

The Sunk Costs Fallacy or Argument from Waste

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ABSTRACT: This project tackles the problem of analyzing a specific form of reasoning called 'sunk costs' in economics and 'argument from waste' in argumentation theory. The project is to build a normative structure representing the form of the argument, and then to apply this normative structure to actual cases in which the sunk costs argument has been used. The method is partly structural and partly empirical. The empirical part is carried out through the analysis of case studies of the sunk costs argument found in business decision-making, as well as other areas like medical decision-making and everyday conversational argumentation. The structural part is carried out by using existing methods and techniques from argumentation theory, like argumentation schemes. The project has three especially significant findings. First, the sunk costs argument is not always fallacious, and in many cases it can be seen to be a rational precommitment strategy. Second, a formal model of argumentation, called practical reasoning, can be constructed that helps a rational critic to judge which sunk costs arguments are fallacious and which are not. Third, this formal model represents an alternative model of rationality to the cost-benefit model based on Bayesian calculation of probabilities. This alternative model is called the argumentation model, and it is based on interpersonal reasoning in dialogue as the model of rational thinking. This model in turn is based on the underlying notion of commitment in dialogue.

KEY WORDS: Argumentation, commitment, decision-making, dialogue, economics, fallacies, practical reasoning, precommitment, rationality, self-binding

The project undertaken in this paper is to analyze a particular type of reasoning, and to provide a basis for evaluating arguments that use this type of reasoning. The type of reasoning is known as 'sunk costs' in economics. It is typified by the following kind of case. Someone has invested a significant amount of money in a stock or business. Decreasing value and poor performance suggest it might be a good time to pull out and invest the remaining money elsewhere. But because the person has already invested so much in this venture, and would lose so much of it by pulling out now, she feels that she must stay with it rather than take the loss. To abandon the investment would be too much of a waste to bear, given all the money that has been sunk into it at this point. Reasoning on the basis of sunk costs, the person concludes that she must stay with this investment, even though she is convinced that the prospects for its rising in value are not good. This kind of argument has also been called the 'argument from waste' in argumentation theory. Recently it has also come to be



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associated with the notion of precommitment as a factor in rational decision-making in law, politics, banking and economic theory.

The aim of this project is to provide some basis for evaluating the argument from sunk costs (or waste) by investigating its underlying normative structure. The main aim is normative or logical in nature rather than empirical, although there will be an empirical aspect as well. Several case studies or examples of this kind of reasoning will provide an empirical background for the analysis. As with all practical arguments of wide significance in human reasoning, the sunk costs argument seems to be fallacious in some cases and reasonable in other cases. An economist, for example, might advise the investor above that she should rationally make her decision on a cost benefit basis. On this basis she should ignore the past, because that cannot be changed, and concentrate on the economic problem of how to maximize profits by looking to costs and probable economic benefits in the future. From this point of view, the sunk costs argument is seen as a fallacy. But are such arguments always fallacious, and might there be factors other than costs and economic benefits that ought to enter into the calculations? And if so, can such factors be grasped within some model of rational decision-making? These are the questions addressed.

In one way, the project of analyzing and evaluating the sunk costs argument is a classic problem in the branch of logic that studies informal fallacies. But it will turn out that this particular fallacy (or alleged fallacy) presents a uniquely difficult problem for fallacy-theoretic methods to solve. The reason is that exposing the underlying reasoning it is based on throws down a challenge to the notion of human rationality. The subject of human rationality has been much discussed recently, but there seems to be no clear outcome, perhaps because the discussion has remained at an abstract level. However, the sunk costs argument is based on a practical kind of reasoning that we use every day, in economics as well as in everyday conversational argumentation, as the cases below show. Thus the philosophical implications of studying the sunk costs fallacy, as shown below, turn out to be quite wide, suggesting the existence and importance of a commitment model of rationality. The commitment model is posed as an alternative to the cost benefit model that has been the dominant model so long in the literature on rational decision-making.

1. GENESIS OF THE PROJECT

The start of this project was a long time interest in a curious argument called the argument of waste (*argument du gaspillage*) cited in the *New Rhetoric* of Perelman and Olbrechts-Tyteca (1969, p. 279): 'The argument of waste consists in saying that, as one has already begun a task and made sacrifices which would be wasted if the enterprise were given up, one

should continue in the same direction.' A typical example is the following argument, familiar to many frustrated graduate students: 'I spent five years working on my Ph.D. I can't give up now, because I have put too much time and effort into it.' What is curious about this type of argument is that it is hard to say whether it is reasonable or not. From the point of view of the frustrated graduate student, the argument would appear to have some force. Despite his frustration, maybe he should really stick with his thesis work if he feels strongly that the project is worthwhile and that in the end, the struggle will be worth it. On the other hand, maybe he should be more practical, and go to law school, where he will definitely get a degree in four years, instead of floundering around indefinitely. It seems very hard to say. Argument from waste seems to be a practical argument of some sort that has to do with goals, and calculations of potential benefits and losses. But the logical basis of how to evaluate such an argument is a puzzle.

In answer to my question about this apparently obscure form of argument on the ARGTHRY network (argthry@yorku.ca), some surprising and provocative information came in. This form of argumentation was of more than merely arcane academic interest as a puzzle of logic.¹ David Hitchcock pointed out that argument from waste is known as 'the Concorde fallacy', named after the supersonic jet project that the British and French governments continued to spend large amounts of money on, even after it became clear that there would be no net benefit from the project. Ernest Sternberg pointed out that economists consider what they call the 'sunk costs' argument faulty reasoning, as in the example, 'That company won't leave town because it has sunk too large an investment into its plant here.' Tim van Gelder wrote that there are examples of the fallacy of sunk costs in books on the psychology of decision-making. These replies indicated the practical significance of the argument from waste in important matters of business, public affairs and economics. The puzzle of argument from waste, or the sunk costs argument as it might be called, was worth trying to solve.

2. THE CONVENTIONAL WISDOM

In textbooks on economics and management, it is often stated that the sunk costs argument is a fallacy. Steele (1996, p. 605) claims that sources can be found as far back as 1910 in the economics literature that explain and defend what is now called the doctrine of sunk costs. In modern textbooks and sources on economics, it is easy to find statements to the effect that taking sunk costs into account in decision-making is a fallacy. Staw (1997, p. 200) wrote: 'Economists universally agree that sunk costs should be ignored in investment situations.' In a textbook on decision-making, Clemen (1996, p. 517) wrote: 'In decision-analysis terms, the money that has already been spent on the project no longer should influence current

and future decisions.' Thus it seems fair to say that there is some convergence of agreement in textbooks on business and economics that argument from waste, or as it is called in economics, reasoning on the basis of sunk costs, is a fallacy. Traditionally, to say a type of argument is a fallacy has two components. It must be logically invalid (incorrect, erroneous), and it must 'seem valid', meaning that it does actually influence people's thinking in a persuasive way.

It has been shown empirically that people are often influenced by sunk costs, both in economics and in everyday decision-making. Both Staw and Clemen agree that sunk costs do, as a matter of fact, often influence business decisions. According to Clemen (1996, p. 517), 'Managers frequently remain committed to a project that obviously has gone bad.' Staw (1997, pp. 200-210) cited a number of empirical studies showing that sunk costs do influence behavior. His summary of the findings of one especially important study (pp. 200-201) is worth quoting.

In the most well-known study of sunk costs, Arkes and Blumer (1985) asked students to imagine they were the president of an aircraft company deciding whether to invest \$1 million in research on an airplane not detectable by conventional radar. In one condition, the project was already 90% completed. The catch was that in both conditions subjects were told that the radar-blank plane was not an economically promising project because another firm already had a superior product. Thus, any difference in the amount of expenditures between the two conditions could be attributed to the influence of sunk costs. Results of Arkes and Blumer's study showed that over 85% of the subjects chose to spend the money to complete the plane that was already 90% finished, whereas only 16.7% chose to commit funds at the outset.

This study appears to show that people are generally influenced by sunk costs in making a decision about whether or not to go ahead with a project. It is hard to know exactly how to interpret the findings however. Does it mean that the respondents were willing to go ahead with the project even though there was no chance of success for it? Or were they reasoning that in the marketplace, there is always some chance of success, even if a competitor has a superior product? We can only guess. Maybe the respondents assumed that there is a lot of uncertainty in marketing any product in the real world, and so it is worth going ahead and trying to market a product even though it is inferior to one already on the market. If that is the case, the respondents weren't really advocating going ahead with the project purely on the basis of sunk costs. Maybe they were assuming that there was still some reasonable chance of economic success with the project.

