utilities.

Introduction

The Dictator Game (DG) is a very simple game – or more properly an experiment – used in experimental economics. The first player, the dictator, is told that he can choose how to divide a small (typically $5 or $10) sum of money between himself and a second player. The second player can do nothing, but simply receives whatever the dictator chooses to give. This contrasts with the Ultimatum Game, in which the second player may choose to reject the offer, in which case neither player receives anything.

If dictators considered only their own economic well being, they would simply keep all the money. There is no economic incentive to give anything away. In practice, however, dictators often give non-zero sums away, and these results seem to be quite robust across different sums of money and different cultures. Experimental studies suggest that typically 70% of dictators give non-zero sums and transfer around a quarter of the initial sum. In one particular study (Forsythe *et al.* 1994), given $10 to distribute, 79% gave away a positive amount, with 20% giving away half. The mode sum given away in that study was $3.

Thus it appears that the majority of people do not act in accord with their economic self interest. We do not, however, have to conclude at this point that the dictators simply fail to maximise their expected utility, but can conjecture that there are other factors contributing to that utility. Plausible suggestions include: that the benefit of the second player has some positive utility to the dictator; that giving in itself confers utility; that there is a sense of fairness which suggests that the money should be shared, perhaps equally; that people are kind; that dictators do not wish to appear selfish. Several subsequent experiments have attempted to explore the effects of these various conjectures by, for example, making the choice entirely anonymous so that the opinion of the experimenter does not need to be considered. Another possibility is that the way the problem is framed has a significant impact, which has problems for approaches based on maximising expected utility, since any framing effect means that the desired state will vary according to the initial state. In this paper we will consider how argumentation based on preferences relating to the personal values of the subjects can be used to analyse this game. What we will consider is how an agent might reason to *justify* its various options, in the light of various preferences that the agent might have with regard to the various social values that it could promote. We will build on (Atkinson & Bench-Capon 2007), and in section 2 we briefly outline their approach. In section 3 we will formulate the Dictator Game in terms of this approach. Section 4 will describe the possible arguments and how they are affected by the agent's preferences. Section 5 will, in particular, point to the difference made by the way the game is presented. It has been noted in the literature (e.g. (Bardsley 2007)) that these framing effects can have a significant effect on the choices made, and this can be explained in terms of our model of the problem where justification of an action depends on both the current and target states. Finally, section 6 will make some concluding remarks, in particular discussing advantages of this approach over those which depend on maximising utilities.

Approach to Practical Reasoning

In this section we provide a brief outline of the underlying approach used in our argumentation-based representation of the Dictator Game and the issues that it brings to light.

As shown in (Atkinson 2005), practical reasoning – reasoning about what to do in a given situation – can be viewed as the exchange of arguments for and against some proposals for action, the merits of which must be considered and evaluated against each other in order to determine the most appropriate action to execute in that situation. The particular approach used to structure such arguments is that of an argumentation scheme and associated critical questions. Ar-

gumentation schemes, following (Walton 1996), represent stereotypical patterns of reasoning whereby the scheme contains premises that presumptively justify a conclusion. Each scheme has associated with it a set of characteristic critical questions that can be used to challenge the presumption justified by instantiated schemes and so identify counter arguments. The claim presumptively justified by the instantiated scheme is acceptable only so long as it can withstand the critical questioning. Whilst such schemes impose a general structure upon the relevant arguments, they require a more rigorous formalisation if they are to be used in computational models of such reasoning. One such formalisation has been given in (Atkinson & Bench-Capon 2007) whereby a particular scheme for practical reasoning is represented in terms of an Action-based Alternating Transition System (AATS). AATSs (Wooldridge & van der Hoek 2005) are used for modelling systems comprising multiple agents that can perform actions in order to modify and attempt to control the system in some way. In (Atkinson & Bench-Capon 2007) AATSs serve as the underlying model for representing an argumentation scheme for practical reasoning, plus its associated critical questions. The descriptive version of the scheme, called AS1, is as follows:

AS1 In the current circumstances R
We should perform action A
Which will result in new circumstances S
Which will realise goal G
Which will promote value V.

