Introduction

A cause ensures that its effects are no coincidence. That is the central claim of this book and it is, at first sight, a familiar one. If the trespasser left the field a moment ago because he had just observed the entry of a bull, then his leaving the field at that moment was no coincidence. The arrival of the bull ensured that he would leave the field without delay. On the other hand, had the trespasser failed to spot the bull prior to his departure from the field then, as far as the presence of the bull goes, it is a complete accident that he chose that moment to leave – here it is a coincidence that the bull's arrival at $t(1)$ preceded the trespasser's departure at $t(2)$, so one who thinks it no accident that the trespasser left at $t(2)$ can't cite the bull's entry as his reason.

Philosophers have found the causal relation deeply perplexing. To say that the bull's entry caused the trespasser's exit appears to commit one to a *sui generis* relation connecting the earlier event and the later one, the existence of which enables the bull's arrival to explain the trespasser's departure. But what is this relation? How do we come to know of its existence? Surely all we actually witness is the bull's arrival preceding the man's departure, but the bull may arrive and then the trespasser may depart without the one event causing the other. So what more is there to causation? Re-telling the bull story in terms of the notion of coincidence does not appear to help here.

A popular answer to these questions is that a cause is an event that is (a) necessary and (b) sufficient (in the circumstances) for its effect. So the bull's entry caused the trespasser's exit because (a) without the bull's entry the trespasser would not have left and (b) given the bull's entry, the trespasser would leave wouldn't he? We believe (a) and (b) because we have observed the behaviour of other trespassers in similar circumstances and know that when no bull appeared they did not leave, but when a bull did appear, they left.

Now many difficulties have been raised for this account of causation

but I wish to focus on three. First, one event may be necessary and sufficient for another without being causally necessary and sufficient. My moving to the left of you is necessary and sufficient to put you to the right of me, but my moving to the left of you does not cause you to go to the right of me. How are the genuinely causal relations to be distinguished from these other relations?

Second, 'being a necessary and sufficient condition for' is a symmetric relation. If the bull's arrival is necessary and sufficient for the trespasser's departure, the trespasser's departure is necessary and sufficient for the bull's arrival. But the trespasser's exit does not cause the bull's entrance, rather the bull's entrance causes the trespasser's exit. How is this fact to be explained?

Third, many philosophers hold that every event (whether physical or not) has a purely physical necessary and sufficient condition. But they do not wish to hold that every event has a purely physical causal explanation. On the contrary, there appear to be many events, psychological and social among them, which do not admit of a physical explanation. But if causes are just necessary and sufficient conditions then every event has a purely physical cause. How then could any of these events fail to have a physical explanation?

I believe we can make an important advance in the theory of causation simply by taking my first sentence literally. A cause ensures that its effects are no coincidence – so whatever is a coincidence necessarily has no cause. Our popular theory is committed to denying this, as can be seen from the following example. Just as the sight of an English bull drives a trespasser from an English field, across the world an antipodean bull provokes a similar response from someone trespassing in an Australian field. Surely none could deny that the simultaneous departure of these trespassers is a coincidence – even though there is a bull to explain why each of them left at the moment he did. But the bulls' simultaneous arrival is both necessary and sufficient for the trespassers' simultaneous departure. So an adherent of the theory must conclude that this collective departure, this coincidence, has a cause after all, namely the bulls' simultaneous arrival.

In the pages that follow, I shall plead the case for saying that the simultaneous departure of the trespassers has no cause, despite having a necessary and sufficient condition. Furthermore, I shall urge that the three problems outlined above can be solved if we accept this verdict. There follows a brief sketch of how this will be done.

In chapter 1, I elucidate the notion of a coincidence and contend that coincidences are inexplicable. A coincidence is an event which can be analysed into constituent events the nomological antecedents of which are quite independent of one another. To explain such a combination of events we must find some common nomological antecedent of its components, or some nomological connection between them. Since there is none, the combination is an accident and, as Aristotle urged, such accidents have no explanation.

Chapter 2 suggests that causal facts be analysed in terms of non-causal facts, among them relations of necessity and sufficiency: 'causation' can be defined in terms of 'coincidence', and 'coincidence' can be defined without reference to causation. Nevertheless, to analyse 'coincidence', we must speak of necessity and sufficiency, and necessity and sufficiency cannot be analysed in amodal terms – so some sort of modality will be taken for granted in our account of causation.