At any rate, the empirical fact that people are influenced by sunk costs is interesting. It could be taken to be the basis for drawing either of two opposite conclusions. One is that sunk costs reasoning really is fallacious, because people are often deceived into reasoning on the basis of sunk costs illogically. The other possible conclusion is that ordinary people are onto something that has been ignored or overlooked by the economists. Could it be that the textbooks in business and economics have overlooked some

additional factor that people take into account when they draw a conclusion based on sunk costs? Could there be a difference of opinions on whether the sunk costs argument really is fallacious? The literature in economics and business does in fact indicate the existence of contrary opinions. Capen (1991) argues that overlooking sunk costs can lead to predictably bad decisions that harm a business. Capen's argument (p. 1423) is that the flaw in ignoring sunk costs is the failure to consider the market value of a project that may appear diminished or worthless to the owner, but might be perceived as valuable by a potential buyer. Camillo and Peccati (1997, p. 43) argue that it is a mistake in decision making in economics to think that taking account of sunk costs should 'automatically' be 'classified as rationally unacceptable.' The basis of their argument rests on the notion of relevance. They see the role of sunk costs in economic decision making as 'disputed', but see a 'diffuse opinion' as holding that sunk costs should either be seen as irrelevant in solving a decision problem, or should be seen as having a circumscribed and minor role (p. 43). They disagree with the generally accepted or 'diffuse' opinion, but conclude (p. 50) that the issue cannot be resolved, or even posed as a meaningful question, until the term 'rational' is precisely defined.

In recent literature in economics and banking, and in political and legal decision-making, a notion called 'precommitment' has come to be very prominent (Patashnik, 1997). Suppose a legislative body votes to pass laws and thus knowingly binds itself to having to act within certain constraints in the future. Such an action in the past commits the agent in advance to other actions in the future, constraining those future actions by the past commitments. Waldron (1998, p. 275), calls this the precommitment view of constitutional constraints. Elster (2000, p. 4) defines precommitment as the use of 'constraints that an agent poses on himself for the sake of some expected benefits to himself.'² Is using precommitment as a strategy a species of sunk costs argument (argument from waste)? It seems plausible that it is. For when the legislative body is constrained by its past enactments, it appears to be following sunk costs. When one acts in accord with a previous self-binding act, one seems to act in accord with one's previously sunk costs. On the assumption that the precommitment way of planning could be rational, the sunk costs argument would not seem to be fallacious. Curiously, in the literature on rationality, there is also a split opinion on whether the sunk costs argument is a fallacy or not. Nozick (1993) argued that it is not a fallacy. His argument to support this conclusion is lengthy and abstract, woven through a carefully argued and wide-ranging book on rationality. It seems to be an early expression of the current opinion that precommitment can be a rational strategy. Steele (1996) flatly disagreed with Nagel's view, arguing that the sunk costs argument is fallacious. His argument is also based on examples, and these too are presented and considered below. Elster (2000) has presented a somewhat different view of precommitment from that of Nagel. But his view also

seems to imply that the argument from waste, if it can be equated with precommitment, is not necessarily fallacious, and can often be a rational way of thinking.

3. A VARIETY OF EXAMPLES OF THE SUNK COSTS ARGUMENT

The following examples of argument from waste are simply presented in this section. Some of them are quoted directly from sources, while others are summarized or paraphrased from the original sources, as indicated. Commentary on any of the cases is reserved for the next section. However, as the reader first encounters each of these cases (they can be read in any order), a definite first impression will probably be formed on whether the argument in the given case is fallacious or not. Some of the cases are, of course, quite puzzling, and the reader may reserve judgment, or not have firm ideas on how to evaluate the argumentation in the case.

*The Osprey case*³

When an M-22 Osprey aircraft crashed on April 11, 2000, 19 marines died. Relatives of the marines felt that the aircraft was experimental. The Osprey is a tilting motor aircraft that can fly like a helicopter when the motors on the wings are tilted upwards. The design has been controversial, and there have been problems with it. In April 2000, the Osprey was going through a final evaluation before the Marines were to decide whether to buy more of them. On April 11, the CBS Evening News interviewed a Marine Spokesman, Lieutenant Mark Carter who said that the project had been started under the Bush (George Bush, senior) administration, but that the Pentagon had tried to discontinue it. According to Carter, the project was continued into the Clinton era, despite all the problems, because so much public money had already been spent on it by that point.

*Nozick's ticket case*⁴

If I think it would be good for me to see many plays or attend many concerts this year, and I know that when the evening of the performance arrives I frequently will not feel like rousing myself at that moment to go out, then I can buy tickets to many of these events in advance, even though I know that tickets still will be available at the box office on the evening of the performance. Since I will not want to waste the money I have already spent on the tickets, I will attend more performances than I would if I left the decisions about attendance to each evening. True, I may not use *all* of these tickets - lethargy may triumph on some evenings - yet I will attend more frequently than if no tickets had been purchased in advance. Knowing all this, I purchase the tickets in advance in order to drive myself to attend.

*The canal case*⁵

Hillary has paid to commence the building of a canal, which is now half-completed. This is sometimes believed to provide a reason for Hillary to complete the canal. But suppose, in an alternative scenario, the half-completed canal existed as a natural geographical feature. The economist would say that these two scenarios are alike in relevant respects, and that past expenditures do not justify future expenditures.

*The stock market case*⁶

I buy Microsoft stocks at high cost and they go down. Whether I sell or not should depend only on their future prospects, and not on the fact that I have already invested in them.

*The widget case*⁷

Bill decides to open a factory producing widgets. Bill's outlays include an expensive durable machine, for which he gets a loan to be repaid over several years. The machine (we stipulate) cannot be resold, and the loan repayments would still have to be kept up if the factory closed. The factory is built, and production starts. It turns out that the market has been misjudged, and the income statement shows a net loss, which is expected to continue as long as the loan payments have to be made. But if we subtract the loan repayments from expenses, the factory is making a profit. The economist holds that, in deciding whether to keep the factory open, the loan repayments should be ignored. . . . Since those repayments would still have to be made if the factory closed, they are not costs of continued operation.

*The treadmill case*⁸

Mary buys a treadmill exercise machine that costs two thousand dollars. She is reluctant to spend this much money on an exercise machine. But she reasons that if she does, it will make her exercise, and she thinks that exercise would be, for her, a very good thing.

*The basketball game case*⁹

A family pays \$40 for tickets to a basketball game to be played 60 miles from their home. On the day of the game there is a snowstorm. They decide to go anyway, but note in passing that had the tickets been given to them, they would have stayed home.

*The Senator Denton case*¹⁰

Senator Denton defended the continuation of a major public works program by using the argument, 'To terminate a project in which \$1.1 billion has been invested represents an unconscionable waste of taxpayer's dollars.'

The Selfish Gene case

In his popular book *The Selfish Gene*, Richard Dawkins (1989, pp. 148-151) considered various strategies that animals (including people) use to preserve their genetic heritage. For the female, being deserted by her mate is a bad outcome, so she might try for a 'domestic bliss' strategy by trying to spot signs of fidelity and domesticity in advance (p. 149). Before copulation, she may insist that the male build a nest, or she may be coy, or insist on a long engagement period. Dawkins (1989, p. 150) then goes on to pose a question.

Could females force males to invest so heavily in their offspring *before* they allow copulation that it would no longer pay the males to desert *after* copulation? The idea is appealing. A male who waits for a coy female eventually to copulate with him is paying a cost: he is forgoing the chance to copulate with other females, and he is spending a lot of time and energy in courting her. By the time he is finally allowed to copulate with a particular female, he will inevitably be heavily 'committed' to her. There will be little temptation for him to desert her, if he knows that any future female he approaches will also procrastinate in the same manner before she will get down to business.¹¹

The argumentation in this case seems to be based on a form of sunk costs reasoning involving a strategy for passing on genes.

The case of Ulysses and the Sirens

Ulysses had ordered his crew to bind him to the mast of his ship in order to resist the charms of the Sirens. He instructed his crew that if he begged to be released as they came within range of the Sirens, they must tighten and add to his bonds (Elster, 1984, p. 36).

