§ 1. Historical Background


Some Dates: (322 BC) Death of Aristotle – (90 - 168 AD) Life of Ptolemy – (1543) Copernicus’ On The Revolutions published – (1596) Descartes Born – (1619) Descartes discovers the universal method of science in a stove heated room – (1632) Publication of Galileo’s Dialogue Concerning the Two Chief World Systems – (1633) Galileo condemned by the Inquisition for heresy and formally denies Copernicanism; Descartes decides not to publish his physics, since it teaches the motion of the Earth – (1637) Descartes publishes the Discourse on the Method, but still suppresses his physics – (1641) Descartes publishes Meditations on First Philosophy [i.e. on metaphysics] – (1644) Descartes publishes Principles of Philosophy, which contains his metaphysics and his physics of the entirety of nature in several volumes – (1650) Descartes dies in Sweden – (1687) Sir Isaac Newton publishes his Principles, which contain his famous three laws of motion and the inverse square law for universal gravitation.

Traditional “Aristotelian” Position = Mathematical models are useful hypotheses, i.e. useful fictions. Yet no matter how useful or beautiful or simple a model may be, it cannot be true if it conflicts with the results of “natural philosophy”. Since the job of the Astronomer is to invent the most useful hypothesis, they are not concerned with truth at all. From Ossiander’s Preface to Copernicus’ On the Revolutions of the Heavenly Spheres (1543): “For it is the job of the astronomer to use painstaking and skilled observation in gathering together the history of the celestial movements, and then – since he cannot by any line of reasoning reach the true causes of these movements – to think up or construct whatever causes or hypotheses he pleases such that, by the assumption of these causes, those same movements can be calculated from the principles of geometry for the past and for the future too.” Again: “For it is sufficiently clear that this art [i.e. astronomy] is absolutely and profoundly ignorant of the causes of the apparent irregular movements. And if it constructs and thinks up causes – and it has certainly thought up a good many – nevertheless it does not think them up in order to persuade anyone of their truth but only in order that they may provide a correct basis for calculation.”

Position of Pope Urban VIII = God is infinite and beyond our comprehension, thus no supposed explanation can be certain in the least. That is, since God is so great, we must admit that he could do anything in any way, and surely in ways that surpass our comprehension. “It would be excessively bold if someone should want to limit and compel divine power and wisdom to a particular fancy of his [i.e., if the physicist should insist that he/she can demonstrate anything true of nature]” (Galileo, Dialogue Concerning the Two Chief World Systems, 270).

Galileo, Descartes, et al. = While we cannot know all things, as God does, we can know individual things with as much certainty as God. These are the things we conceive using mathematical arguments. This latter is because God created the world in accordance with mathematics: “Philosophy is written in this all-
encompassing book that is constantly open before our eyes, that is the universe; but it cannot be understood unless one first learns to understand the language and knows the characters in which it is written. It is written in mathematical language, and its characters are triangles, circles and other geometrical figures; without these it is humanly impossible to understand a word of it, and one wanders around pointlessly in a dark labyrinth” (The Assayer, 1623).

§.2. Descartes and the Origins of the Discourse on the Method (published anonymously, 1637)

In the Discourse and later in the Meditations, Descartes attempts to secretly build a foundation for the method employed by Galileo and others. The first two parts of the Discourse, explain how Descartes arrived at the idea of a universal method for reaching certain knowledge in science.

1) He first discovered no certainty in knowledge gained from books, custom or even his own experience, and thus resolved to accept nothing as truth that was not certainly true.

“Thus I gradually freed myself from many errors which may obscure our natural light and make us less capable of heeding reason.” (10)

“But regarding the opinions to which I had hitherto given credence, I thought that I could not do better than undertake to get rid of them, all at one go, in order to replace them afterwards with better ones, or with the same ones once I had squared them with the standards of reason.” (14-15)

2) He then reflected on how science could best be constructed, and found common knowledge to be defective mainly in its lack of a single secure method. It was an accumulation of materials from different sources, when it should be one well-structured whole.

