1 · Introduction

We learn most of what we know from teachers and experts of one kind and another and this is not surprising in a highly specialised modern society. However, it is possible to rely too heavily on experts and this approach to learning and knowledge tends to encourage passivity and receptiveness rather than inventiveness and imagination. We tend to think that because the teachers and experts *know more* about the subject than the rest of us we must ask for their judgement and we must rely on it. One object of this book is to combat this attitude and to impress on the reader what a long way one can get in understanding any subject by thinking it through for oneself, by being imaginative and inventive rather than by simply accepting expert opinion. We shall do this by concentrating on the arguments experts have produced for believing a wide range of things and showing how it requires only a relatively slight knowledge of the subject to evaluate these arguments oneself. (When we speak of an argument in this book, we mean a train of reasoning – not a quarrel!) Confidence in one's own judgement is another key to understanding and a secondary objective of this book is to give the reader such confidence. It's like learning to ride a bicycle – you will have some falls on the way but once you can do it you'll realise you can do a great deal on your own.

It is surprising how far one can get by thinking things through. Here is an example: it is an argument about how bodies of different mass/weight fall under the influence of gravity.

> Suppose (as Aristotle believed) that the heavier a body is, the faster it falls to the ground and suppose that we have two bodies, a heavy one called M and a light one called m. Under our initial assumption M will fall faster than m. Now suppose that M and m are joined together thus $\boxed{\frac{m}{M}}$. Now what happens? Well, $\boxed{\frac{m}{M}}$ is heavier than M so by our initial assumption it should fall *faster* than M alone. But in the joined body $\boxed{\frac{m}{M}}$, m and M will each tend to fall just as fast as before they were joined, so m will act as a 'brake' on M and $\boxed{\frac{m}{M}}$ will fall *slower* than M alone. Hence it follows from our initial assumption that $\boxed{\frac{m}{M}}$ will fall both *faster* and *slower* than M alone. Since this is absurd our initial assumption must be *false*.

This beautiful piece of reasoning shows – *if it is correct* – that heavier bodies *cannot* fall faster under gravity than lighter ones. It illustrates what can be discovered by *thinking things through* (if it is correct). Of course the big question is whether it is correct and we shall consider how to answer that question later in the book. We introduce it now because it is a lovely example of the kind of reasoning – thinking things through – to which this book is addressed. It is a fairly *complex* piece of reasoning: it is not too easy to say exactly what the structure of the reasoning is and it is not easy to see whether the reasoning is correct. But it is also an *important* argument, because if it is correct it establishes a substantial, scientific conclusion which has very considerable implications (as we show in Chapter 8). Last, but not least, it is the sort of *complex* and *important* reasoning which most people feel unable to handle. They tend to give up on it and to ask someone they regard as an expert, 'Well, is it right?' The object of this book is to *show* the reader how to extract and evaluate such complex and important arguments and to demonstrate that one does not need to be an expert in the field to make significant progress in doing this.

Here is another, rather different example.

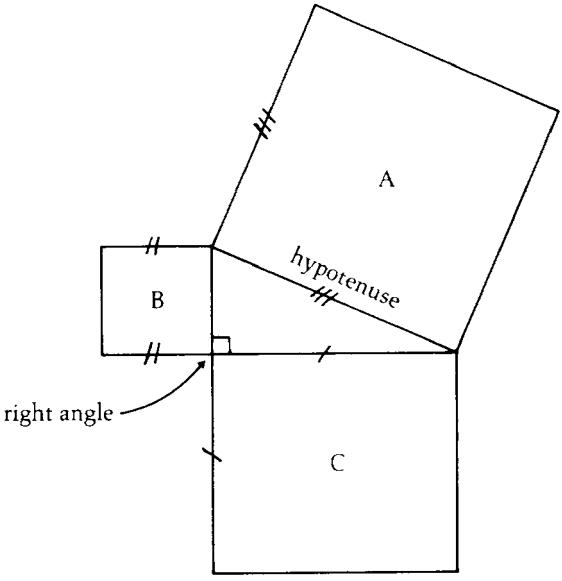
> Either there is a Christian God or there isn't. Suppose you believe in His existence and live a Christian life. Then, *if He does exist* you will enjoy eternal bliss and if He doesn't exist you will lose very little. But suppose you don't believe in His existence and don't live a Christian life. If He doesn't exist you will lose nothing, but *if He does exist* you will suffer eternal damnation! So it is rational and prudent to believe in God's existence and to live a Christian life.

Again, this is a fascinating piece of reasoning. It is complex and important and hard to handle. In this case furthermore, it is the sort of argument which tends to stop the non-believer in his tracks: *if it is right* it seems to provide a very compelling reason for reforming his ways because the consequences of his being mistaken are so appalling. And yet one can't help feeling that one's beliefs are not things which can be adapted simply to avoid some awful consequence. Again this book tries to help.

