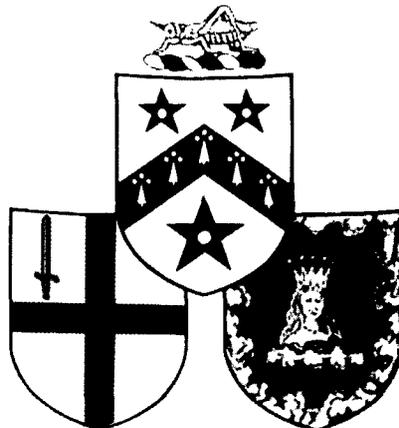


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**MIND, MORALS AND THE ORIGIN OF OUR
IDEAS**

Lecture 3

**SOME GREAT PHILOSOPHERS WAITING TO BE
REDISCOVERED**

by

PROFESSOR RICHARD SORABJI CBE FBA
Gresham Professor of Rhetoric

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Some Great Philosophers Waiting to be Rediscovered

Professor Richard Sorabji

I have some regrets about today's subject, because all the philosophers whom I have chosen owe some of their claim to greatness to the fact that they expose what is wrong with Aristotle. This means that I shall have to start by explaining some of Aristotle's mistaken views. I am sorry about this because Aristotle is himself one of the truly great philosophers. I admire him because, for example, in my view, he answered the argument that whatever you do tomorrow has been fixed in advance, because whatever happens has earlier causes, and those causes have earlier causes, until we get back to the past. And it is too late to undo the past. Not only do I believe that Aristotle answered this argument which still defeats people today, but also, we shall see, Aristotle was the first to understand many of the features of *infinity*. We shall also see that he made some of the most fundamental distinctions in biology. But there is no doubt that in certain other ways his view of the universe was wrong, and I shall for today concentrate more on his wrong views than his right ones.

Theophrastus

The first of the four or more philosophers of whom I shall speak is Aristotle's pupil, friend and successor, Theophrastus. Theophrastus lived like Aristotle, in the fourth century BC, and being an Athenian citizen, he was able to own property and to give some of his property to Aristotle's school. Aristotle as a foreigner could not own property. Theophrastus is best known for his thirty character sketches which cover idle chatter, obsequiousness, garrulity, sponging, penny-pinching, bad timing, grouchiness and many other traits. These *Characters* are a literary genre and are most widely studied in literary circles. As regards his philosophy, critics both ancient and modern said that he merely copied Aristotle. This is far from being true.

Let me explain first how his teacher, Aristotle, thought of the physical universe. Like most Greeks, Aristotle believed that the earth was at the centre of the universe and that the sun, moon, and stars revolved around it. There were other views, for example the view that the universe was infinitely large and randomly filled with matter. But only one thinker, Aristarchus of Samos, proposed that the earth revolved around the sun. Aristotle thought of the physical universe as consisting of concentric spheres of five different elements, with earth at the centre. Earth, he thought, was surrounded by the sphere of water with the oceans, and that sphere in turn surrounded by air, and the air surrounded by a sphere of transparent fire. Outside that he postulated spheres made of a fifth element which carried the sun, moon, stars and planets around us. Imagine the importance that we would attach to the heavens or to their mover, if we thought that they could revolve around us in one day across such vast distances in such perfect order. Imagine too the importance we would feel we humans possessed if we were at the centre point of this spectacle.

There was one other Greek thinker, the Platonist Heracleides, who postulated, not that the earth revolved around the sun, but that the earth spun on its own axis. When Copernicus in the sixteenth century argued instead for the hypothesis of the earth rotating on its axis and orbiting around the sun, he referred to both Aristotle and Heracleides. Even Copernicus did not dismantle the whole of Aristotle's system. He kept Aristotle's concentric spheres and had those carrying earth, moon and planets all orbit around the sun, with the outermost sphere, which carried the non-planetary stars, at rest.

Aristotle thought that the spheres which carried the sun, moon, stars and planets were alive and were moved by their admiration for the philosopher-god which Aristotle postulated. They moved in circles because that was the only activity of which the fifth element was capable.

