Lecture 4 - Philosophy and the New Science

Outline

1. Science and (natural) philosophy
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1. Science and (natural) philosophy

- We tend to make a sharp distinction between science and philosophy. But to understand the historical situation, we must know that this is a relatively new phenomenon. Until the 19th century, what we call science was called 'natural philosophy': it was the systematic investigation of nature, just like, say, moral philosophy was the systematic investigation of ethics and human behaviour.
- It should not surprise us, therefore, to find people in history contributing both the what we think of as science and to what we think of as philosophy. This was clearly true in Antiquity, just think of Aristotle, but it remained true in the 17th century and to a diminishing extent in the 18th century. Descartes, Pascal, Leibniz, Newton – these are just a few examples of 17th century names that play a very big role in both the history of science and that of philosophy.
- But something more essential is at stake here: philosophy and science cannot be disentangled. It is simply not true that someone like Descartes did a bit of philosophy on Monday and then some physics on Tuesday, and that there is no real connection between them. On the contrary: the rise of modern science and the rise of modern philosophy cannot possibly be understood apart from each other. Modern philosophy arises out of modern science, and modern science arises out of modern philosophy. And so we must understand this interplay.
- Of course, to understand the new, we must understand the old. So I will first focus on some crucial elements of the Aristotelian worldview, which dominated the more respectable scientific circles; and then on some elements of Renaissance Neoplatonism, which was also very important in the 16th and early 17th century.

2. Aristotelian natural philosophy

- The central terms: substance and accident; matter and form; potentiality and act.
- It is especially important to understand that *form* is not the same as *shape*: the shape of the statue is part of its form, to be sure, but so is its being cold and its being made of marble.
- It is also important to see that potentialities are inherent in form: being an acorn, that is, being matter having the form of an acorn, *is* in part having the potentiality to grow into an oak.
- We can make a distinction between substantial form and accidental form, where the former encompasses those accidents that a substance cannot lose without ceasing to be the substance it is. Being rational and being alive are part of my substantial form; having two arms and teaching this course are parts of my accidental form.

- The central phenomenon studied by science – and here we see a rejection of the Eleatics and Plato – is *motion*. But let us not misinterpret this. Motion is not to be understood as change of place; or rather, change of place is merely one species of motion. Motion in general is the change from potentiality to actuality. The growing of the oak from the acorn is motion, and so is the dying of the tree, or the heating of a stone that lies in the sun.
- Clearly, we can make an important distinction between *natural motion*, which proceeds from the form of the substance, and *forced motion*, which does not. The acorn growing into a tree is an example of natural motion; the acorn turning into horse dung is an example of forced motion. A stone falling down is natural motion, a stone being thrown is forced motion. There is a clear sense in which natural motion is more relevant to the investigation of nature.
- Understanding the world involves finding the causes of motions. Aristotle distinguished between four types of cause, but one especially interests us here – I'll leave a full treatment to whoever teaches the course on Ancient Greek philosophy! – namely the *final cause*. This is the goal or aim towards which something tends by virtue of its form. Why does an acorn grow into an oak, and not into a pear tree or a horse? Because the acorn tends towards the goal of oakhood. One could say that final causes are the active, animating principles in nature – they are what keeps nature going.
- There is in Aristotle, and even more strongly in the neo-Aristotelian tradition, an idea that the universe itself is a constant striving towards a goal. Aristotle has some rather cryptic remarks about the heavens being animated by love for the unmoved mover; in the later tradition, the idea is that everything is animated by a love for God and strives to become as much like God as possible.
- Finally, we should note an important feature of Aristotle's account of perception, which is after all the basis of all our natural philosophy. When we perceive something, our soul in some sense takes on the form of what it is that we perceive: the form of blue, of heat, and so on. There are problems with this that need not concern us. What is important to our story is that we perceive what the object is like.

3. Renaissance Neoplatonism

- There is a mulitform tradition that become especially influential in the 16th century which is not entirely opposed to the Aristotelian tradition, but also not entirely aligned with it, aspects of which can be caught in such terms as Neoplatonism, Pythagoreanism, occultism, natural magic, animism, and Hermeticism. I can't go into it in too much detail, though if you're interested, especially in the more mystical side of the tradition, you might like the classic *Giordano Bruno and the Hermetic Tradition* by Frances Yates, the novel *The Island of the Day Before* by Umberto Eco, or the four-book fantasy novel *Aegypt* by John Crowley. But I will say some things about it that are useful for our purposes.
- The Aristotelian tradition is not very mathematical. But there was an ancient tradition, starting in Pythagoras and taken up by Plato – especially in his 'unwritten philosophy' – that thought of the world as mathematical; and this involved what we would think of as number mysticism. This tradition lived on in the 16th and early 17th century, especially among astronomers. We find Galilei telling us that the book of nature is written in the language of mathematics, and basing his scientific method on the assumption that there is a perfect mathematical pattern underlying the messy phenomena. (We also find Kepler deducing the number of planets from the number of Platonic solids!)
- This mathematical side of Neoplatonism will continue to play an important role later on; but to do so, it will have to lose its association with the other side – the mystical, animistic view of nature that believes that everything around us is endowed with souls, with intelligence, with occult powers that escape the senses but that we can perhaps intuit.