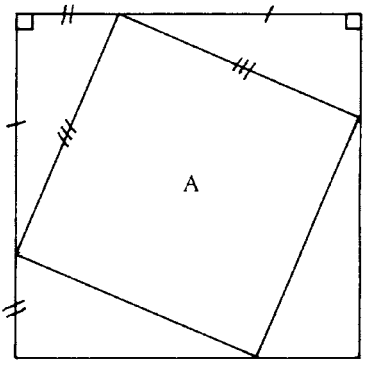
As it happens both the examples we have considered so far are of great historical importance. The first was due to Galileo and the second is known as Pascal's Wager after the French philosopher and mathematician. Many of the examples of reasoning which we shall consider in this book are historical classics in the same way. We have chosen them because, being classics, they tend to be of interest in their own right (apart, that is, from their interest in argument analysis). They also tend to have a history and a contemporary relevance which is instructive. But they are also usually backed by some

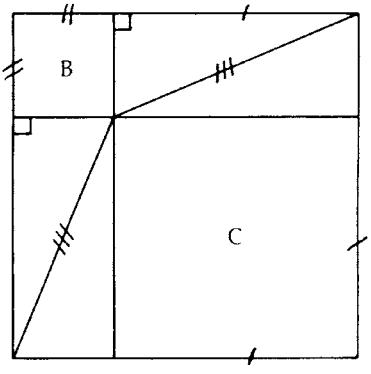
'authority', for example Galileo or Pascal, and it is precisely the tendency to rely on the expert authority that we wish to combat – up to a point!

Here is another example. Most people who struggled with the proof of Pythagoras' Theorem at school never came anywhere near to understanding it, but here is a much simpler 'proof' (*if it is correct*). Pythagoras' Theorem is about any right-angled triangle in the Euclidean plane (i.e. on a flat surface like this page). The 'hypotenuse' in such a triangle is the side opposite the right angle and Pythagoras' Theorem says that for any right-angled triangle the square on the hypotenuse equals the sum of the squares on the other two sides, i.e. the area A = the area B + the area C.



Few people grasp the standard Euclidean proof, but here is a much simpler one. The same large square can be formed by arranging four copies of the given triangle with B and C or with A as shown below:





Do these diagrams prove Pythagoras' Theorem? Or is there a catch? One only has to think about it to realise that any reader can judge this – and yet most will lack the confidence to do so.

Here is a last example – for the time being.

> Suppose four-fifths of all the money in Great Britain to be annihilated in one night, and the nation reduced to the same condition, with regard to specie [cash], as in the reigns of the Harrys and Edwards, what would be the consequence? Must not the price of all labour and commodities sink in proportion, and everything be sold as cheap as they were in those ages? What nation could then dispute with us in any foreign market, or pretend to navigate or to sell manufactures at the same price, which to us would afford sufficient profit? In how little time, therefore, must this bring back the money which we had lost, and raise us to the level of all the neighbouring nations? Where, after we had arrived, we immediately lose the advantage of the cheapness of labour and commodities; and the farther flowing in of money is stopped by our fulness and repletion.
>
> Again, suppose, that all the money of Great Britain were multiplied five-fold in a night, must not the contrary effect follow? Must not all labour and commodities rise to such an exorbitant height, that no neighbouring nations could afford to buy from us; while their commodities, on the other hand, become comparatively so cheap, that, in spite of all the laws which could be formed, they would be run in upon us, and our money flow out; till we fall to a level with foreigners, and lose that great superiority of riches, which had laid us under such disadvantages?
>
> Now it is evident, that the same causes, which would correct these exorbitant inequalities, were they to happen miraculously, must prevent their happening in the common course of nature, and must forever, in all neighbouring nations, preserve money nearly proportionable to the art and industry of each nation.

This argument is again quite complex, quite hard to unravel, and of considerable historical and theoretical importance. Its author was David Hume, the philosopher, and it was first published over two centuries ago. However, it is not of purely historical significance: in short it is a classic statement of the case for what we now call 'monetarism'. If the reasoning is correct

it has important implications for government policy. If it is incorrect many Western governments have based their economic policies in recent years on a fallacy! But again it is the kind of argument most people shy away from. They feel that it is a matter for the experts – in this case economists. But since economists disagree strongly over this and many other issues why should we rely on them and not on ourselves?

In this book we shall try to show that it is possible to get quite a long way in handling arguments like those above just by thinking things through. All that is needed is a fairly simple intellectual framework within which to organise one's thoughts plus the confidence to be imaginative and inventive instead of waiting for the expert. A little practice at riding this particular bicycle will show you what you can do and what your limitations are and most people can get further than they realise.

