Determinism[1]

DETERMINISM DEFINED

Determinism is a view about causality. In its most common form, it holds that everything that happens or occurs has a cause ('universal causation'). Our idea of causality includes the idea of *regularity*, that the same cause will operate in the same way on different occasions. This allows us to formulate laws of nature. More controversially, many philosophers want to develop the idea of regularity into the stronger claim that, given a particular cause in a particular situation, only one outcome is *possible* ('causal necessity').

For example, suppose there is water on the kitchen floor. We assume that there is a causal explanation of how the water got there, even if no one knows what it is. If the mess was not caused at all, then we would consider it a miracle. Suppose a pipe burst. So we say 'The burst pipe caused the kitchen floor to become wet'. This claim is about this one occasion. But we expect that on other occasions if a pipe burst in the kitchen, the floor would be wet. This is the idea of regularity. The same cause will lead to the same effect, and if the effect is different, then the cause must be different too. So if on another occasion, a pipe burst, but the floor remained dry, there must be something which is different between that situation and our original one. (For example, it might be that the whole house is well below freezing, so that the water in the burst pipe is and remains ice – so it stays where it is, and the floor remains dry.)

The idea of regularity can lead to the stronger thought that, given this cause – in exactly this situation – only one outcome is *possible*. In a different situation, a burst pipe might not lead to water on the floor; but in this situation, not only does the burst pipe lead to a wet floor, but it had to. For instance, it is not possible that in this situation, and any other situation exactly like it, the pipe could burst but the floor not become wet. The situation determines a unique effect. This is the idea of causal necessity.

It is worth pointing out that determinism is not an empirical discovery, something that science has proven true. We can't show that every event has a cause. It isn't an analytic truth and we can't investigate every event to establish that the event does, indeed, have a cause. However, as science has progressed, it has explained more and more events, and discovered more and more general regularities in how the world works. Determinism is best understood as a commitment or an assumption that we make in doing science.

---

[1] This handout is based on material from Lacewing, M. (2008) *Philosophy for AS* (London: Routledge), Ch. 10, pp. 351-2, 367-9

Again, laws of nature are universal – there is no part of the universe in which they don't apply. So every event – at least every *physical* event – falls under the laws of nature. So every physical event was caused in accordance with these laws.

DETERMINISM DEVELOPED

The state of the universe

We said that in the same situation, the same cause (a burst pipe) leads to the same effect (a wet floor), as long as the two situations were the same. But any number of things may disrupt the cause producing the effect: a meteor could land at the moment the pipe bursts, destroying the kitchen floor, a simultaneous explosion of gas could turn all the water into steam – so the burst pipe doesn't lead to a wet floor.

To defend the idea of causal necessity, we need to be able to say that there is only one possible outcome, given the cause. Given the possibilities just mentioned, how can we? We need to consider anything that *could* have an effect. How can we do this? The safest, and most complete, specification of the situation is *the entire state of the universe at that moment*. With the universe in that state (including the pipe bursting), the next state of the universe (including the wet floor) must follow, given the laws of nature.

We don't normally talk of 'the state of the universe'. But we need to get rid of 'other things being equal' – as long as allow this, the effect isn't the only *possible* event. So to capture causal necessity, we can take into account all 'other things' – the entire state of the universe. From this state, only one state can be caused by it and will follow it. The past determines a unique future. Determinism, then, is the view that given the state of the universe and the laws of nature, only *one* unique state of the universe can occur next.

Causal chain

As the universe continues through time, so the events which are effects of earlier causes become causes of later effects. This gives us the idea of a *causal chain*. This event, G, was caused by an earlier event, F, which in turn was caused by an earlier event, E, and so on. So any event is determined by what caused it; its causes were determined by what caused them; and so on, back through time. So any event is determined by what happened in the *distant past*. The entire future of the universe was causally fixed from the first moment; from that first moment on, no other set of events than what has actually happened and will happen was physically possible. This is the very strongest statement of determinism.