- For instance, William Gilbert writes a celebrated book on magnetism, published in 1600. It collects many very good observations of magnetism; and then proceeds to explain the phenomenon in terms of an occult power, a universal sympathy and antipathy, that works through voluntary agreement and union. That magnets point to the north indicates the underlying intelligence that orders the universe; the compass is the finger of God, and iron deprived of its innate magnetic power wanders lost and directionless. The Earth rotates because the Earth's soul perceives the sun's magnetic field, and chooses to revolve in order not to burn on one side.
- This is a universe that is saturated with life, as well as with *meaningful connections*. A great example of the latter is the popular theory that the fatal stab wound in a dead man will bleed again if the weapon that inflicted it is brought close; and that a non-fatal wound can be cured by applying a salve to the weapon.

4. The mechanical world

- Nothing, one is tempted to say, could be less like this animated and meaningful world than the mechanical world picture developed by the early modern philosophers, with Descartes as the central figure.
- We have seen that Descartes makes a strict distinction between matter and mind. This is not at all the Aristotelian distinction between matter and form; rather, it is a distinction between two kinds of substance, one of which is unique to humans beings and hence of little concern to the natural sciences. Clearly, the material world for Descartes is *not* to be understood in terms of souls and sympathies. Nothing could be less Cartesian than the idea that the north and south pole of the magnet freely turn towards each other because of a mutual love.
- By itself, this is not yet a decisive break with the *Aristotelian* project. For although Aristotle believes that all material objects have, in a sense, 'goals', we do not at all have to understand this in terms of conscious states. An Aristotelian might well agree with Descartes that the acorn does not literally desire to become an oak.
- A decisive break with the Aristotelian project, however, is made once we consider what Descartes tells us about the nature of matter. It is *res extensa*, extended substance; this is in fact its *entire* essence, its *entire* nature. All that can be predicated of matter are extension and modes of extension (such as shape and size). Once we now the size and shape of a body, *we know all there is to know*. This means that the entire Aristotelian idea of form is being abandoned. There is no such thing as the form of oak or acorn; there is only acorn-shape-and-size, oak-shape-and-size.
- Clearly, the idea of potentiality is also destroyed, as well as the idea of a final cause, a goal that an object is moving towards because of its nature. There are no goals in nature, there is nothing that animates the universe. Matter is totally inert; it has *no* inner principle of change.
- Necessarily, the idea of motion is utterly transformed as well. The only form of change that is intelligible in Cartesian physics, is change of place. Matter can move. It will persist in its movement until something forces it to change its movement. But this forcing is no more goal-directed than anything else: it is just a matter of different pieces of matter bumping into each other, and it is – at least for Descartes – to be understood solely on the principle that two pieces of matter cannot exist in the same place. Everything that happen is purely *mechanical*.
- Clearly, there can be no difference between natural and forced movement. Movement is movement; it is all subject to the same simple mechanical laws of motion. It is not more natural for an acorn to grow into an oak tree than for it to do anything else. If we make a difference between natural and forced movement, this can only be an illegitimate application of subject ideas to the objective world.

- If there is only extension, then we must also say that matter is not really blue, or sweet. The Aristotelian theory of perception, according to which we perceive qualities that are in the objects themselves, must be rejected. Locke, following Descartes, introduces the distinction between primary qualities and secondary qualities: only the primary qualities are truly qualities of matter itself; the secondary qualities are how matter affects us, and must be explained in terms of primary qualities (and the relation between matter and mind).
- For Aristotle, the universe was Matter + Form. For 17th century science, it becomes Matter + Motion. What we should realise is how *impoverished* this metaphysical picture is, how *sparse*. Goals are gone; mind is gone; meaning is gone; intrinsic principles of action are gone; colours are gone; tastes are gone… all there is, is moving extension. There are big debates in 17th century science about whether we should allow terms like force, or action at a distance. Even if we end up with a universe slightly less sparse than that of Descartes, it is still a far cry from Aristotle and the two thousand intervening years.
- Descartes and mechanical models. Newton and the combination of mathematics and mechanics.

5. The new science and the new philosophy

- Clearly, the new science was going to be very very different from the old science; and the development of this new science was, at the same time, the development of a new metaphysics and a new epistemology.
- But the new science also created big problems for philosophy, many of them among the most important and most characteristic problems of modern philosophy. What, for instance, is the relation between mind and matter? How can there be causal interaction between them, if they are utterly different? How can the material world be grasped in thought? What is the relation between our will and the movements of our bodies; for that matter, between us and our bodies? How can there be freedom in this mechanical universe? Are animals any different from machines?
- Once God disappears from the philosophical systems, new questions will be added to this, questions that very much still plague us today. Is there a place for values in the universe? Is there a place for meaning in the universe?
- None of these questions would have made much sense to an Aristotelian or a Platonist! The trajectory of modern philosophy is determined to a large extent by the rise of modern science.