The methods which work for these relatively difficult arguments will of course work for easier arguments, but the *test* of any method which aims to help people in reasoning is how it handles difficult cases, which is why we tend to concentrate on these in this book. We cannot of course start with difficult cases, so we begin with some basic elements of the intellectual framework we need and some easier examples which will lead us in the right direction.

First, some basic ideas. Although much of what is said in this book generalises to broader areas than the sort of 'nuggets' of reasoning we have introduced above we shall restrict our attention to such reasoning for the sake of simplicity. By the end the reader should see how to generalise the approach explained in this book in various ways – especially in the light of the last chapter.

So basically we shall be looking at passages quite like those introduced so far (though often rather longer). The key ideas we need to introduce for the moment are '*conclusion*', '*reason*' and '*establish*'. The passages in which we are interested all contain reasoning, they are all arguing a case. We argue a case by presenting grounds or *reasons* for accepting some *conclusion* (which need not come at the 'end' of the passage of course!) and the reasons are put forward in order to *establish* the conclusion, to *justify* it, *prove* it, *support* it, *demonstrate* it – or some such word. For present purposes we do not need to define these terms. The reader will be used to using such terms and for the present we want to rely on, and draw out, the reader's logical intuitions.

Of course the interesting question is always whether the reasons given *do* justify the conclusion, but it is impossible to answer that question until you have identified the conclusion and the reasons presented for it, so we now set a few simple exercises in doing this. It will help the reader to see what the problems are and to see why the 'machinery' introduced later in this book (especially in Chapters 2 and 8) is necessary if he or she writes out

careful answers to each of the questions below before reading the answer which immediately follows.

The general form of the exercise is the same in each case. For each of the following passages the reader should first say whether it is an argument (whether it contains reasoning to a conclusion). For those which are arguments the reader should next say what their conclusion is, and then what reasons are given for that conclusion. Finally the reader should attempt to decide whether the reasoning establishes its conclusion in each case. It is important of course to say *why* you reach your decision.

> Example (1)
>
> If the money supply were to increase at less than 5% the rate of inflation would come down. Since the money supply is increasing at about 10% inflation will not come down.

This clearly is a piece of reasoning. It is the sort of argument which has been all too familiar in Britain in recent years, but, discounting this, the use of the word 'since' shows that what we have here is reasoning. The conclusion is,

> inflation will not come down

and the reasons given are,

> if the money supply were to increase at less than 5% the rate of inflation would come down

and,

> the money supply is increasing at 10%.

This reasoning does *not* establish its conclusion: the reasons could both be true and the conclusion false. Something else could bring inflation down – for example a fall in the price of imports. There is nothing in the argument *as it is presented* to suggest that *only* a reduction in the rate of increase of the money supply will bring down inflation. Many people, perhaps under the influence of monetarism, construe this as a *good* argument (it has been used often by British politicians in recent years), but it isn't. In fact it is an example of a classical logical fallacy: this will become obvious later if it is not already.

> Example (2)
>
> If Russia were unsure about American reactions to an attack on Western Europe, and if her intention were to conquer Western Europe, she would create local *casus belli* (causes of war) but since she has not done this, she cannot intend to conquer Western Europe.

Again this is clearly a piece of reasoning to a conclusion; again the word 'since' is the linguistic clue that we have an argument here. The conclusion in this case is,

> [Russia] cannot intend to conquer Western Europe

and the reasons given for this conclusion are,

> If Russia were unsure about American reactions to an attack on Europe, and if her intention were to conquer Western Europe, she would create local *casus belli* but . . . she has not done this.

Again, this reasoning does *not* establish its conclusion: the reasons could be true and the conclusion false. Suppose the reasons *are true*, then it does follow that *either*,

> Russia cannot intend to conquer Western Europe

or,

> Russia is *not* at all unsure about American reactions to an attack on Europe.

But it may be that Russia is very sure about American reactions to such an attack, that Russia has no doubt at all that America is ready and willing to fight a European war if the Russians are so foolish as to provoke one. So it may be that the Russians would dearly love to conquer Western Europe but that they carefully avoid creating *casus belli* knowing only too well what the American reaction would be. Hence the reasons could be true and the conclusion false, so the reasoning does not establish its conclusion. This example is very like one which is considered later in this book and which is due to Enoch Powell, the British politician. He takes it to be a good argument. He would probably say in response to the above criticism that the argument has an *implicit* assumption, namely that,

> The Russians must be unsure about American reactions to an attack on Western Europe.