A challenge

These developments of determinism are controversial. In particular, we began with the idea of determinism as a methodological commitment in doing science. It relates to our knowledge of the world, the view that events as intelligibly connected and occurring according to laws. As a result, events are predictable in principle in advance, given suitable evidence. But the idea of predicting the entire state of the universe on the basis of complete knowledge of the previous state of the universe is extremely impractical (to say the least). Developing determinism in the way we have just done here shifts us from epistemology – a way of thinking

about and investigating the world – to metaphysics – a claim about how the world really is, whether we could know about it or not. That may be an illegitimate move.

Part of the debate here is how to understand the nature of causal necessity. In the handout 'Midgley on human evil and free will', we note that Mary Midgley argues that we should not understand the thought that only event is possible, given preceding conditions, as claiming that each event is *forced* to happen. Philosophers who think that this *is* how we should understand determinism are more inclined to see it as a metaphysical claim than an epistemological one.

CHANCE AS COMPATIBLE WITH DETERMINISM

If things happen by chance, does that make determinism false? What is 'chance' at one level can be explained at another level. For example, you might bump into an old friend 'by chance', i.e. you hadn't arranged to meet. But if physical determinism is right, then this event was caused, in accordance with the laws of physics; and in that sense, it didn't happen by chance at all. But does chance operate at the physical level?

Chaos theory

Chaos theory is about how some complex systems, e.g. the weather, work. Given 'same cause, same effect', we might expect that if we get the cause wrong by just a little bit, then our predictions of the effect will just be slightly wrong. But this isn't always true. A very small difference in the initial causal conditions can lead to a very big difference in effect; a popular – if unproven! – example is that a butterfly flapping its wings in Europe may lead to a storm in China.

The theory has been *misunderstood* to say that different effects can be produced by causes so similar as to be 'the same' – for all we can tell. But while we may not be able to specify the cause precisely enough to predict the effect accurately, chaos theory is completely deterministic: different effects require different causes; the effect is still predictable in principle, though not in practice; and given the *precise* cause (or causal chain), the effect must follow.

Quantum mechanics

Quantum mechanics is a theory about what happens at the sub-atomic level of physics. Many people believe that it is a *probabilistic* theory – that it can only say what will happen, e.g. when a radioactive atom will 'decay', with a degree of probability. And probability is the degree of chance that something will happen.

However, we can argue that because the probabilities at the sub-atomic level are *fixed*, so at the level of our normal interactions with the world, events happen perfectly deterministically. Sub-atomic probabilities don't become chance at the macrophysical level.

However, one interpretation of quantum mechanics goes further than chance. It says that sub-atomic states are *not determinate*. A famous example (known as Heisenberg's Uncertainty Principle) is this: we cannot measure both the velocity and the position of an electron at one moment; if we measure how fast it is

moving, we cannot tell exactly where it is; if we measure where it is, we cannot tell just how fast it is moving. Some physicists argue that we may say that the electron *does not have* a determinate velocity and position - it acquires one or the other when we measure it.

It is worth noting, however, that some physicists disagree with this interpretation and argue that what happens sub-atomically is fully determinate and determined (Schrödinger's equation shows that sub-atomic states change in a perfectly regular manner). Some argue that the apparent indeterminacy is just to do with our ability to make measurements. Some argue that there are 'hidden variables', causes we don't know about, and these cause events deterministically.

But even if the indeterminacy interpretation is right, this *still* isn't incompatible with determinism in this sense: determinism claims only that a *determinate* set of conditions will produce only one possible outcome. If sub-atomic states are not determinate, then determinism doesn't apply to sub-atomic states. So the same sub-atomic state may cause or be followed by a number of different possible outcomes on different occasions without conflicting with determinism.

We can object that the indeterminacy interpretation does undermine determinism. If sub-atomic states are indeterminate, then everything physical is indeterminate, because everything physical is ultimately composed of sub-atomic states. So determinism is false.