AS1 is an extension of Walton's *sufficient condition scheme for practical reasoning* (Walton 1996) in which Walton's notion of a 'goal' is articulated in more detail by separating it into three elements: the state of affairs brought about by the action; the goal (the desired features in that state of affairs); and the value (the reason why those features are desirable). This extended scheme has associated with it sixteen critical questions that can be used to challenge instantiations of the scheme. These critical question can be used to identify attacks on instantiations of AS1, Examples of such critical questions are: "Are the circumstances as described?", leading to the attack "R is not the case"; "Does the goal promote the value?", leading to the attack "G does not promote V" and "Are there alternative actions that would realise G?", leading to the attack "we should perform B instead". The full list of critical questions can be found in (Atkinson 2005).

A key distinction made in AS1 is the notion of values that are distinct from goals. Values, as we use the term, denote some actual descriptive social attitude or interest which an agent may or may not wish to uphold, promote or subscribe to and they provide a subjective reason for an agent wanting to realise some particular goal. In this sense, values are not some quantitative measure, but instead provide qualitative, personal motivations to explain why particular agents should wish to reach or avoid certain states. It thus possible for several distinct goals to promote (or demote) the same value, and a goal to promote several distinct values. An agent will, according to the context and its interests and aspirations, express preferences between these values. These preferences are subjective and will differ from agent to agent.

Argumentation scheme AS1 and its associated critical questions have been given a more formal characterisation in terms of an AATS extended to handle values, as shown in (Atkinson & Bench-Capon 2007). This formalisation provides the machinery by which actions and their effects can be modelled for a given situation thus enabling agents to construct arguments and counter arguments for proposals for action, based on their individual models of the world. It should be noted that the formalisation also allows for reasoning about joint actions. Whilst this consideration is essential in many situations, it is not of concern to us in the Dictator Game since this game only concerns a single action of a single agent allowing the use of a simpler transition diagram. We can define the state transition diagrams for given situations showing the transitions that occur between states when actions are executed and the values that are promoted through the transitions. Although, in general, since values represent individual agents' perspectives, the transitions may promote and demote different values for different agents, again here we need consider only a single agent.

The reasoning involved in the complete practical reasoning process is divided into three stages: *problem formulation* – deciding what the propositions and values relevant to the particular situation are, and constructing the AATS; *epistemic reasoning* – determining the initial state in the structure formed at the previous stage; and, *choice of action* – developing the appropriate arguments and counter arguments, in terms of applications of the argument scheme and critical questions, and determining the status of the arguments with respect to the other arguments and the value orderings. For the Dictator Game the first two of these stages are straightforward and uncontroversial since the dictator can be assumed to have perfect information as to the model and current state, and there is no uncertainty as to the effects of actions. Thus, the only aspect of interest to us here is the different arguments and counter arguments that can be put forward, based on the values that are promoted or demoted by the particular transitions detailed in each proposal for action. Given that we are not making use of the full model but only a smaller subset of it, we need only define the aspects of the model that are relevant for our representation of the Dictator Game, which are as follows:

- Each state transition diagram comprises a set Q of *states* of which one state, *q0*, is designated the *initial state*.
- A is the set of *actions* available to the dictator.
- The *state transition function* defines the states that execution of each action from the initial state results in.
- V is the set of *values* relevant to the scenario.
- The *valuation function* defines the status (promoted +, demoted –, or neutral =) that labels the transition between two states.

Given this model, arguments can then be generated that propose and attack particular actions based on the values promoted through execution of the actions. Once such a set of arguments has been identified, the arguments must then be evaluated to determine their strength and resolve

disagreements over which action should be performed. The evaluation mechanisms we use are Value-Based Argumentation Frameworks (VAFs) (Bench-Capon 2003), which are an extension of Dung's abstract Argumentation Frameworks (AFs) (Dung 1995).

An AF is defined as a finite set of arguments and a binary relation between pairs of these arguments called an *attack*. AFs can conveniently be modelled as directed graphs with arguments as nodes and attacks as edges showing which arguments attack one another. The notion of an argument is entirely abstract: no concern is given to the internal structure of the arguments. Thus, the status of an argument can be determined by considering whether or not there is a set of arguments which can defend the argument from attack by other arguments in the AF. A maximal set of arguments which do not attack one another, but which between them attack every attacker of a member of the set is a *preferred extension* and represents a maximal consistent position.

