Well, Isaac Newton can be seen as following both Descartes and therefore Galileo and Boyle. He looked at the results about the motion of the planets and tried to come up with a theory that would explain them. He was a brilliant mathematician and one of the inventors of calculus. Through very clever geometrical calculation and arguments involving calculus, he came to the conclusion that if you postulate a force of gravity acting between objects in inverse proportion to the square of the distance, that means if two bodies are two units apart, the gravitational force is a quarter of what it would be if they were one unit apart. If they're three units apart, the gravitational force between them is 1/9.

Now, suppose you have a force like that, where the closer things are, the more gravity there is between them. Suppose you postulate that the force of gravity is proportional to the mass of each body. So, the bigger an object, the more gravity there is on it. And suppose you postulate that the acceleration of a body, that is, the amount it deviates from the straight-line motion that it would otherwise take, deviates from that in a way that is proportional to the force and inversely proportional to the mass. So, the bigger the force, the more it accelerates. The bigger the body, for a given force, the less it accelerates. What do you get? And the answer is elliptical motion.

Now, that is a fantastic result. You have this problem that people have been trying to explain for centuries – the motion of the planets. You have Kepler coming along and giving predictions that are far more accurate than any previous attempt. And hot on its heels, you have an explanation of elliptical motion which is amazingly simple in terms of just one force and one law. Not only that, exactly the same theory with exactly the same equations could be used to explain the motion of cannonballs on Earth. If you drop a stone or throw a stone, the motion can be explained by exactly the same equations that you can use to explain the motion of the planets.

So again, just like Galileo, one of Galileo's big results was that the substance of the Moon looked very much like the substance of the Earth with mountains and valleys and craters and so forth. Now we find that exactly the same laws can be used to explain the motion of both. Newton also proved incidentally that a vortex could not generate elliptical motion. It's almost impossible to have a vortex that generates elliptical rather than circular motion. So Descartes' theory, which had never been that popular in Britain anyway, was discredited over these years. Incidentally, Descartes' theories lingered much, much longer in France than they did on this side of the channel. There was quite a lot of nationalism about these things.

Now let's reflect on this. We've got this wonderful scientific achievement. It's perhaps the most important scientific work ever published. You can sprinkle yet. But think of that in the context that we were looking at before. We have the background of the Aristotelian theory of motion which ascribed desires to physical objects, which saw them as analogous to human beings or animals desiring, striving to reach particular objectives. And that seemed objectionable, occult, weird, spooky. We want to get rid of that. We want to explain things in a very down-to-earth mechanistic way – one thing bashing into another. That seems much more comprehensible, much more subject to human understanding and analysis.

Okay, Descartes' theory of the orbiting planets fitted in with that. But Newton's doesn't. Newton is postulating this weird force between bodies. How can the earth be attracted to the Sun unless it knows where the Sun is? How can the moon be attracted to the earth unless it knows where the earth is? It seems very peculiar. So a lot of people objected to Newton's postulation of this gravitational force. They didn't like it because it didn't conform with the ideal of mechanistic understanding. Others, particularly followers of Newton, said no, no, it's a proof of God's existence. We know, don't we, that matter cannot think? It's the kind of power that matter can't have, cause matter by itself can't be attracted to another body either. No, it must be God's action. So it's a proof of God's existence that things move in the way they do.

Now Newton himself took an instrumentalist attitude. Very famous phrase – "hypotheses non fing go," I fain to know hypotheses. So Newton was asked, "What do you make of gravity?" Gravity? Well, he said slightly different things at slightly different times, but the most famous response of his was to say, "I'm not going to try to make up any explanation of how gravity works, why it does what it does. All I'm going to say is that the observations are consistent with it working as I described." So we've got these equations which explain how gravity works. Okay, it's proportional to the masses of the two objects, inversely proportional to the square of the distance between them. If you postulate a force like that, it explains the phenomena. I'm not going to go further. I'm not going to try to explain why. Maybe it's God's action. Maybe there's some sort of ethereal fluid that somehow brings it about. But if the behavior of things is explained by this theory, that's good enough.

Now, this is a, well, I've called it methodological instrumentalism. Instrumentalism is essentially the view that when you have a scientific theory, what matters is the results that it delivers. So let's suppose you have a scientific theory in terms of atoms. As long as it delivers the right results, you don't care about whether there really are any atoms. Maybe there aren't any atoms. Doesn't matter. If the theory delivers the right result, that's good enough. That's instrumentalism. You see a scientific theory as an instrument for delivering results. And Newton took something like that attitude to gravitation. And as we'll see, it was very influential.