This leaves us with a problem. Any adequate theory of causation must distinguish nomological necessity and sufficiency from their logical counterparts, which are presumably irrelevant to causation. One option is to use the Humean shibboleth that causes are only contingently necessary and/or sufficient for their effects to make this distinction. But since it is impossible to analyse causation, except by taking some sort of modality for granted, one cannot demonstrate the contingency of these modal relations by reducing them to some amodal and clearly contingent relations. Furthermore, Hume's direct argument for the contingency of laws, from the fact that we can imagine their not holding, fails to establish its point and the problem remains.

The next beacon of hope is the Humean doctrine that causes must be distinct from their effects. This has been construed, by several modern philosophers, as the doctrine that causes and effects are objects which may stand neither in the relation of parthood nor in the relation of identity. Chapter 3 concludes that this idea cannot help us to distinguish causal explanations from those explanations, arising out of our logical or linguistic practices, which depend on non-nomological connections between events.

In chapter 4, I move from the conclusion that coincidences have no causal explanation, to the further conclusion that they have no cause *tout court*. In fact, I define a cause as something which explains its effects, which ensures that its effects are no coincidence. I then confront the question: why does my moving to your right not cause you to move to

my left? The answer is there is no other event, *a priori* independent of your moving to my left, such that my moving to your right ensures that the co-occurrence of that event and your moving to my left is no coincidence. So we are at last in a position to distinguish those relations of necessity and sufficiency which give rise to causation from those which do not.

In chapter 5, I criticise a number of attempts to account for the fact that causes precede their effects. These attempts rely on the assumption that each event is necessary for more subsequent events than it has antecedents sufficient for it. As they stand, these efforts fail, but they can be made to succeed provided the role of a cause is to ensure that the co-occurrence of different effects is no coincidence. For, given the above mentioned assumption, there will be far fewer coincidences if causation runs from past to future than if it goes against the grain of time: that is why causal explanation flows from earlier to later events. Once we have a theory of the direction of causation along these lines, we can distinguish events related as cause to effect from causally unconnected events which possess a common cause. Other theories find this distinction hard to make, since events with a common cause may be both necessary and sufficient for one another.

Chapter 6 considers events which have economic, but not physical, explanations. These economic events are physical in that they are entirely composed of physical events, but the innumerable physical explanations which are required to account for the occurrence of all of these physical components cannot be combined to yield an explanation for the economic event which they compose. This economic event is a physical coincidence – it ceases to be a coincidence only when we take account of its economic causes. I show that these facts undermine various reductionist and non-reductionist proposals about the relationship between the physical sciences and the special sciences, and then formulate my own view of the connection between these different levels of explanation.

In chapter 7, I apply the theory of causal explanation, expounded in the rest of the book, to the problem of deviant causal chains. This problem arises in the context of causal analyses of perception, memory and action. For instance, it is said that a visual experience of a certain object must be caused by that object, but it quickly becomes apparent that not any old causal chain from object to experience will do. Several philosophers have made suggestions as to how the unwanted, deviant causal chains might be characterised and ruled out, and I aim to show that these suggestions are,

in fact, an application of points about causal explanation established earlier on in this book.

Chapter 8 is taken up with the role of causation in human action. The causal theory of action is introduced and it is argued that those laws which govern human decision making and action may be causal laws. Next, I apply the model of the relationship between the physical and non-physical sciences, sketched in chapter 6, to resolve a tension which many have felt between the claims of psychology and those of physiology to explain human action. Finally, the resurgent problem of deviant causal chains is dealt with for the case of action.

Throughout this book, I shall speak in terms of necessary and sufficient conditions. This terminology might be considered rather quaint in the light of the probabilistic turn taken by modern physics. Philosophers, at least in the last fifteen years, have bent over backwards to allow for causation without determinism. Indeed, they have gone further and attempted to analyse the notion of causation itself in probabilistic terms. Now I have nothing against these developments which seem to me entirely sensible. Nevertheless, I do not think that our treatment of the problems considered in this book would be enhanced by reformulating the issues in probabilistic terms. All the traditional difficulties philosophers have faced with deterministic causation can be restated in the new probabilistic vocabulary and after this reformulation the problems are no less intractable.

For expository convenience, I assume throughout the book that determinism is true. Nothing rests on this assumption. A reader used to probabilistic treatments may follow a simple translation procedure. Whenever I say 'p is sufficient for q', read 'p raises the probability of q', and whenever I say 'p is necessary for q' read 'The falsity of p lowers the probability of q'. Necessity and sufficiency are just the limiting cases of these probabilistic relations. For instance, a coincidence may be defined as an event analysable into two components such that the factors which raise the probability of one component occurring (or which would lower this probability were they absent) are probabilistically independent of the factors which raise the probability of the other component's occurring (or which would lower this probability were they absent). My analysis could just as well proceed in terms of this probabilistic notion of a coincidence.

1

The inexplicability of a coincidence

What is a coincidence?