VAFs extend AFs by associating arguments with values that are promoted through acceptance of the argument, thus accommodating different audiences with different interests. VAFs define a notion of defeat of arguments different to that of an AF. In AFs an argument is always defeated by an attacker, unless that attacker can itself be defeated. In a VAF, however, attack is distinguished from *defeat for an audience* whereby strengths of arguments for a particular audience are compared with reference to the values to which the arguments relate. This allows a particular audience to choose to reject an attack, even if the attacking argument cannot itself be defeated, by preferring the value the argument promotes to that of its attacker. The preferred extension for an audience (defined as a particular ordering on values) can be defined analogously to the preferred extension of an AF using *defeat for that audience* rather than attack. Formal definitions of AFs, VAFs and related notions can be found in (Bench-Capon 2003) which also gives an algorithm for determining the PE for a particular audience. Complexity of decision problems related to VAFs, and methods for determining the audiences which will accept specific arguments are given in (Bench-Capon, Doutre, & Dunne 2006). In our argumentation-based representation of the Dictator Game we will make use of VAFs to evaluate the arguments involved in the scenarios that we consider. In the next section we explore the nature of these arguments and their comparative evaluation.

Problem Formulation

We begin by identifying the states in the set *Q* that can be reached. We will represent a limited number of options that comprise the set of actions *A* and assume 100 needs to be divided. The set *A* thus comprises the following five actions corresponding to the five different divisions of the money: dictator gets 100% (a4); other gets 100% (2); each party gets 50% (a3); dictator gets 70% (a5); other gets 70% (a1) (with any remainder being given to the opposite party in each case). We also include, to begin with, as the initial state *q0*, the state where neither have any money, as this is the situation of the subjects at the start of the experiment. The dictator thus starts in the state $\{0,0\}$ and can move to any of the other states, as shown in Figure 1. We then need to attach values to the transitions. We will use a range of values representing the various motivations that have been discussed in the literature.

***Money*:** Most obvious is the value of money. This is what economic man is supposed to maximise. Because, however, we need to recognise the idea that the other player having money may be considered positively by the dictator, we distinguish money for the dictator himself (**MS**) from money for the other (**MO**).

***Giving* (G):** It can be held that giving a gift is a source of pleasure, and this is what motivates the dictator to share.

***Image* (I):** Some have argued that it is the desire not to appear mean before the experimenter that motivates sharing. It could even be that one does not want to appear mean to oneself.

***Equality* (E):** Equality, as defined by an equal distribution, characterises a sense of fairness.

These values will be promoted and demoted as follows: MS will be promoted if the dictator's money increases and demoted if it is reduced. MO will be promoted if the other's money increases and demoted if it is reduced. G will be promoted if the other's money increases as a result of the dictator's decision. Value I will be demoted if the dictator keeps all the money. E will be promoted if the distribution becomes more equal, and demoted if a distribution becomes less equal. These transitions are also shown in Figure 1.

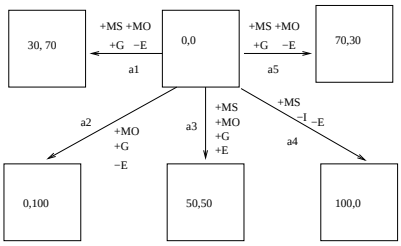

Figure 1: Values promoted or demoted by transitions from $\{0,0\}$.

At this point we wish to distinguish between two kinds of value. With some values more is always better: the object is to maximise the promotion of the value. For other values, however, more is not always better. For example there may be pleasure in giving, but this pleasure may not be increased if the gift is larger. Thus with respect to each of the values the agent may be a *maximiser* or a *satisficer*. In our terms the difference between these is that if we have an argument "I should do a1 to promote V1" then the counter argument "a2 would promote V1 to a greater extent" is possible for a value to be maximised, but not for a value to be satisficed.

We can now consider the arguments for the various actions in Figure 1. We omit reference to the current and target states, and the goal, as these are obvious from the context. The promotion of the various values gives rise to the following instantiations of AS1[1] in favour of the possible actions.