3) He looked to logic and mathematics for help in discovering a universal method, because they were most reliable, but found even these too defective.

4) Finally he resolved on four rules: Accept nothing that is not certain, break all problems down into their simple parts, understand all complex matters on the basis of their parts, and practice running through his reasoning several times so he could see all the parts of his argument combined into a whole.

5) Finally, at the end of the Part Two, Descartes reveals that this method requires a foundation, and so a move to Metaphysics or First Philosophy:

“But observing that the principles of these sciences must all be derived from philosophy, in which I had not yet discovered any certain ones, I thought that first of all I had to try to establish some certain principles in philosophy. And since this is the most important task of all, and the one in which precipitate conclusions and preconceptions are most to be feared, I thought that I ought not to try accomplish it until I had reached a more mature age than twenty-three...” 21-22

§.3. Descartes’ Metaphysical Strategy for Founding Modern Science (Discourse, Part Four – Meditations)

Step 1. Deny every truth that can be doubted at all. (Methodological Doubt)

Step 2. Discovery of the fundamental truth, “I think, therefore I exist” [Aside: Discovery at the same time of the true nature or essence of the self: thinking.]
Step 3. Examine this fundamental undeniable truth to discover what makes it impossible to deny. This is found in its being absolutely “clear and distinct.”

Step 4. Prove from within myself that God exists. Proof One: I am aware of myself as imperfect or as limited. But to think myself as limited, I must have the idea of something unlimited. I cannot be the source of this idea, and indeed no being less than God could be the source of it. Therefore, God exists. Proof Two: The idea of God is the idea of a being with all perfections. Existence is a perfection. Therefore, God exists.

Step 5. Prove God is not a deceiver. Proof: Deception is only suitable to a being with limited power. God is of unlimited power. Thus God cannot deceive. God is therefore truthful.

Step 6. If God is truthful, then since he is the author of my being, everything that I clearly and distinctly represent to my mind will necessarily be true. Put differently: If God is good and truthful, then he certainly will not make it that I am deceived when I use the best and indeed the only guide to truth that I find within myself.

4-5-6: “However much the best minds study this question, I do not believe they will be able to give any reason sufficient to remove this doubt unless they presuppose the existence of God. For in the first place, what I took now as a rule, namely that everything we conceive clearly and distinctly is true, is assured only for the reasons that God is or exists, that he is a perfect being, and that everything in us comes from him. It follows that our ideas or notions, being real things coming from God, cannot be anything but true, in every respect in which they are clear and distinct.” (38)

Step 7. The Clincher for Mathematical Physics: The most clear and distinct representations, and indeed the only clear and distinct representations, that I have of external physical things, are those treated in geometry. Therefore, external physical things in reality have nothing other than geometrical characteristics: “The essence of bodies is extension.” Thus colors, heat, cohesion and even weight, must be reducible to geometrical properties.

Major Conclusions for Science:

1) Genuine knowledge is only possible through mathematics, and indeed, through the construction of mathematical models, the entire truth of the physical world can be known.
2) The Aristotelian natural philosophy, which does not employ a mathematical method, is necessarily false.
3) Every physical body, including therefore also the human body, is entirely nothing but a machine, i.e. the operations of the whole depend upon and are a necessary consequence of the character of the parts from which it is constructed in exactly the same way as a geometrical description of a body is composed of the geometrical descriptions of the parts. Universal physical mechanism!

General Major Conclusions for Philosophy:

1) To the extent that the body is determined by its mechanism, it acts independently of the soul.
2) Since clarity and distinctness can only be “seen” in one’s own mind, the only path to truth is by reliance on one’s own judgment. No need to listen to the Aristotelians or accept the authority of Aristotle!
3) What we know and can prove using clear and distinct ideas (mathematics!) can happen in no other way than this. Pope Urban VIII is therefore wrong. We can demonstrate natural truths.