As I write, it rains outside. It has been raining all week. Tomorrow is my wedding day and I crave fine weather, but the forecasters give me little grounds for hope. In desperation I pray for fine weather and, sure enough, tomorrow dawns clear and bright. Those sceptical of the power of prayer will dismiss this as a coincidence, while many of the faithful will insist it was no coincidence. I shall not attempt to adjudicate this dispute. My aim is to discover exactly what is at stake here: what is it for an event to be a coincidence?

The sceptics will enlarge on their interpretation of events as follows: 'your prayer's being answered is an event which is composed of two other events – (a) your praying for fine weather (b) your getting fine weather. The meteorological processes which brought about the fine weather were quite independent of those which brought about your prayer, therefore it was a coincidence that your prayer was answered.'

The faithful will reply as follows: 'we agree that your prayer's being answered is an event with two components, but we refuse to believe that these components are independent of one another. Either your prayer caused the weather to be fine because God heard your request and granted it, or else your prayer and the state of the weather had a common cause in God who set up the world at the beginning of time so that your praying one day would be followed by fine weather the next.'

It should now be clear what is at issue. The sceptics say that the answered prayer is a coincidence, by which they mean that it is a conjunction of two separate events, each produced by quite independent causal processes. The faithful say that the answered prayer is no coincidence, by which they mean that its components are either causally interrelated or have some common cause – they are not causally independent of one another.

Coincidences are not confined to the realm of human or divine action. For instance, the sun's exploding during an eclipse would most likely be a coincidence. It would be a coincidence because eclipses and explosions are causally independent. The intentions of a powerful being might have linked these events and ensured that the outcome was no coincidence, but an inanimate natural force would have served this purpose just as well.

Hart and Honore characterise the ordinary notion of coincidence as follows:

> We speak of a coincidence whenever the conjunction of two or more events in certain spatial or temporal relations is (1) very unlikely by ordinary standards and (2) for some reason significant or important, provided (3) that they occur without human contrivance and (4) are independent of each other. (Hart and Honore, 1959:74)

In defining a coincidence simply as any event whose constituents are produced by independent causal processes, I have accepted (4) and, by implication (3), since human contrivance would act as a common cause. But (1) and (2) have been omitted from my notion of a coincidence, thus stretching the ordinary concept in at least two directions.

First, I have not insisted that coincidences be significant or striking. The conjunction of my now driving a green car and the Queen's beginning a visit to France in exactly a year's time is a coincidence. More salient coincidences include the eclipsed explosion or my unwittingly booking myself onto the same cruise as my long lost enemy. But the universe abounds in coincidences which are of no interest to human beings. My insistence that many perfectly uninteresting events are coincidences does involve a certain departure from ordinary usage, but I would argue that such extensions of a familiar concept are perfectly permissible if they aid the task of understanding other familiar concepts such as causation.

Still someone may object to this liberality on the philosophical grounds that not every conjunction of two events is itself an event and genuine events alone can be coincidences. This point has force only if we regard events as like material objects, concrete particulars which we cannot amalgamate at will to form genuine new particulars – as we cannot fuse your hand and my book into a single self-standing entity. In chapter 3, I shall urge that an event, what explains and is explained, is expressed by a sentence and is not some concrete object to which a singular term might refer. So 'It is a coincidence that' is a sentential operator which may be tacked onto the front of sentences like 'My

prayer was answered' and not a predicate of a concrete particular denoted by expressions like 'the answering of my prayer'. And surely we may conjoin sentences to form new sentences to our heart's content.

There is a second respect in which my definition of 'coincidence' constitutes a departure from the ordinary concept. Coincidences do not have to be unlikely, surprising, unpredictable or improbable (Mill, 1906:345–8). I may pray for the sun to rise tomorrow, in which case it is highly probable that my prayer will be answered. Nevertheless, so long as my prayer is independent of the causal factors which lead to its being answered, this is a coincidence. The rationale for this stipulation is again a theoretical one. I shall urge that *explanation* is the key to causation and, as we shall see, explanation does not go hand in hand with either prediction or high probability.

So far, I have given the impression that being a coincidence is an all or nothing matter – either an event is a coincidence or it is not. According to the sceptic, my prayer's being answered is a complete coincidence since meteorology has nothing whatever to do with psychology.[1] In the eyes of the faithful, it is completely non-coincidental since what is intentionally brought about (by God or anyone else) is no coincidence at all. But there are many events, partial coincidences, whose components share some, but not all, of their causal ancestors.