Each of these cases brings out many aspects of argument from waste that could be discussed at length, raising many issues of interest in argumentation theory and the study of rationality generally. It is hoped, in fact, that such discussions will be provoked by these cases. However, the commentary below concentrates on certain aspects of the argumentation in the cases that pose central questions about how this form of argument can be identified, analyzed and evaluated.

4. COMMENTS ON THE VARIOUS CASES

The Osprey case and the Senator Denton case show how argument from waste can be affected by political considerations in decisions about

spending on projects involving public funding. The voters, or the opposition politicians, could criticize any politician who seems to have wasted public money by discontinuing a project on which a lot of money has already been spent. To discontinue the project at that point would be taken by the critics to be an admission of failure. Of course, the rational decision, from a point of view of cost benefit analysis, might be to discontinue the project. But then the decision might not be rational for the politician, from a point of view of self-interest, if it leads to a loss of confidence among the majority of voters. The lesson is that in public funding cases, public opinion is a factor. Some might argue that the holder of a public office should make the best decision from the viewpoint of a cost benefit analysis of what is best for the public, and should stick with that decision even if it is unpopular. But the reality is that politicians can only afford to do that under the risk of being voted out of office. Also, the holder of a public office should, in a democratic system, represent public opinion, or at least take it into account in decision-making. Therefore, public opinion should perhaps not be treated as entirely irrelevant.

An interesting factor in the equation in such cases is that public opinion might be quite out of synchronization with cost benefit analysis. For example, consider a decision whether to upgrade an old university building, or tear it down and build a new one. The public might not tolerate a new building project, even if, over a period of years, it could be a lot less costly than the project of upgrading the old building. From a cost benefit point of view, building a new structure could be better. But from a public relations point of view, it could be a much harder sell. Of course, the cost of public relations could be considered as one relevant factor in the cost benefit decision. But the point is that a cost benefit analysis of such a case that did not take public opinion into account could be narrow and misleading. On the other hand, trying to express public opinion factors in a cost benefit framework might be a poor fit. The dimension revealed by these cases is that the sunk costs argument needs to be evaluated in light of its effects on others, for example its political effects. This dimension suggests that the logic of the argument needs to be seen in a dialogue format in which two parties are reasoning or arguing with each other.

The Senator Denton case represents the extreme kind of case where the sunk costs argument is fallacious. The Osprey case also shows the danger of this fallacy.¹² In the Osprey case, what is suggested is that it is a wrong decision to continue spending money on a project that should be scrapped, even if a lot of public money has already been spent on it. This kind of wrong decision could be serious, involving considerable loss of life. Of course, in the Osprey case, it is not known whether the case fits this description or not. However, Lieutenant Carter's remarks suggest the possibility that the case could fit this description. If it does fit the description, then the argument in this case would be an example of the sunk costs fallacy. But whether the Osprey project is worth continuing, or should be discon-

tinued, is a highly complex decision at any given point in time. Above all, what this case shows is the involvement of the argument from waste in many highly significant cases of public spending.

In some of the cases, the argument from sunk costs strongly appears to be fallacious. Perhaps the leading one, and clearest one in this regard, is the stock market case. Presumably, the investor in stocks has only one goal, and that is to maximize profits. If so, it would clearly be fallacious to stick with a stock that has gone down merely because one has already lost quite a bit of money in that stock. The argument from waste seems so clearly fallacious in such a case because the framework seems to be one of a purely cost benefit calculation in dollars. Of course, other considerations, like a preference for 'ethical stocks' might complicate the decision. But barring such other factors, the sunk costs argument, in this case, stands out as quite clearly fallacious.

Another example where the argument from sunk costs seems to be quite clearly fallacious is the canal case. If the two scenarios are alike in all relevant respects, by assumption, then it seems correct to say that past costs do not justify future ones. But of course the comparison of cases posed is purely hypothetical. In any real case of building a canal, there would tend to be all kinds of factors relating to past costs that would be relevant to a decision of whether to continue with the project.

Yet another case where the sunk costs argument seems to be fallacious is the selfish gene case. Dawkins (1989, p. 150) answered the question he posed by citing the sunk costs fallacy, comparing the reasoning to the case of the Concorde aircraft. A businessman, according to Dawkins, should never say, 'I have already invested so much in the Concorde airliner (for instance) that I cannot afford to scrap it now.' Instead, the businessman should look to the future and ask whether it would be better to cut his losses. Dawkins went on to argue that the domestic bliss strategy of the female described above could be a fallacy. As long as the majority of females play the same game, forming a kind of conspiracy, the strategy might work. But if there are 'fast' females in the population, who will copulate right away, as well as coy females who demand a waiting period, the male may realize that it will pay to desert his mate, even if he has already invested a lot time in her and has children with her (pp. 150-151). In short, the female who adopts the strategy of coyness could be committing the sunk costs fallacy. Or perhaps it would be more accurate to say that the male who falls for this strategy is committing the sunk costs fallacy. At any rate, the genetic strategies described by Dawkins represent an example of the argument from waste, or so-called sunk costs fallacy.

In contrast with the cases where the sunk costs argument seems fallacious, the argument as used in the treadmill case seems to be reasonable. Maybe Mary is right that if she buys the treadmill, it will cause her to exercise more. Since that outcome seems to be very good, and is presumably what Mary wants, the argument from sunk costs, in this case, does

not appear to be fallacious at all. So what factors distinguish this case from some of the others? One factor distinctive of this case is that Mary is reasoning about her own future reasoning. She is making a prediction about her own behavior in the future, based on what she knows about her own patterns of reasoning and decision making. This case is one of simulative reasoning, meaning that one agent is reasoning about the reasoning of another agent (Barnden, 1995). But the special kind of simulative reasoning represented in this case is generally called autoepistemic reasoning in artificial intelligence (Moore, 1985). Mary is reasoning about her own reasoning. She is thinking about her own future decision-making. Mary could be quite successful in this kind of reasoning. Maybe she is right that owning the treadmill will cause her to exercise more, as indicated above. Therefore, to all appearances, the argumentation used by Mary in this case could be judged to be quite reasonable. Certainly, in light of the comments above, one would not want to say that Mary's reasoning is fallacious. This case can be contrasted with public spending cases. In these cases, a lot of people are involved in the decision-making. In this case, Mary is thinking about her own decision-making, and her own goals and interests as an individual.

Nozick's ticket case and the basketball game case are, in many respects, clear and simple cases that lack some of the complexities found in the other cases. However, like the treadmill case, they involve autoepistemic reasoning. In the basketball game case, a group, the family, is reasoning about their reasoning. In the simpler Nozick ticket case, one individual is reasoning about his own future decision-making. The treadmill case seems to be similar to Nozick's ticket case, in that the person is making an investment at a prior time that will make it easier at a later time to carry out some actions that he or she thinks would be good for him or her. But the treadmill case may have factors other than sunk costs that may be important in understanding the argumentation used in the case. By buying the machine, and putting it in a convenient location in her home, Mary is making the equipment for exercise available, and easy to use. Otherwise, to exercise she might have various obstacles that would be in the way. To jog outdoors, she would have to contend with the cold weather. To use a treadmill at a gym, she would have to drive to the gym, find a parking spot, and so forth. So ease of use is a factor. But of course, comparable remarks might apply to Nozick's ticket case as well. By buying the tickets at the prior point, the person makes it easier to go the concert or play on the day of the event. He does not have to wait in line for a ticket or worry about whether no more tickets may be available. In both cases, these factors are additional to the sunk costs reasoning. A critic might argue that they make the sunk costs reasoning appear reasonable in both cases, whereas it may be these other factors that make the argumentation seem reasonable. Part of Steele's argument against Nagel (Steele, 1996, p. 610) seems to be based on this sort of criticism.

The basketball game case is a typical case of the sunk cost fallacy, but Leland (1991, p. 218) argued that the family's decision may not have been fallacious.

Many people see nothing inconsistent or irrational in the family's decision to go the game even though, if the tickets had been free, they would have preferred to stay home. After all, if they did not go to the game, they will be wasting the \$40. But this conclusion is not true. The decision to buy the tickets was made, and the \$40 is gone regardless of whether the family goes to the game or not. The \$40 is not an element in the opportunity set. The opportunity set consists of two options: (a) going to the game and (b) staying home.