[1]As discussed in the previous section, the single reasoning agent in this scenario has perfect information about the represen-

Arg1.1: We should do a1 to promote MS
Arg1.2: We should do a1 to promote MO
Arg1.3: We should do a1 to promote G
Arg2.1: We should do a2 to promote MO
Arg2.2 :We should do a2 to promote G
Arg3.1: We should do a3 to promote MS
Arg3.2: We should do a3 to promote MO
Arg3.3: We should do a3 to promote G
Arg3.4: We should do a3 to promote E
Agr4.1: We should do a4 to promote MS
Arg5.1 We should do a5 to promote MS
Arg5.2: We should do a5 to promote MO
Arg5.3: We should do a5 to promote G

Simply on the basis of number of arguments in favour, we would choose a3. However, we need to consider the counter arguments. Let us first assume that the agent will wish to maximise rather than satisfice money, but wishes to satisfice giving rather than maximise it[2]. Note that the question does not arise with equality or image which are each taken to be an all or nothing thing here. The critical questions that are applicable here are:

1. Would a different action promote the value (of the maximiser) to a greater extent?
2. Would a different action also promote the value (of the satisficer)?
3. Would the action demote some other value?
4. Would the action preclude the promotion of some other value?

We then have the following counter arguments to a3:

Obj3.1 a4 would promote MS more than a3
Obj3.2 a5 would promote MS more than a3
Obj3.3 a2 would promote MO more than a3
Obj3.4 a1 would promote MO more than a3
Obj3.5 a5 is as good as a3 with respect to G
Obj3.6 a2 is as good as a3 with respect to G
Obj3.7 a1 is as good as a3 with respect to G

Similarly we have arguments to counter the arguments for other actions:

Obj1.1 a3 would promote MS more than a1
Obj1.2 a4 would promote MS more than a1
Obj1.3 a5 would promote MS more than a1
Obj1.4 a2 would promote MO more than a1
Obj1.5 a1 would demote E
Obj1.6 a5 is as good as a1 with respect to G
Obj1.7 a3 is as good as a1 with respect to G
Obj1.8 a2 is as good as a1 with respect to G
Obj2.1 a2 would demote E
Obj2.2 a5 would promote G as well as a2
Obj2.3 a3 would promote G as well as a2
Obj2.4 a1 would promote G as well as a2
Obj2.5 a2 precludes the promotion of MS
Obj4.1 a4 would demote E
Obj4.2 a4 would demote I
Obj4.3 a4 precludes the promotion of MO
Obj4.4 a4 precludes the promotion of G
Obj5.1 a4 would promote MS more than a5
Obj5.2 a1 would promote MO more than a5
Obj5.3 a2 would promote MO more than a5
Obj5.4 a3 would promote MO more than a5
Obj5.5 a5 would demote E
Obj5.6 a1 would promote G as well as a5
Obj5.7 a2 would promote G as well as a5
Obj5.8 a3 would promote G as well as a5

These arguments stand in an attack relation. Note that some of the objections urge the performance of a particular action. These are thus attacked by arguments against that action. The attack relation is summarised in Table 1. Arguments are annotated by their values (S for MS and O for MO).

Table 1: **Table 1: Attack relation applicable in $\{$0,0$\}$**

Action	For	Against
a1	Arg1.1S, Arg1.2O, Arg1.3G, Obj2.4G, Obj3.4O, Obj3.7G, Obj5.2O, Obj5.6G	Obj1.1S, Obj1.2S, Obj1.3S, Obj1.4O, **Obj1.5E**, Obj1.6G, Obj1.7G, Obj1.8G
a2	Arg2.1O, Arg2.2G, Obj1.4O, Obj1.8G, Obj3.3O, Obj3.6G, Obj5.3O, Obj5.7G	**Obj2.1E**, Obj2.2G, Obj2.3G, Obj2.4G, **Obj2.5S**
a3	Arg3.1S, Arg3.2O, Arg3.3G, Arg3.4E, Obj1.1S, Obj1.7G, Obj2.3G, Obj5.4O, Obj5.8G	Obj3.1S, Obj3.2S, Obj3.3O, Obj3.4O, Obj3.5G, Obj3.6G, Obj3.7G
a4	Arg4.1S, Obj1.2S, Obj3.1S, Obj5.1S	**Obj4.1E**, **Obj4.2I**, **Obj4.3O**, **Obj4.4G**
a5	Arg5.1S, Arg5.2O, Arg5.3G, Obj1.3S, Obj1.6G, Obj2.2G, Obj3.2S, Obj3.5G	Obj5.1S, Obj5.2O, Obj5.3O, Obj5.4O, **Obj5.5E**, Obj5.6G, Obj5.7G, Obj5.8G

Note that some objections do not urge another action. These, emboldened in Table 1, are interesting because as unattacked arguments in the argumentation framework they cannot be defeated, so their attack can fail only in virtue of a value preference. In the other cases, the attacks are symmetric.

