I'm just going to end with a brief comment about what happened after the early modern period. Well, we saw Hume leaving us with a rather unsettling picture of human nature. Humans, part of the animal world, not nearly as clever as they thought they were, reliant on brute animal instinct to find out about the world, quite incapable of knowing about things by pure reason. Then along came Immanuel Kant, a very famous philosopher.

Kant, starting from the premise that Hume has to be wrong, why does Hume have to be wrong? Well, Kant thought that there are certain things that we do know about the world with absolute and complete certainty. Here are some of them: we know with certainty, according to Kant, that the world has to be governed by universal causation. We know, according to Kant, that the principles of Euclidian geometry are utterly and completely certain. For example, the square on the hypotenuse of a right angled triangle is equal to the sum of the squares of the other two sides. We can prove it. We can prove it by pure logic. That is a truth about the world that we know with absolute certainty. And what about Newtonian mechanics? For example, the law of conservation of momentum, that has such a natural, elegant simplicity to it. According to Kant, this again is a principle that we can know to be true a priori of the world. We can know simply by applying our pure reason that these things are all true of the world. It follows that Hume must be wrong, because if Hume is right, then it isn't possible to apply our pure reason to know things about the world. Kant developed a very elaborate theory to explain how it was that Hume could be wrong. According to Kant, our minds condition the way the world appears to us, and so we can know a priori how the world will appear. The phenomenal world, that is the world that we experience, must, for example, satisfy the axioms of Euclidean geometry because our minds themselves constitute it in such a way. Very interesting theory. Unfortunately, its premises are completely wrong. So let's look at what happened after Kant.

Darwin's "On the Origin of Species" in 1859 was as strong a confirmation as one could wish that we are indeed part of nature, not above it. Einstein's theory of general relativity in 1915: space, it seems, is gravitationally curved. Euclid's axioms probably aren't true of the actual world after all. At any rate, they're certainly not knowable a priori. Kant and all these others had assumed that geometry does give us pure insight into the way the world is. It seems that that is not the case. The logical deductions that we make from the axioms may be fine if the axioms are true of the world, but we've no way of knowing a priori that they are true of the world. And then we get quantum mechanics in 1925. Well, there it was, quite some long development undermining the idea that the world is law-governed in the way that Kant thought and severely undermining the idea that it is intelligible.

I'm just going to give you a brief illustration of this. So this is a computer model of the famous two-slit experiment. Here you have a light source at the bottom, and here you have a screen with two slits in it, very small slits. The light travels through these slits and then at the far end here we have a screen on which we see where the light has fallen and in what intensity. And what you can see here is that you get this interesting pattern. Why does that pattern occur? Well, it seems that light has a waveform. So if I do this, you can now see how you're getting an interference pattern. You've got waves going out from each of the slits, and where they meet, they interfere with each other, just like ripples on a pond. If you drop two stones into a pond and you get the ripples coming from each of them, wherever the ripples coincide, they're both high or they're both low, the combination of the two will be even higher or lower. But at other points, you'll get an upward ripple combining with a downward ripple, and the two will cancel out. So you get an interference pattern. Light, it seems, is constituted by waves. All well and good.

But if that pattern was a result of interference, then presumably what we can do is get rid of the interference by firing single particles of light, single photons, at the screen. So what I've done now, I've put a detector up the left slit and a detector at the right slit, and I'm going to fire individual photons at the screen. Let's do that. Oops, I want to show these on the screen. So here we are, I'm firing them. You can see that the photons are going randomly through the two detectors and then they're ending up randomly on the screen. Now, let's speed that up and see what happens.

What we now have is individual photons going to the screen. The ones that get through either go through the left slit or the right slit. Then they go on to hit the screen at the back, and you can see that the interference pattern has completely disappeared. Fine, all nice and straightforward. We understand pretty much what's going on, right? Let's try that again, except this time I'll take the detectors away. So now I'm firing individual photons at the screen, as you see. Let's do it repeatedly. How weird! What on earth is going on? If we fire the individual photons and have detectors at the slits to find out which way each photon went, the interference pattern disappears. If we then take the detectors away, we're still firing individual photons one at a time, but we no longer know which slit they're going through. Somehow, the photons still end up on the screen in an interference pattern. How can that possibly be? How can there being two slits rather than one make a difference to where the photon goes, if when you put a detector there, you only ever find the detector going through one slit rather than the other? It's seriously weird. Seriously, seriously weird.

Now, you can do the mathematics to find out what's going on. You can show that if you put a detector on either slit, the wave probability function changes. But that's not explaining why it happens. It's just saying this is the way it does happen. And I think quantum mechanics is a beautiful example of how Hume's approach to science has turned out to be right, rather than Kant's. It seemed when Newton came out with the beautiful mathematics of his "Principia," we were getting real insight into the way the world works and why it works that way. It all seemed to be so logical. And yet, as modern science has gone on, we found that trying to understand why it works as it does is a dead end. We have to make do with codifying how it works, not why it does it.

Okay, incidentally, if you want to find out more about the stuff I've been talking about in these first two and a half lectures, you might be interested to look at the introduction to my edition of Hume's "Inquiry," in which I give quite a lot more detail on all of this stuff. I don't know how that little subliminal bit got in.