This comment casts the basketball game case, as well as the Nozick ticket case, in a different light. The way Leland has restructured the cost benefit framework of the decision, the sunk costs argument may appear to come out as reasonable, not fallacious. This outcome agrees with Nozick's conclusion that the sunk costs argument is not a fallacy. But it would appear that Nozick's argument supporting this conclusion is quite different from Leland's. Steele's comments (1996, p. 610) on Nozick's ticket case are also quite interesting in this connection. Steele noted that in Nozick's case, once the person in the case has already bought the ticket, then at the later time when he makes the decision whether to go the concert or not, he does not have to pay for the ticket. Thus by buying the ticket at the earlier time, the person has restructured the decision he makes at the later time. Steele (p. 610) takes this fact to show that the plausibility argument in Nozick's ticket case does not rest on counting sunk costs. Thus Steele concluded that Nozick has failed to show that the sunk costs argument is nonfallacious. This judgment on the case is interesting, because it seems to show that even on a purely cost-benefit model of the decision-making in the case, the argument can come out as non-fallacious.

Finally, the Ulysses and the Sirens case seems to involve a form of argumentation that is similar to that of Nozick's ticket case, but is also somewhat different. In the ticket case, the precommitment is not self-binding. It only gives encouragement that will hopefully offset the lethargy likely to occur once the time to take action arrives. In the Ulysses and the Sirens case, the 'binding' is literal and physical. Once Ulysses orders himself bound to the mast, and the crew carries out the action preparatory to sailing within range of the Sirens, an external causal mechanism has been set in place that Ulysses cannot reverse or override after that point. In Nozick's ticket case, precommitment is used to offset one's internal emotions, like lethargy or weakness of will, in the future, providing an incentive to carry out a commitment. In the Ulysses and the Sirens case, no choice is left to the agent. He binds himself in advance to the commitment, so that he is left no real possibility to retract the commitment once the future time for action or inaction arrives. And yet both kinds of cases seem to fall under the heading of sunk costs. In both kinds of cases, once the time to act arrives, the basis of the decision is either made or

influenced by the previous commitment, which could be seen as a form of costs or incentives 'sunk' in advance. In both cases, one acts on the basis of the commitments made in the past.

But does the strategy of precommitment used by Ulysses when he had himself bound to the mast really fit the form of argument called argument from waste or sunk costs? Arguably not, because Ulysses really had no choice once he was bound to the mast and had instructed his crew not to remove the bonds once they came into range of the Sirens. At that point, Ulysses was not making a decision whether he should give in to the Sirens or keep to his prior commitment to sail past them. His prior actions had (presumably) already foreclosed that decision. Still the Ulysses and the Sirens case is interesting in that it does resemble the sunk costs argument in that both appear to be based on the underlying notion of a strategy that is based on making a precommitment that bears some relation to a subsequent action or decision. Underlying both kinds of argumentation is the notion of commitment. The argumentation in the treadmill case, as well as in the ticket and basketball cases, could be seen as based on rational strategies of precommitment. And yet they are still instances of the sunk costs form of argument.

Some of the cases considered above, as noted, are autoepistemic. One party is trying to influence her later actions by now acting or making commitments that will influence her later. But other cases, especially the political cases, suggest a dialogue framework in which one party is using the sunk costs argument to influence another party. Some cases of this sort have been noted by Elster (2000, p. 42). Consider the case of an electronics firm that buys equipment in order to have a strategic effect on its rivals. It makes this move to suggest that it is committed to serious efforts in a particular segment of the market, and that competing with it in this sector would not be profitable for the other firm. This tactical move could be called a strategy of 'sinking costs' for the purpose of deterring a competitor. Many other examples of using a strategy of sinking costs in negotiations are also cited by Elster (2000, p. 43). A union may make a threat by taking steps that indicate its commitment to a certain course of action to the management negotiators. These cases suggest that if you look at the argument of sunk costs in the context of a dialogue, like for example a negotiation, with more than one party involved, the argument could be seen as a rational strategy. It begins to seem less like a fallacy and more like a reasonable argument. Context of use seems to play an important role in which way it goes.

5. NOZICK'S AND ELSTER'S ARGUMENTS

Nozick saw the argument from sunk costs used in the ticket case as a reasonable argument. But he admitted that whether the argument should be

seen as reasonable or not is controversial, and that his view is opposed to a view of decision-making that is prevalent in economics.

Economists present a doctrine that all decisionmaking should pay attention to only the (present and) future consequences of various alternative actions.... This may be a correct rule for the maximization of monetary profits, but it is not an appropriate general principle of decision, for familiar reasons (Nozick, 1993, p. 22).

What these 'familiar reasons' are, and what the alternative to the economists' doctrine is, in Nozick's view, seems to be long story. And it is difficult to do justice to Nozick's lengthy account by offering any brief summary. But the gist of it appears to have to do with Nozick's idea of acting on principle. I would say something like the following to try to convey the gist of this notion in my own words. A principle is something that I form myself and that I 'stand for'. Once I have formed a principle, then I should stick to it, although in some situations I may depart from it, or even decide to give it up. In the ticket case, for example, on principle, I feel it would be a good thing for me to see plays and concerts. So I buy some tickets, in advance, to some plays and concerts. This advance action will give me more incentive to go, when the time comes. My acting on principle at the prior time then helps me to avoid the temptation to take the easy way out, and stay at home, once the night of the concert or play arrives. How does this notion of principle question or refute the economists' view that paying heed to sunk costs is a fallacy? The answer is not immediately clear from what Nozick has written. To begin to understand Nozick's view, one has to look at what he means by 'principle'.

Nozick (1993) uses the term 'principle' as a kind of technical term, and he takes great care to define it. The following remarks quoted from Nozick (1993) clarify his meaning.

Principles 'license the derivation of new judgments from previously accepted ones' (p. 5).

'A person may seek principles not only to test his own judgment or give it more support but also to convince others or to increase their conviction' (p. 6).

'Principles can guide us to a correct decision or judgment in a particular case, helping us to test our judgment and to control for personal factors that might lead us astray' (p. 8).

'A principled person can be counted upon to adhere to his principles in the face of inducements or temptations to deviate' (p. 9).

'Principles constitute a form of binding: we bind ourselves to act as the principles mandate' (p. 10).

'Another person's principles enable me to predict with reasonable (though perhaps not with perfect) accuracy some aspects of his behavior and hence lead me to count upon those aspects' (p. 12).

'By adopting a principle, we make one action stand for many others and thereby we change the utility or disutility of this particular action' (p. 18).

Principles are 'ways of accomplishing our goals' (p. 21).

From all these remarks, it could be inferred that a principle, in Nozick's sense of the term, is something like what is called a commitment in (Walton and Krabbe, 1995). A commitment, in this sense, is something that a person goes on record as holding, so that if she later fails to stick to it, she can be questioned or even criticized for the departure. Commitments can be retracted. But as long as a commitment has not been retracted, it has a kind of binding nature. If you appear to depart from it, or go against it, you may be charged with inconsistency. The term 'commitment' seems more general than the term 'principle'. If I say 'Wellington is in New Zealand.' then I am committed to the proposition 'Wellington is in New Zealand'. It is a commitment of mine. But it would not seem right to say that it is principle of mine. So perhaps a principle is a special type of commitment, one that has a level of abstraction in collecting together a bundle of actions of a certain type. At any rate, that is one way of attempting to define the notion of a principle in roughly the sense that Nozick seems to use the term. Certainly it can be said that all the characteristics of the term 'principle' cited from Nozick above fit the account of the term 'commitment' given in (Walton and Krabbe, 1995).

Nozick's remarks about decision-making based on 'principles' seems to suggest that there can be a model of rational thinking or deciding what to do that is separate from the cost-benefit or utilitarian model. But what is that model? What are its identifying features? How does it work? Can it be formalized as a clear step-by-step process of reasoning used to arrive at a conclusion on how to act in a given case? Nozick does not answer these questions, or present any account of the model as a well-defined structure. Nevertheless the example he used, along with other cases studied above, suggest the practical utility of such a model, should it be possible to articulate it as a structure. Nozick's descriptions of the kind of thinking based on 'principles' suggests that this alternative model to cost-benefit analysis is not based on numerical calculations of probabilities in the same way that the cost-benefit model is. What then is it based on? The best that can apparently be extracted from Nozick's account is that it is a form of commitment-based argumentation. What seems to be suggested is the hypothesis that there is a second model of rationality that is an alternative to the cost-benefit model that is so familiar and has been so dominant not only in economics but also in philosophy.