With this addition to the reasoning the conclusion would indeed be established if all the reasons were true: that is to say, there would be no way in which all the reasons could be true and the conclusion false. When people produce real arguments which are aimed at convincing others, there are nearly always *some* relevant *implicit* assumptions – as Powell would no doubt point out in this case. The only way to deal with such arguments is to handle them initially *as they are presented*, to extract and evaluate the argument on the basis of what is actually said or written. This process may reveal implicit assumptions and we shall explain how to deal with these in the course of

considering examples throughout the book. In this case the soundness of the argument hinges on whether it is reasonable to assume that,

> the Russians must be unsure about American reactions to an attack on Western Europe

and we leave that question open.

> Example (3)
>
> If the civil population cannot be defended in the event of nuclear war, we do not need a civil defence policy. But, we *do* need a civil defence policy if 'deterrence' is to be a convincing strategy. Therefore deterrence is *not* a convincing strategy.

This is clearly a piece of reasoning: the word 'therefore' is the linguistic clue. The conclusion is,

> deterrence is not a convincing strategy

and the reasons given are,

> If the civil population cannot be defended in the event of nuclear war, we do not need a civil defence policy

and (but),

> we *do* need a civil defence policy if deterrence is to be a convincing strategy.

In this example the reasoning is a bit more complex. It contains two separate hypotheticals (a hypothetical is a sentence of the form '*if* this *then* that') and it can be tricky to put them together. (The notation of classical formal logic makes it easy but for that see the Appendix.) Once again, however, the reasoning (as it is presented) does *not* establish its conclusion: the reasons could be true and the conclusion false. It could well be true that,

> If the civil population cannot be defended in the event of nuclear war we do not need a civil defence policy

whilst *as a matter of fact* the civil population *can* be defended in the event of nuclear war (for example by having shelters for everyone, as in Switzerland). In that case the reasons given in this argument could well be true whilst the conclusion was false.

This example is adapted from a CND (Campaign for Nuclear Disarmament) pamphlet. No doubt CND would respond to the above by saying that the argument rests on the *implicit* assumption that,

> the civil population cannot be defended in the event of nuclear war.

No doubt they would also point out that since this is official government policy it is a reasonable assumption to make (in Britain). With this additional reason the argument does indeed become watertight if the reasons are all true.

Suppose it is true that,

> If the civil population cannot be defended in the event of nuclear war we do not need a civil defence policy

and suppose it is also true that,

> the civil population cannot be defended in the event of nuclear war

then it does indeed follow that,

> we do not need a civil defence policy.

But from this conclusion and the truth of the second reason (slightly re-written for convenience),

> if deterrence is to be a convincing strategy we *do* need a civil defence policy

it follows immediately that,

> deterrence is *not* a convincing strategy.

One could say much more about this little argument but for our present purposes it is sufficient to say that *as it stands* it does *not* prove its conclusion, but with its additional reason it does if all the reasons are true. If you really want to establish the conclusion by means of this argument you must also establish the truth of its reasons and it is a useful exercise to consider how you would do this. For example to show that,

> If the civil population cannot be defended in the event of nuclear war we do not need a civil defence policy

is true, presumably you have to show that no useful purpose would be served by having a civil defence policy – the civil population would not be defended, they would not be reassured, the enemy would not be deceived, and such like.

> Example (4)
>
> The materials of nature (air, earth, water) that remain untouched by human effort belong to no one and are not property. It follows that a thing can become someone's property only if he works and labours on it to change its natural state. From this I conclude that whatever a man improves by the labour of his hand and brain belongs to him and to him alone.

This is clearly a piece of argument. The linguistic clues are 'it follows that' and 'from this I conclude that': in fact it is a very famous argument from John Locke's *Second Treatise of Government*. He starts with a basic reason,

> The materials of nature (air, earth, water) that remain untouched by human effort belong to no-one and are not property

and from this he draws the conclusion (he says 'it follows that'),

> a thing can become someone's private property only if he works and labours on it to change its natural state.

We might call this an *intermediate* conclusion in Locke's argument because he then goes on to use it as a reason for a further conclusion – what we might call the *main* conclusion of the passage, namely,

> whatever a man improves by the labour of his hand and brain belongs to him and to him alone.

In fact this is a 'chain' of reasoning. A basic reason is presented and a conclusion is drawn from this: that conclusion is then the reason for a further conclusion, so the reasoning has a structure which might be pictured like this,

Basic reason
↓
Intermediate conclusion
↓
Main conclusion.

Such chains of reasons are very common in arguments and may be a good deal longer.

Again, the reasoning does *not* establish its main conclusion. The basic reason could be true and the main conclusion false. To see this let us suppose that the basic reason is true, that,

> The materials of nature (air, earth, water) that remain untouched by human effort belong to no-one and are not property.

Let us also suppose that it does indeed follow that,

> a thing can become someone's private property only if he works and labours on it to change its natural state.

(Some might want to criticise this move in the argument by insisting that something can become your private property if you are *given* it by someone else whose property it was, but we ignore this objection for the moment