Now let us consider what this says about the preference ranking of agents who choose particular actions. Consider first the simplest case, a4. In this case all the arguments in favour are based on MS and each of the other four values give rise to a distinct argument against. Hence an agent selecting a4 must have a preference ranking corresponding to

tation of the problem scenario and the effects of actions. Thus, instantiations of AS1 need not consider the current circumstances, nor the goal states achieved by performing the actions, since these are not under dispute. Hence, the following arguments comprise only the action choices and the values promoted by the actions.

[2]This seems to conform with experiments in (Bolton, Katok, & Zwick 1998), in which dictators would give trivial amounts rather than nothing.

the partial order MS $>$ {MO,G,E,I}. To justify a2, the preference order must include MO $>$ {MS,E}. G cannot justify doing a2, since other actions are equally good with respect to this satisficer. Turning to a3, we can see that E must be preferred to all of {MS, MO and G}, since these three values would be better or equally well promoted by other actions. This leaves a1 and a5. Clearly in both cases one of MS, MO and G must be preferred to E. This already means that a3 is defeated. Similarly a preference for G, I or MO over MS will defeat a4. So we need only consider the conflict between a1 and a5. The VAF for the relevant arguments is shown in Figure 2. It contains the three arguments in favour of a1, the three arguments in favour of a5, the two objections against a1 based on a5, and the two objections against a5 based on a1.

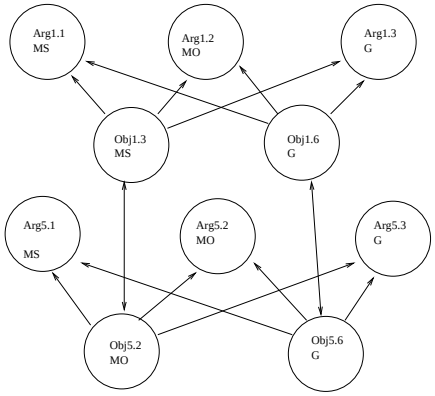

Figure 2: VAF for arguments relating to a1 and a5.

Note first that a preference for G cannot discriminate between these actions. This is because the two cycle between Obj1.6 and Obj5.6 means that these two arguments will each give rise to a distinct preferred extension. It is desirable that G cannot be used to discriminate since both the actions promote G and it is only a satisficer. Thus if MS $>$ MO we will perform a5 and if MO $>$ MS we will select a1. G may be the most preferred value, but the preference between MS and MO will determine the action selected.

Recall now that one of MO, G and I must be preferred to MS in order to defeat a4. Suppose we now make the reasonable assumption that MS is preferred to MO. This means that if MS is the most preferred value, a4 will be selected. If I or G is preferred to MS but MS is preferred to E, then a5 will be chosen. Otherwise a3 will be chosen. Note that these are the three choices that are made by almost all subjects in the experiments.

Framing

One claim made about the Dictator Game is that the results are highly sensitive to the way the task is presented to the subjects (Bardsley 2007). Bardsley writes:

> Experimental dictator games have been used to explore unselfish behaviour. Evidence is presented here, however, that subjects' generosity can be reversed by allowing them to take a partner's money. Dictator game giving therefore does not reveal concern for consequences to others existing independently of the environment, as posited in rational choice theory. It may instead be an artefact of experimentation.

If the framing is to have an impact, the choice of action cannot be determined by the expected utility of the target state, since the utilities of the states are unchanged and the effetcs of action certain. In our approach, however, the justification of an action does also depend on the current state.

In the above previous section we took {0,0} as a starting point. This can be rationalised because the subjects come to the game with nothing. But the initial state could be seen as {100,0}, or as explicitly presented in the Taking Game[3], as {0,100}. Let us consider this from our argumentation perspective. Figure 3 has {100,0} as the initial state.

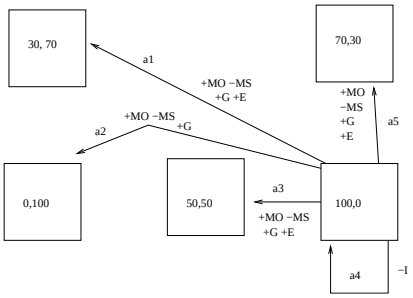

Figure 3: Values promoted and demoted by transitions from {100,0}

Now the arguments change significantly. In particular notice that E can now be promoted by a5 and a1 as well as a3. In particular if E is a satisficing rather than a maximising value, this should lead to more agents selecting a5. Note also that there are now no positive arguments in favour of a4: however, the demotion of MS provides arguments against all the actions other than a4 based on actual demotion of MS rather than just not maximising it.