Some of Nozick's questions are answered by the analysis of the notion of precommitment worked out by Elster (2000). Elster uses the term 'commitment' where Nozick had used the term 'principle'. A somewhat clearer idea of how commitment-based reasoning works comes out of Elster's reconstruction of the Ulysses and the Sirens case, and by his studies of other comparable cases based on the notion of precommitment. Elster studied many cases of actions involving a temporal sequence in which an agent carries out an action at an earlier time that has the effect of binding his actions at a later time. Nozick was primarily concerned with cases in

which an agent makes an internal commitment that enables him to psychologically overcome his emotions later on. Elster is more concerned with cases of self-binding in which the earlier decision or action in the sequence leads to its outcome through some causal process in the external world. Among the various precommitment devices studied by Elster (2000, p. 6) are eliminating options, imposing costs, setting up rewards, creating delays, changing preferences, investing in bargaining power, inducing ignorance and inducing passion. What is suggested by Elster's consideration of many realistic cases of the use of such devices of thinking is that precommitment can be rational strategy. If so, and if the sunk costs argument can be seen as based on a strategy of precommitment, then the sunk costs argument may not be fallacious. But as indicated in the previous section, it is doubtful that the argument from precommitment in the Ulysses and the Sirens case can properly be classified as a sunk costs argument. Ulysses did sink his costs in one outcome, but then he can't really be said at the later point to have argued or reasoned on the basis of sunk costs. Once tied to the mast, he (presumably) had no choice one way or the other. But perhaps part of the problem in dealing with such cases is to try to identify the form of the sunk costs argument. What counts as a case of the sunk costs form of argument? How can what appear to be similar arguments, like the one in the Ulysses and the Sirens case, be classified, so that it becomes clear whether they are really instances of the sunk costs form of arguments or not? The questions can only be answered by investigating the form of the sunk costs argument.

6. FORM OF THE SUNK COSTS ARGUMENT

The argumentation scheme for argument from waste was given in (Walton, 1996, p. 80) as follows. *a* is an agent, and *A* is a statement that represents the outcome of an action.

Argument from Waste

If *a* stops trying to realize *A* now, all *a*'s previous efforts to realize *A* will be wasted.

If all *a*'s previous attempts to realize *A* are wasted, that would be a bad thing.

Therefore, *a* ought to continue trying to realize *A*.

But this statement of the form of the argument from waste, or sunk costs argument (which we take to be essentially the same argument), seems to hard to model formally. The terms 'realize', 'previous attempts' and so forth, express the right idea in natural language. But it is not easy to see how they represent some kind of structure that could be formally expressed. A clue as to how to improve the argumentation scheme is the notion of

precommitment that has come to be prominent in the recent literature on business and financial decision making. The concept of commitment is of course fundamental to argumentation theory and to many argumentation schemes.

The argumentation scheme for the sunk costs argument seems to be based on a notion of action commitment over time. The proponent of the argument commits herself to a certain action or a certain policy for action at time $t1$. Let's say this action or policy can be expressed in the form of a statement A , as above. And then later, at time $t2$, she is confronted with the decision of whether to carry out this precommitment to A or not. Reasons for against either option could be given at $t2$. But one of these reasons would be the following argument: I am already committed to A , therefore given the choice between A and $not-A$, I should carry out A . In the case of the Ph.D. student for example, she might reason as follows. I am already committed to the policy of working on my thesis, most especially because I have already sunk so much time and work into it. Therefore, given the choice between (a) quitting work on the thesis and going to law school, and (b) keeping at work on the thesis, the student, using argument from sunk costs, goes for (b). The form of the argument could be expressed as follows.

Form of Argument from Sunk Costs

There is a choice at $t2$ between A and $not-A$.

At $t2$ I am precommitted to A because of what I did or committed myself to at $t1$.

Therefore I should choose A .

Note also that the precommitment need not have taken place at a single instant $t1$. It could have taken place over a stretch of time from $t1$ right up until $t2$. That would seem to be the pattern in the Ph.D. student case. Note that this new version of the form of the argument is based on the concept of precommitment. Notice that it rules out the Ulysses and the Sirens case as being an argument from sunk costs (or argument from waste) more clearly than the previous argumentation scheme for argument from waste (above).

Of the known argumentation schemes, the form of argument from sunk costs seems to come closest to what is called argument from commitment. To take an example, suppose that George goes around saying 'Power to the people.' Suppose, on many occasions he declares that Marx and Lenin are his heroes. It would be reasonable to infer from this evidence that George is committed to communism. Of course, this could be wrong. George could be being ironic, or he might have changed his mind and recanted his communist views. But in the absence of evidence to the contrary, George's declarations could be taken as evidence of his commitment to communism. A comparable example is given in (Walton, 1996,

p. 55). This form of argument is called argument from commitment. If someone goes on record as expressing some sort of statement, policy or viewpoint in a positive way then, other things being equal, we can conclude that he is committed to this statement, policy or viewpoint. What he believes in his heart may be another thing. But what he has said in front of hearers may be evidence of his commitment. The argumentation scheme for argument from commitment has been presented in (Walton, 1996, p. 56).

Argument from Commitment (Walton, 1996)

a is committed to proposition *A* (generally, or in virtue of what she said in the past).

Therefore, in this case, *a* should support *A*.

This version of the argumentation scheme for argument from commitment is accurate, as far as it goes in representing the outline of this form of argument. But a newer, more sophisticated version of it is presented below. The new version reflects the more general kind of case in which the derived commitment and the original statement uttered by the agent are not necessarily the same statements. For example, George may not say, 'I am a communist', but he may say other things, like 'Power to the people' that may be taken to imply that he is communist. Thus the new version of the argumentation scheme for argument from commitment is slightly more complex than the older one.

Argument from Commitment (New Version)

Major Premise: If arguer *a* has committed herself to proposition *A*, at some point in a dialogue, then it may be inferred that she is also committed to proposition *B*, should the question of whether *B* is true become an issue later in the dialogue.

Minor Premise: Arguer *a* has committed herself to proposition *A* at some point in a dialogue.

Conclusion: At some later point in the dialogue, where the issue of *B* arises, arguer *a* may be said to be committed to proposition *B*.

This form of argument is very common in everyday conversational argumentation. The most common problem with it is that commitments often need to be retracted, and many arguments, especially in persuasion dialogue, concern retraction of commitments (Hamblin, 1970; Walton and Krabbe, 1995). It may be, for example, that arguer *a* has committed herself to *A*, but then later in the dialogue, she sees that *B* follows from *A*. But she doesn't want to commit herself to *B*. What should she do? This type of situation represents the typical problem of retraction of commitment. In some systems of persuasion dialogue, she must make up her mind whether to retract both *A* and *B* or re-affirm her commitment to both. But there is

no simple solution to the problem of retraction, and the reader must simply be referred to the literature on the problem."

Now one question is whether argument from sunk costs is the same thing as argument from commitment. Or perhaps it is a subspecies of argument from commitment. One complicating factor is that argument from sunk costs typically seems to be an argument about actions and choices between alternative actions. The context seems to be one of deliberation. Thus the argument from sunk costs seems to fit naturally into the form of argumentation called practical reasoning (Walton, 1996, pp. 11-13). This form of reasoning is goal-directed and commitment-based. In argument from sunk costs, an agent is typically committed to some course of action because it is a goal of hers, and because she has invested resources of time and effort, and perhaps money, into trying to realize this goal. As a worthy goal, and one that costs have been sunk into, this policy or outcome represents a commitment for the agent. According to the practical reasoning model, the inference proceeds from a goal to a means to realize that goal (Walton, 1990). If *A* is the agent's goal, and to bring about *A*, it looks to her like she should bring about *B* then she draws the conclusion that she should bring about *B*. For example, finishing her thesis is her goal. To finish her thesis, it looks to her like she needs to keep working on it. By practical reasoning then, she draws the conclusion that she should keep working on her thesis. As this example shows, practical reasoning is a very natural model of the kind of argumentation used in the sunk costs type of argument. In the next section, an argumentation scheme for practical reasoning is presented.

