***Modern Science, Metaphysics, and Mathematics* by Martin Heidegger**

*Modern Science, Metaphysics, and Mathematics* is excerpted from a 1936 lecture course Heidegger gave originally entitled, “Basic Questions of Metaphysics" and eventually published as *What is a Thing?*

The central point of this passage is that modern science and philosophy pre-determine what things are and how they are to be encountered in the world because they are built on fundamental principles (axioms) which emerge from a *mathematical project* that is metaphysical in nature and actually bypasses the things in themselves, reversing how things were seen in earlier ages.

The Mathematical

Heidegger begins by pointing out that the difference between Ancient/Middle Age ‘science’ and modern science isn’t one between concepts and facts, or the fact that modern science uses experimentation and calculates and measures (the Ancients also experimented and calculated). The difference lies in a more fundamental conception which underlies how modern science approaches and understands things and thereby conditions its conclusions, namely, the way modern science is *mathematical*.

The original Greek word here, *ta mathemata*, has nothing to do with numbers or calculating. Instead it means what can be learned and therefore also what can be taught. So what is learning? Far from just ‘picking something up’, learning only happens when the student “experiences what he takes as something he himself really already has.” It is therefore a *self-giving*. Teaching is therefore letting others learn.

What is the *mathemata*, or the mathematical, about then? It must be about things we really already know. Heidegger gives the example of “three.” In seeing three chairs we note that they are three in number. But we didn’t ‘learn’ about the number three from the chairs. We brought that concept with us and applied it. In applying what we already knew, we *learned* something.

So, the mathematical is not a subject as such, rather, it is “the fundamental presupposition of the knowledge of things.”

The Mathematical and Modern Science

After analysing Aristotle’s, Descartes’ and Galileo’s understandings of motion, Heidegger outlines in more detail what is mathematical in modern science. Essentially, it is mathematical in that it opens up a domain where things (actually ‘facts’) show themselves and in doing so, assembles certain *axioms* (fundamental propositions) which determine, in advance, the essence of things and how they relate to each other. The establishment of this domain also prefigures how things show themselves (i.e. in a relation of time and place and in the measure of mass and force). Because it is to be a uniform project, modern science also requires a universal, uniform measure, i.e. numerical measurement. So, modern science isn’t mathematical because it relies on numerical measurement, rather, it relies on numerical measurement as a “*consequence* of the mathematical project.”

It will not have escaped your notice that the mathematical project precisely “skips over the things” themselves, so rather than *letting* them be, it *tells* them how to be.

 Metaphysics and the Mathematical

The mathematical project didn’t just reform science (physics) but, through Descartes, also metaphysics and this means all of modern philosophy.

Descartes is usually seen as forging a sceptical path, the end of which led to the “I”, human subjectivity, as the centre of thought. This entails that doubting stands at the beginning of philosophy and the idea that a theory of knowledge (epistemology) needs to be erected before a theory of the world can be outlined. Heidegger rejects this interpretation.

Rather than epistemology, Descartes was taking up anew “the question about the Being of beings, the thingness of the thing, “substance.”” But because he was doing so in an era when the mathematical was in ascendance, his project also took this direction. Because Descartes’ reflections concerned the “totality of beings and the knowledge of it, it had to become a reflection on metaphysics.”

If mathematics is to be universal it must be built on axioms and these must be absolutely self-sufficient (relying on no others) and absolutely certain. They must also “establish in advance, concerning the whole of beings, what is in being and what Being means, from where and how the thingness of things is determined.”

So, a mathematical project must specify its domain but it cannot do this arbitrarily nor can it rely on outside principles, or it would no longer be absolutely certain and self-contained. Every philosophy student knows how Descartes accomplished this feat. He formed, not just a fundamental law for the realm of nature but “the very first and highest basic principle for the Being of beings in general”, namely, *cogito, sum*. In this ““I posit” the “I” as the positer is co- and pre-posited as that which is already present, as the being. The Being of beings is determined out of the “I am” as the certainty of the positing.”

The upshot of this is that Descartes didn’t come to the certainty of the “I” from a logical argument or sceptical process, but by embracing the mathematical project.

The Reversal

Descartes’ “I” is not subjective “in the sense of an incidental quality of just this particular human being”; rather, it is a “special *subjectum*” understood in terms of its mode of Being, i.e. mathematical. This resulted in a reversal of the meaning of the words, subject and object. Prior to Descartes, all things at hand were subjects, but after him, they are now objects for “I”, the special subject. In addition, these things in the world can only receive their thingness, their Being, through this “I”. Again, prior to Descartes, an object was what one imagined for oneself in fantasy. Now, such a thing is termed ‘subjective’ precisely because it doesn’t exist ‘objectively’.

This reversal is not just a linguistic curiosity. It is “a radical change of Dasein, that is to say, of the clearing of the Being of beings on the basis of the predominance of the *mathematical*.”