Now consider the Taking Game, as shown in Figure 4.

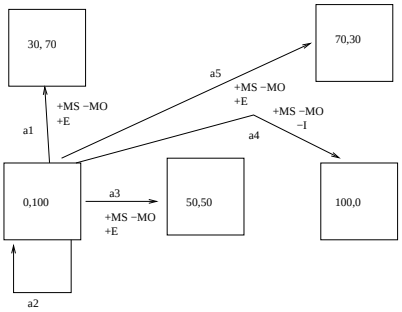

Figure 4: Values promoted and demoted by transitions from {0,100}, the Taking Game.

The most significant factor here is that G can no longer be promoted at all. This may help to explain Bardsley's finding "that subjects' generosity can be reversed by allowing them to take a partner's money". Notice also that E can be promoted by both a1 and a5, giving a positive non-selfish motivation, and hence more acceptable justification, for taking at least some of the other's allocation. Both of these aspects would lead to the less generous behaviour observed.

[3]The Taking Game presented here is a simplification of the game used in (Bardsley 2007).

Another aspect of the framing problem is that it might affect the preference ranking on values. For example, in the talking game, the dictator is very likely to perceive the initial situation as unfair, which could give greater prominence to, and result in a greater preference for, E. In the game starting from $\{100,0\}$ the sense of giving is emphasised, and thus G may well be ranked more highly by subjects with this perception of the initial situation.

Discussion

Thus far we have shown how our model of an agent choosing an action on the basis of justifications in terms of arguments and a preference ranking on personal values can account for the behaviours of subjects in the Dictator Game experiments, and which in particular emphasises the importance of how the scenario is presented to the subjects. It could, however, be argued that the machinery is unnecessary and the behaviour could equally be accounted for in terms of subjects maximising their expected utilities. Such a utility function would, of course, relate not only to the subject's money, but to other factors corresponding to our values, and individual preferences would be modelled by attaching different weights to these factors.

While this may be true, the following points should be noted. First, such a function cannot be simply be applied to states, unlike classical decision theory in which expected utility is calculated on the basis of the likelihood of reaching various states. If so, in the Dictator Game, the same state would be chosen regardless of how the problem were framed. Thus the utility function would need to be applied to the transitions, recognising that actions can have intrinsic utility. Second, any such function would need to be complicated to distinguish between maximisers and satisficers, whereas our account handles this distinction rather elegantly by using different critical questions and so identifying different attacking arguments. Third, our framework provides an explanatory account of the reasoning process of the participants in terms of arguments, which we regard as more instructive than reference to a formula and expected utility calculations. Fourth, in extreme situations we cannot trade off one benefit for another; some risks are simply too great to run for a small benefit, however, unlikely they may be. The value based account naturally represents this absence of trade off. Fifth, to be usefully deployed, we need a way of identifying the utility function in advance: this is psychologically implausible. In many situations we are really rather bad at attaching numerical weights to our various interests and aspirations, making a qualitative account more plausible. Finally, another feature of practical reasoning identified in (Searle 2001) is that our preferences are typically determined as a product of practical reasoning rather than given as an input to it. On our account this process is seen when the agent needs to choose actions on the basis of value preferences: we believe that considering the issue that "if you prefer V1 then do A with these consequences but if you prefer V2 do B with these other consequences" gives a more plausible basis for arriving at these preferences than being asked to assign relative weights to factors V1 and V2 so as to determine a calculation of utility. For all these reasons, we believe that the approach described here is worthy of consideration, at least in some situations, as an alternative to utility theory.

To summarise, we have given an account of reasoning in a simple scenario from experimental economics using preferences over values which provides transparent justification of actions, does not require estimation of utilities and weights for different factors, can allow preferences to emerge from reasoning, and which can be used to explain observed behaviours, in particular the framing effect present in these experiments. In future work we will use our approach to model the reasoning processes involved in other experiments undertaken in behavioural economics where subjects appear to not always maximise their expected economic utility, such as the Ultimatum Game (Bearden 2001).

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