In short, the hypothesis suggested is that the argument from sunk costs is a hybrid composed of argument from commitment and practical reasoning. It is a species of argument from commitment, but a special type of one in which actions and policies for actions are involved, over a time sequence with two special points. But it would also seem to be, in typical cases, a special form of practical reasoning involving an agent's goals and the means to carrying out these goals. Now we have an analysis of the form of the sunk costs argument, the next question is how this form of argument should be evaluated when it is encountered in particular cases. But because the notion of practical rationality is controversial, some theoretical issues need to be discussed first.

7. THEORETICAL ISSUES

Camillo and Peccati (1997) seem to be on the right track when they suggest that the questions raised by the so-called sunk costs fallacy cannot really be answered, or even asked meaningfully, until the term 'rational' is precisely defined. They argue that sunk costs could rightly be judged to be relevant from one point of view on rationality, while at the same time,

they could rightly be judged to be irrelevant from a different point of view on rationality. Much the same conclusion is brought out by Nozick's philosophical investigation of rationality. Nozick (1993) contrasted a cost benefit view of rational decision making with another view that is concerned with 'principles' or commitments of an agent. What his account seems to suggest is the existence of two views of rationality. This same kind of duality is already quite familiar in the field of ethics, where the well-known utilitarian view is contrasted with an opposed (but less sharply defined) view, sometimes called the deontological view. The deontological view sees intentions or motives, as opposed to consequences, as what is important to take into account in making ethical judgments of actions. Nozick (1993, p. 62) has compared these two views with the two views of rationality discussed in his book. By grouping actions together under a principle, like 'Do not murder.', the deontological view 'removes' an action 'from separate utilitarian (or egoist) calculation of its costs and benefits.' The action comes to stand for the principles of the group, and thus has value apart from the calculation of its consequences on a cost benefit model.

A theoretical issue underlying the argument from waste or sunk costs, is that of different models of rational decision making. In assessing the role of sunk costs in any given case of rational decision-making, it should be possible to distinguish between two different models for evaluating the reasoning used in the case. One could be called the cost-benefit model, although it has been given various different names in the literature. According to this model, a rational decision should be made by breaking the decision scenario down into a set of mutually exclusive possible outcomes. Each outcome is assigned two factors, represented by a number. One represents the degree of probability of occurrence. The other represents the value or desirability of the outcome. In many cases of the kind considered in economics, this second factor is measured in dollars (or some monetary figure that can be represented by a number). The method of decision making is to multiply these two factors for each outcome, and then pick the outcome where the number representing the probability times the value is the highest. If there is a tie, then either outcome can be selected at random. This method of reasoning is also associated with the Bayesian model of calculating probabilities, because the underlying presumption is that numerical probability values can be attached to all the outcomes in a case, so that the axioms of the probability calculus can be applied. Let's call this model of decision making the cost-benefit model. The other model that has been suggested as being an alternative to the cost-benefit model is not Bayesian. It appears to be based on relating the decision-maker's prior commitments to his actions in the given case. Instead of Bayesian calculations of numerical probability values, this model uses argumentation under conditions of uncertainty. It could be called the practical reasoning model. In this model, an agent has some goal in mind, perhaps a task or action she wants to carry out. The problem then is to find some

available means to carry out the task, and then select one from among the various available means. The method used is to base the reasoning on the commitments of the practical reasoner, as well as its information on what is occurring in a given situation, as far as one can tell.

The economist H. A. Simon (1983) has cited two different kinds of decision making, called 'maximizing' and 'satisficing', that may correspond to the kind of reasoning used in the two models. They can be illustrated by the following example. Suppose you want to find a needle in a haystack containing many needles. One way would be to look through the whole haystack and then pick the sharpest needle. This would be the maximizing method. Another way would be to keep searching until you find a needle sharp enough to sew with. This would be the satisficing method. The maximizing method seems to be one for reasoning in more ideal conditions. The satisficing method seems to be a more practical and rough method, applicable under conditions where the costs of time and effort for searching for an ideal solution are limited by the need to take action.

The cost-benefit model of reasoning is quite familiar in current texts on decision making, especially in fields like business and economics. This method is amenable to mathematical treatment, using probability theory, based on a Bayesian approach. The practical reasoning model is less familiar, and is less amenable to purely mathematical calculation of the Bayesian kind. Instead, it is based on looking at the arguments on both sides of an issue or decision in which there is a conflict of opinions about what to do. In (Walton, 1990) practical reasoning is modeled as a form of inference that tilts argumentation in a dialogue to one side or the other, on a balance of considerations. In a practical inference, as represented below, an agent reasons forward from its goals, and the known, available means to achieve these goals. The variables *A* and *B* represent states of affairs, or outcomes that can be brought about by the agent, represented by the first-person pronoun 'I'.

- (PInf.) *A* is my goal (represents my general values).
 To bring about *A*, it looks like I should bring about *B*.
 Therefore, as far as I can tell, I ought to bring about *B*.

Practical reasoning is made up of a chain of practical inferences. Practical reasoning should be evaluated as a kind of argumentation in a dialogue format, according to the account given in (Walton, 1990). Five critical questions can be asked in a given case.

- CQ1. Are there alternative possible courses of action to *B*?
 CQ2. Is *B* the best (or most acceptable) of the alternatives?
 CQ3. Do I have goals other than *A* that ought to be taken into account?
 CQ4. Is it possible to bring about *B* in the given circumstance?
 CQ5. Does *B* have known bad consequences that ought to be taken into account?

So conceived, practical reasoning is a more rough method of decision making than cost benefit analysis. It is applicable under conditions of uncertainty where exact calculation of costs and benefits is not possible, or would not be realistic. It is a method of making an intelligent guess in a case where, for example, there are so many relevant factors that the body of evidence is massive and rapidly changing. On the practical reasoning model of decision-making, consequences are only one factor to be taken into account. There are also other factors, as indicated by the critical questions above. In particular, the goals, principles or commitments of an agent may be extremely important, even if they cannot be fitted into a cost benefit model and calculated in a quantitative way as probabilities. An agent may have personal goals that are very important to her, even though they may not be expressible in dollar values, or have any numerical values that can be attached to them that express their importance as her commitments. In the practical reasoning model, a goal can be very much worth sticking to, even if it goes strongly against cost benefit calculations. For example, a person might even risk the high probability of death to support her principles. Of course, from a purely economic point of view of rational decision-making, such a decision could be (quite correctly) judged to be highly irrational.

Let's apply the practical reasoning model of the argument from waste to the case of the Ph.D. student who is thinking of giving up and enrolling in law school. In such a case a number of critical questions have to be asked. These particular critical questions correspond to the five generic types of critical questions for (PInf.) above.

1. How close am I to completion?
2. What are my realistic chances of completion?
3. Will the time I expend from now to the projected completion date be wasted if I can't get a tenure-track job?
4. Will it look bad on my transcript if I drop out of graduate school?
5. What do I really want to do, anyway?

What typically prompts a use of argument from waste in a case of this sort is despair about whether the thesis will ever get completed successfully. If there was assurance that even though it will take a lot of time and agony, the thesis will eventually be completed, then perhaps the candidate would stay with it. But contrast this case with the one where the student decides that the effort has really been wasted. She has discovered that she is no longer interested in the discipline. In this second case of sunk costs, the student should go to law school. But in the first case the student should stick with the thesis work. So there are many complicating factors in different kinds of cases. The outcome should depend on how the critical questions above are answered. Question 5. is important in this case, because the ultimate goal of the student should be the basic issue. If the student has a strong commitment to a career in her Ph.D. area, she could use a strategy of precommitment to reinforce this goal by doing things like

not applying for law school, or not writing the LSAT. Such a strategy of precommitment could be rational if it reflects the strength of her commitment to her goal. A comparison could be made here to the case of Ulysses and the Sirens, where precommitment was also a rational strategy. The issue here concerns the fifth critical question of how strong the agent's commitment really is to her main goal. But this critical question is not the only one that is appropriate.

In other cases other critical questions could be more important. As indicated by critical questions one and two, degree of completion of a project is an important factor in judging any case. Staw (1997, p. 210) cited empirical research on oil drilling which differentiated between dry wells and wells where there was a possibility of striking oil. The research found that people were influenced by sunk costs only in cases where there was some hope of completion of the project. Even within parameters that could perhaps be handled on the cost-benefit model, the practical reasoning model is useful because it tells you what questions should be asked. In this respect, it gives better general guidance on relevant considerations in making a decision than the cost-benefit model. The cost-benefit model is good when numerical values can be attached to all the relevant outcomes and values (commitments) in a case. But treating all cases in this way could amount to committing the fallacy of introducing margins of error that are so large that they make the calculations meaningless and misleading. Most argumentation based on precommitment is not like the case of Ulysses and the Sirens. Instead, the case is one where a previous commitment, even though it still carries some weight in one's thinking, can later be retracted if new information comes in. The initial goal may still be highly worthwhile, but if the costs of achieving it are shown to a lot higher than was initially anticipated, one's proposed line of action may need to be reconsidered. The problem is then one of retraction of commitment, once new evidence comes in, and critical questions about the old plan of action are asked.