Nearer to the centre, things do not circle, according to Aristotle, but move in straight lines up or down. Rocks move down, fire moves up. These move towards their natural place, earth down or (equivalently) at the centre, fire upwards in the direction towards the moon.

The entire universe is finite for Aristotle. There is neither matter, nor vacuum outside the sphere which carries the non-planetary stars. The objection was raised: 'if a person were at the edge, could he stick his hand out, or not? If he could, there is empty space beyond the supposed boundary. If he cannot, there is an obstacle beyond'. The Aristotelian, Alexander, who lived five hundred years after Aristotle, replied on Aristotle's behalf. Since there are no surroundings outside the heavens, there is, on Aristotle's definition of place as surroundings, also no place, neither empty nor full. So the whole idea of stretching your hand out makes no sense.

Aristotle had a curious view about place and space, a view which very few other Greeks accepted. Unlike almost all his successors, he denied that there was such a thing as three-dimensional space. He saw that as redundant, given that we already had three-dimensional bodies and their three-dimensional volumes. All we need, in his view, is the idea of a thing's place as its surroundings. Since there is no three-dimensional space, there is also no vacuum, because a vacuum would have to be an empty three-dimensional space.

Aristotle made two further requirements. A thing's place must be immobile. We can see why he required this. Suppose one thought of the air surrounding each of us as being each person's place. Then if a breeze passes through the room we will have changed our surroundings, and so changed our place. But that is absurd. So Aristotle feels obliged to require that our place should be thought of as our immobile surroundings. Surroundings can be judged immobile, if they maintain a fixed distance from the heavens. But Aristotle has a second requirement, because he is thinking not only of our position, but also of the exact place into which we fit. And so he further requires that our place should hug us tight and be in direct contact with us. These two requirements are in potential conflict because the surroundings which hug us tight may fail to be immobile and conversely our immobile surroundings may fail to hug us tight.

Theophrastus' claim to notice is that he began to probe some of the difficulties in Aristotle's account of the physical universe. He raised many queries about Aristotle's account of place. He saw that our place or surroundings will often be in motion. He saw that, if there is a breeze, we will no longer retain our place. He saw too that since, in Aristotle's system, the heavens have no further surroundings, they too will have no place.

Theophrastus asked a further question: Why does the Aristotelian system need God? Since the spheres which carry the sun, moon, stars and planets are alive, their souls can be the ultimate movers. Why do we need a God for them to admire before they can be inspired to motion?

Theophrastus also asks: Why should place not be an order or arrangement (*taxis*) instead of a being in its own right, rather like the order or arrangement that is found in plants and animals? Some people think that with his reference to place as order or arrangement, Theophrastus is anticipating Leibniz's view of space as a certain type of relationship between bodies. But an alternative is that Theophrastus is thinking about Aristotle's idea of *natural* place and suggesting that rocks may fall and flames rise not because they are drawn to a place considered as a thing in its own right, but because they are inclined to adopt an appropriate spatial relation to each other just as the parts of plants and animals do in nature. In either case, Theophrastus emerges as a free thinker. And indeed the Aristotelian school was the school which above all encouraged free thought and allowed the founder's ideas to be questioned at every point. Theophrastus' contemporary, the founder of Stoicism, around 300 BC, comments that Theophrastus had the larger classes but he, the Stoic, had the greatest consensus.

Last I will mention Aristotle's great achievement of defining the difference between life and non-life, and again the difference between plants, animals and humans. Aristotle distinguishes these by reference to certain capacities. The basic capacity which distinguishes life from non-life is the ability to use food to grow, and to grow not haphazardly like fire, but while maintaining a distinctive structure, and passing it on in reproduction. Plants have only this most basic capacity. But animals also have sense perception. And with sense perception there always goes the capacity for desire. Humans have in addition the capacity to think and reason. Animals do not need to think, provided that their perceptions are allowed to have a sufficiently rich content. And Aristotle does allow that the lion can perceive that the ox is near and rejoice that he will have a meal. Aristotle was a biologist who discusses more than five hundred species. He is well aware how difficult it is

to distinguish the lowest forms of animal life from plants and how difficult it is to distinguish humans from animals. Nonetheless, although he allows animals to share our emotional temperaments he does not allow them, I believe, to share our intellectual capacities. Indeed the whole of Aristotle's ethics would founder if he allowed reason to animals, because he defines the distinctively human kind of happiness on the basis of the assumption that humans alone have reason.