Consider the fact that I'm on the same cruise as my old enemy. This might be a complete coincidence – perhaps a full explanation of why I am on that cruise will have nothing in common with a full explanation of why he is on that cruise. But this is unlikely. Suppose that I am cruising partly because the weather is hot and I wish to escape to the cool sea – this may well be why he is cruising also. So there is at least one causal factor which is relevant both to my presence and to his presence on the liner. But if our meeting is not a complete coincidence neither is it likely to be wholly non-accidental. He is on that particular boat partly because it is calling at ports adjacent to antiquities which would bore me, but he has not heard of the liner's well-known jazz band which I am looking forward to hearing. So there are causal factors which are relevant to my presence but not to his, and *vice-versa*. I conclude that our meeting is a partial coincidence. How much of a coincidence it is will depend on the

[1] In fact, there are some common elements among the conditions necessary for the prayer and for the fine weather, for example the presence of oxygen in the earth's atmosphere. If the big bang hypothesis is true then there are common elements among the conditions necessary for any pair of events, so nothing is a *complete* coincidence.

weight and salience of the causes shared by its components relative to those of the causes which are not shared.

Coincidences are often contrasted with lawlike regularities. For instance, it is a law that all unsupported bodies fall to the ground, but it is a coincidence (let us suppose) that all hunks of gold are less than one mile wide. This usage of the word 'coincidence' is different from, but related to, my own. On this usage, a coincidence is an accidental correlation or regularity and what makes it a coincidence is the absence of any natural law which might explain the correlation. Both the correlation and the law would be expressed by eternal sentences, without tense or date.

My coincidences are events whose occurrence is expressed by a time-indexed sentence (for example 'The prayer was answered today') and what makes an event non-coincidental is another event, namely a cause. This 'singular' notion of a coincidence is obviously connected to the 'general' notion. It is no coincidence in my sense that an unsupported object falls to the ground – its being unsupported combines with its mass and gravity to cause the fall in the way dictated by a covering law. But, in general, it is a coincidence if a hunk of gold is less than one mile wide because, there being no law connecting size with golden constitution, usually a thing's being gold is causally independent of its size.

Until now, I have assumed that both coincidences and the subjects of explanation are to be expressed by true sentences. But it would be better to say that they are to be expressed by true sentences as used in a given context. Van Fraassen asks us to consider the following request for an explanation:

(i) Why did Adam eat the apple?

It may seem perfectly clear what the question is asking for, but that is only because we assume the sentence will be uttered in a context which will determine which of the following questions is intended:

(ii) Why was it *Adam* who ate the apple (rather than somebody else)?
(iii) Why was it *the apple* Adam ate (rather than some other fruit)?
(iv) Why did Adam *eat* the apple (rather than throwing it)?

The context of utterance will comprise the interests and the beliefs knowingly shared by the speaker and the hearer. For instance, the questioner may take it as read that it was Adam who ate a fruit – he may already have accounted for the fact that Adam and eating were involved, or else he may not be interested in these aspects of the situation. What he

is not taking for granted is that Adam ate an apple rather than a pear, so our explanation must not presuppose this fact, it should explain it (Van Fraassen, 1980:126–9).

We can represent our interpretation of the why-question by specifying the intended contrast class. The contrast class will contain those statements which appear in the bracketed 'rather than' clause. Once we have specified the contrast class, we have also specified which statements the speaker is taking for granted, which he is not requiring an explanation of, when asking his question, namely those statements entailed by both sides of the contrast.

Van Fraassen's point applies to the examples already considered. For instance, I said that the summer heat might provide a partial explanation of why my enemy and I took the same cruise. But, strictly speaking, what the heat partially explains is why my enemy and I *both went on the cruise* (as opposed to taking a simultaneous trip up the Amazon). It does not help to explain why *both I and an enemy of mine* went on the same cruise (as opposed to some long lost friend). His being a long lost enemy of mine played no part in getting him on the cruise. So, while the fact that two people caught up in a hot English summer both went on a cruise is a partial coincidence, it is a complete accident that I met an enemy of mine on the cruise.

Someone may conclude from this that an event is a coincidence only in the eye of the beholder. It was no coincidence when everyone went off to the polls today – they all heard the election announcement – but it was a great coincidence that they all tried to vote at exactly the same time. How can the same situation be objectively coincidental from one point of view and yet not from another?

There is no mystery here. The coincidence is that certain sentences are true, sentences which we might try and fail to explain the truth of. As I shall argue in the next section, we may be able to explain why everyone went to the polls today, yet be unable to explain why they all appeared at exactly the same time of day. But, once we have determined precisely what we want explained, it is up to the world to decide whether a suitable explanation can be given. Similarly, while it is up to us to choose which true sentence (in a given context) we want explained, it is up to the world to decide whether the truth of that sentence is a coincidence.