8. CASES FOR THE PRACTICAL REASONING MODEL

The sunk costs argument has mainly appeared as a phenomenon for study in banking and economics, fields that emphasize numerical methods of data collection and calculation as the basis for decision-making. But to consider models of rational thinking, one should also look at areas where the values of situations and the probabilities of outcomes are not expressible numerically. One could think of all sorts of everyday decisions about what to do, or ethical decisions about personal dilemmas. Is it really helpful to place such decision-making within the framework of the Bayesian model, where exact numerical values are attached to all the relevant factors? Consider practical cases of physician-patient decision-making. Recent work in artificial intelligence is showing the practical value of argumentation

methods in this area, as opposed to traditional Bayesian methods using probability theory.

Recent studies of medical decision-making (Fox and Das, 2000) have shown that using argumentation methods, as opposed to Bayesian probability calculations, is a practically useful technique for many decision situations where knowledge is incomplete or inconsistent, including diagnosis, prescribing, risk assessment and image interpretation decisions. Fox and Das have shown that argumentation is a useful method for applying artificial intelligence to medical decision-making because it provides a better method than Bayesian methods for comparing the relative persuasiveness of competing claims for a best course of action in cases where quantitative knowledge cannot be assumed to apply numerically to a case. Fox and Das (1996) have put forward a hypothetical and practical model of reasoning to apply to common medical decision-making cases where the probabilities of events are unknown or the values of situations cannot be quantified. Their model draws on an argumentation approach that accommodates linguistic and qualitative representations as data in rational decision-making for weighing up the factors in a case and arriving at an outcome on a balance of considerations. In a case of advising a patient with high cholesterol on how to reduce cholesterol by changing life style or taking drug treatment, the argumentation model stresses the dialogue interaction with the patient, how the information about mortality rates and the like is presented to the patient, and how the patient reacts to the information presented. Fox and Das (2000) show, through many cases studies of this kind, that greater precision does not generally lead to better decision-making. The whole area of medical decision-making opens up a vast array of cases in which the practical reasoning model, based on argumentation, is a promising alternative to the cost-benefit model of rational thinking.

But the most striking area where the practical reasoning method of rational decision-making is visibly useful is not in any academic field, but in everyday conversational argumentation and ethical decision-making. Some very simple and ordinary cases can be cited here just to suggest how widely applicable the practical reasoning approach is. These simple examples also pose some general problems on how to further analyze practical reasoning. For example, the following case seems to throw some light on argument from waste by posing some new questions.

The rubber bands case ¹⁴

Dave and Debbie had brought two Dutch bikes back to Canada some years ago. On the metal carrier of each bike, there was a rubber band attached around the carrier, to hold objects on the carrier. Over the years, these rubber bands had deteriorated. When Dave and Debbie were in Holland again they bought two new rubber bands of this kind, and brought them home. One sunny day, Debbie said to Dave, 'Let's put the new rubber band

on your bike.' Dave replied, 'That means I have to take the nuts on the back wheel off, and also remove the gear cable. It will be hard to get all that back on in the right way, and the likely result is that I will not be able to use my bike today.' Debbie replied, 'Why did we buy the rubber bands in the first place?'

The argument used by Debbie in this case is an argument from sunk costs. But the appeal is not just to the waste of money that would be a consequence of not using the rubber bands. The appeal is to a prior goal. When Debbie asks, 'Why did we buy the rubber bands in the first place?', she refers to the original goal that she and Dave presumably had when they bought the rubber bands in Holland, namely the goal of using the bands on their bikes so they could carry things on the carrier as needed. Her argument could be put in the following form.

Fact: Then I had a goal.

Question: Why now do I fail to carry out that goal when I have a chance?

What is especially interesting about this use of argument from waste is that it seems to conform more to the practical reasoning model than to the cost benefit model. What drives the argument forward is the precommitment to the past goal. The argumentation scheme for argument from commitment is also evident. It is argued that the commitment to the prior goal will not be implemented if the recommended action is not carried out.

What is especially interesting about this example of argument from sunk costs is that it has the form argument from commitment as opposed to an appeal to consequences. Dave used appeal to consequences when he argued that putting the rubber bands on the bike might make it impossible to use the bike that day. But Debbie, when she used argument from waste, appealed not to future consequences but to the precommitment expressed by the prior action of buying the bands. What Debbie's argument appeals to is the goal that she and Dave presumably had in mind when they bought the rubber bands. This appeal to precommitment is what is used to drive the argument forward to the conclusion that they should install the rubber band on Dave's bike. This case shows that the practical reasoning model is not completely driven by looking to the future possible consequences of a contemplated line of action. Instead, it looks to the past by basing the reasoning on the commitments of the agent as expressed in a precommitment. Thus an element of precommitment enters in. The outcome is decided partly by the commitments of the agent as expressed in a dialogue. The difference between the commitment-based practical reasoning model and the cost-benefit model is highlighted by this case.

Another problematic example is also worth considering at this point. This case suggests the applicability of the practical reasoning model to ethical decision-making.

*The Torturer case*¹⁵

I've been torturing you for so long, I can't stop until you will confess. Otherwise all my (admittedly) evil acts would have been in vain, and would therefore have been even more evil than if a confession had been obtained.

In this case, it is easy to simply dismiss the argument from waste as fallacious, given the immoral action (torturing) that is being justified. But it could be that the argument, although weak, is not entirely worthless, even in this case. By starting the torturing process, and by continuing it, the torturer has made a commitment. Once that precommitment is in place, he needs to keep going in order to get an outcome that could justify the bad acts already carried out. But then torture is such a bad practice, ethically speaking, that there should be a strong commitment against it. Shouldn't the torturer just stop, once he realizes how bad his actions are? What makes the precommitment argument seem so ridiculous is that it should be considered to have any force at all in overcoming such a strong commitment to the notion that torture is simply wrong. At any rate, this example is puzzling enough that it is worth including in the various cases featured for study.

9. THE BAYESIAN MODEL VERSUS THE ARGUMENTATION MODEL

Argument from waste could be more complicated than previous writers on the subject have been inclined to think. There is a tendency, as with most informal fallacies, to see this kind of argumentation as either being a fallacy or not. But reality may be more complicated. It may be that this form of argumentation is fallacious in some instances of its use, but quite reasonable in other cases of its use. As noted above, the sunk costs argument has been most prominently treated as a fallacy in economics, in relation to certain cases of decision-making in business where the outcomes and goals can be quantified with numerical values. But surely there are also many realistic cases of business decision-making in economics where the argumentation model would work better. The hypothesis suggested is that the argumentation model of rationality would fit with the more subtle situations of realistic decision-making in which the probability values of events or goals are unknown but where sunk costs factors come into play in economic argumentation. It seems that sunk costs factors that are difficult or impossible to calculate numerically are extremely common in economic argumentation, especially in recent cases of internet business ventures. Typically, in such cases, a lot of money needs to be sunk into a project before it finally starts to show a profit. In internet projects like Amazon.com for example, the stock in the company may be very high, even though the business has never yet actually made a profit. From the point of view of

the entrepreneur, you should expect that it may be many years before your company actually starts to show a profit. You may not be able to calculate how many years are involved, or what the potential profits are exactly. Instead, it may be best to use the model of commitment-based practical reasoning. You may have to start up by giving your product away, and use advertisements, or some other source of revenue to keep the company going. But then once the market becomes established, you may quite correctly guess that you will reap huge profits. In this kind of scenario, much of the reasoning centers on sunk costs. Yes, your sunk costs are huge, and the profits are way in the future, but still the prospects for success may be quite good, and the stockholders may realize that. In such cases, the rational entrepreneur would not ignore sunk costs. But she would not be too highly swayed by them either, and would only base her calculations on commitment to realistic prospects of future success or failure, judged by practical reasoning. In real cases there is such complexity in weighing the factors in the case that it could be an error to try to attach a numerical probability value to each outcome and then use cost benefit calculations to decide a course of action. What seems to be suggested is that in real life, the more practical approach would be to simply look at all the relevant arguments on both sides. Then using argumentation, one could compare the body of evidence on one side against that on the other side. Instead of using numbers, one could use argumentation schemes to draw conclusions from the given arguments on each side by asking the right critical questions. These schemes include practical reasoning, argument from commitment, argument from sunk costs, as well as other schemes found in (Perelman and Olbrechts-Tyteca, 1969) and (Walton, 1996). Real cases in business not only suggest an opposition between the two models of rational deliberation. Some of these cases should also suggest the superiority of the argumentation model.

This ambivalence about sunk costs seems to be reflected in the teaching of economics. The argument from sunk costs is emphasized as a fallacy at the introductory level. At this level, someone not very familiar with business methods may attach an emotional value to unrecoverable sunk costs that is not justified by a more pragmatic approach to business decision-making. Once the fallacy is recognized, however, the more sophisticated economic thinker can realize that of course sunk costs are a factor to be taken into account in decision-making. It's just that one must be careful not to overestimate how they should be weighed. Once sunk costs are unrecoverable, then their unrecoverability must be factored in, so you base your calculations on whether to stay with a started business venture on future factors that can be changed. This two-sided nature of informal fallacies is also evident in how fallacies are taught in logic. At the introductory level, we warn student about committing certain kinds of common reasoning errors and deceptive tricks called fallacies. But then at a more advanced level, in a course on argumentation theory, we teach the students

that the so-called fallacies are based on forms of argumentation that are quite often reasonable (non-fallacious). Then we can go into more complex and subtle considerations of using criteria to determine which instances of use are fallacious and which are not. To introduce too many of these subtle considerations at the introductory level may simply inhibit the students by making them despair of trying to undertake a task that seems (at their level) formidable or even impossible. Even if they can recognize relatively clear cases of common fallacies, this relatively crude skill will help them significantly to avoid some common errors and deceptions.

The negative lesson that has been achieved by learning that two models of rationality are involved is to rule out any straightforward calculative way of deciding in a given case whether the argument from sunk costs is fallacious. Simply dismissing all instances of argument from sunk costs as fallacious has definitely been ruled out. Offering the structure of practical reasoning as an alternative model of rationality to the cost benefit model has thrown some light on the problem. What has been revealed is that the notion of commitment in dialogue shows the way to setting up a different standard of rational argument that can be contrasted to the cost benefit model of rational argument. This alternative standard of rational thinking could be called the argumentation model. But the relationship between these two models is currently a subject of intense disputation in artificial intelligence, pitting the Bayesian approach against those who have misgivings about using the axioms of the probability calculus as applied to cases of practical reasoning under uncertainty. There are vocal advocates on both sides. Some would say that the cost benefit model is easily incorporated into the practical reasoning model through the critical question about consequences. Others would say it should be the other way around, and that the cost benefit model should be in the forefront. As noted above, given the continuing parallel conflict in ethics between advocates of utilitarianism and advocates of the opposed view, it would be naive to think that a general problem about rationality can easily be resolved.

Perhaps the relationship between the two models of rational thinking can best be put into perspective as follows. The cost benefit model is relevant in cases of decision-making where numerical probability values and monetary (or other numerical values) can be attached to each possible outcome in the case. In such a case, the Bayesian model of calculating probabilities is the method of choice. But there are other cases where applying numerical values in the Bayesian way would produce margins of error that would be greater than the confidence with which the original numerical values could be assigned. These are the cases where using the cost benefit model looks impressive, but where the numbers are really meaningless. Even worse, they are misleading, because they suggest a degree of exactness that is just not there. As a better alternative to the cost benefit model, what one should use in such a case is a commitment-based argumentation

model. In this model, there is a set of arguments and counter-arguments on two sides of an issue. The issue represents a conflict of opinions. Each argument on each side has some weight of acceptability. But instead of assigning each a numerical value or Bayesian probability, the arguments on each side have an ordering, from stronger to weaker. Then the arguments on each side are put into a data base (commitment set), and implications are drawn from the facts and rules in the data base (in the usual way, characteristic of reasoning in a knowledge base). The decision is then arrived at by comparing the arguments on both sides, using argumentation schemes to identify, analyze and evaluate each argument. In the argumentation model, as opposed to the cost benefit model, numerical probability values are not attached to each proposition. That is not the basis of how the reasoning is carried out. Instead, the mass of evidence on one side is compared to the mass of evidence on the other side of the issue. The calculation involved is the sorting out of the commitment set on each side. Inconsistencies need to be resolved. Conclusions need to be drawn from the given premises using argumentation schemes. Then the set of commitments on the one side can be compared to and weighed against the set of commitments on the other side. The key to the distinctiveness of this method is that it does not use numerical probabilities to attach to each proposition in the commitment set. This method is most useful in cases of decision-making under uncertainty when such Bayesian calculations would be misleading because margins of error are too large to justify the use of numbers to attach to outcomes and values. Instead, what one needs to do is to look at the arguments on both sides in a comparative way.

The way of posing the problem of how to evaluate sunk costs arguments by expressing the problem as one of relevance (Camillo and Peccati, 1997), has emerged as a good approach. For what many of the examples above have shown is that the problem in each case is to determine which sort of framework is relevant, the cost benefit model or the commitment model. In many cases of business and economics, the decision is one of whether to sink more money into a project that is underway. Since the goal is presumably to make a profit, the cost benefit model represents the only kind of consideration that is assumed to be relevant. However, the variety of examples studied above show that in many cases, the commitment model is not only relevant, but brings forwards evidential considerations that outweigh those produced by a cost benefit calculation. Examples from realistic argumentation show that there can be many factors that are relevant that are hard to fit into any abstract theoretical model of rationality.¹⁶ The increasing use of the precommitment approach to decision-making in banking and economics also indicate that the argumentation model is being taken as more and more widely acceptable, as an alternative to exclusive use of the cost benefit model.¹⁷

NOTES

- 1 For comments, information and discussions about the sunk costs fallacy provided on the ARGTHRY network, I would like to thank Virginia Allen, Daniel Cohen, Jim Crosswhite, Dov Gabbay, Dale Hample, David Hitchcock, Erik Krabbe, Ernest Sternberg, Tim van Gelder, and Michael Scriven.
- 2 Elster (2000, p. 4) noted that what he calls 'precommitment' or 'self-binding' has been called 'commitment' or 'self-commitment' by others.
- 3 This case was taken from watching CBS Evening News on April 11, 2000, and from some details of the case that were found on the CBS web page on April 12, 2000. The case, as presented above, is partly from my own recollection, as the interview with Lieutenant Carter was not on the web page.
- 4 Quoted from (Nozick, 1993, p. 22).
- 5 Paraphrased from (Steele, 1996, p. 609), but not quoted directly.
- 6 Quoted (with only a minor change) from Dov Gabbay's message of April 13, 2000 on the ARGTHRY network.
- 7 Quoted from (Steele, 1996, p. 606).
- 8 Paraphrased from the account given in (Steele, 1996, p. 610).
- 9 Quoted from (Thaler, 1980, p. 47).
- 10 Quoted with minor changes from the message of April 13, 2000 from Tim van Gelder on the ARGTHRY network.
- 11 Quoted from (Dawkins, 1989, p. 150).
- 12 The Osprey case, the Concorde case, and many other cases of large projects that pose controversial issues of public funding could all fit into this same category as arguments.
- 13 I would like to thank Chris Reed for discussions on argumentation schemes when we presented a joint talk on the formalization of argumentation schemes to the Communication Department at the University of Arizona on March 23, 2001. I would also like to thank Sally Jackson and Scott Jacobs for helpful discussions of the same subject when this talk was presented.
- 14 This example was written down, as recalled, from an everyday conversation.
- 15 This example was presented on the ARGTHRY network on April 13, 2000 by Erik Krabbe.
- 16 I would like to thank the Social Sciences and Humanities Research Council of Canada for support for this project through the award of a research grant, and the two anonymous referees who made many corrections on the initial draft and suggested some important improvements. I would like to thank the Communication Department of the University of Arizona for inviting me to serve as Visiting Professor in the spring term of 2001, and for providing facilities that supported the research in this paper.
- 17 (Considine, Daripan, Varotto, Kobayakawa and Parkinson, 1998).

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