It is all the more striking therefore to find that his friend and successor as head of the school, Theophrastus, does allow reasoning (*logismoi*) to animals after all. Some earlier thinkers had urged that animals are *akin* to us. But when the Pythagoreans said this, they meant that, because we may be reincarnated as animals, we may be *literally* akin to them. Theophrastus like Aristotle rejected all belief in reincarnation or life after death, and he therefore looked for kinship in another direction. We are akin, according to Theophrastus, because of all the things we have in common and the highest of these is *reasoning*.

Posidonius

Theophrastus lived in the late fourth century BC. Posidonius lived from 135 to 51 BC. He came from Apamea, the city where many centuries later the philosophical mosaics were installed which I described in an earlier lecture. He studied in Athens and then set up his own school in Rhodes. His lectures were heard both by Pompey and Cicero. At one time, scholars exaggerated his importance by ascribing to him all sorts of doctrines that were probably not his. But the value of the doctrines which we can safely ascribe to him has not so fully been recognised.

We saw in an earlier lecture that Posidonius produced five brilliant arguments against the view of his fellow Stoics that emotions are nothing but judgements to the effect that there is benefit, or harm in the offing. He insisted that humans are not so intellectual. As Plato had said, in addition to intellect or reason, humans have irrational desires for domination or pleasure. If this is not understood, we will not know how to educate children. They need not just their intellect to be trained, but also their emotional capacities. Plato had been quite right to say that the training of these must begin in the womb, and Posidonius has a lot to say about the effect of music on our irrational capacities. Posidonius claims also to be able to explain what could not be explained by his intellectualistic fellow Stoics. Why is it that even *philosophers* do not always have good children? The answer is that intellect alone is not enough for good character. The emotional capacities of the child also need to be trained. Posidonius made emotion central not only to education, but to the whole of ethics. In this already, I think he was important.

But there is more, for Posidonius was also a scientist. He was the first to recognise the effect of the moon on the tides and he was also an anthropologist. To illustrate his scientific interest, I will mention his response to Aristotle on the notions of time, place and vacuum.

Aristotle had propounded a paradox. How can time exist since none of its parts exist? The past no longer exists and the future does not yet exist. But what, you may ask, about the present? Surely the present exists? The answer is that the present does exist but how long is the present? If it has any length at all, it will overlap with past or future. It turns out that present is only a size-less point of division between past and future, and a size-less point is not a *part* of time. For many centuries philosophers tried to answer Aristotle's paradox. Posidonius accepts that, in the strict sense, the present is only a size-less point. But he urges that nonetheless there is a 'least perceptible time' and the least perceptible time has a positive length and so can be a *part* of time. We can therefore speak of a present which has a least perceptible length. I think this does not solve the paradox, because the truth remains that the real present has no size at all. But at least Posidonius has made an interesting attempt at solution.

He is brilliantly successful, by contrast, in answering Aristotle's argument designed to show that there is no space or place beyond the furthest star. The reply to Aristotle comes from another man, Cleomedes, two centuries after Posidonius, but Cleomedes says that he draws almost all his arguments from Posidonius. Aristotle had said that there cannot be place or space outside the heavens beyond the furthest star, because what we mean by place or space is that which can receive matter. Now on Aristotle's view the matter in the region of the stars is the fifth element, which cannot fly out at a tangent, but is capable only of moving in circles. Consequently, no matter can fly out beyond the furthest star in order to be

received. But if matter cannot be received beyond the furthest star, Aristotle concludes, then there cannot be beyond the furthest star place or space, since that is defined as what can receive matter. Posidonius' reply, found in Cleomedes' treatise, is that you might as well say that there cannot be an empty water vessel in an impenetrable desert. For what do we mean by an impenetrable desert? We mean a desert which water *cannot* enter. And what do we mean by a water vessel? We mean a vessel which water *can* enter. On Aristotle's reasoning, there cannot then be a water vessel in an impenetrable desert. But that is absurd. Posidonius' reply seems to me decisive and very clever. On the other hand, I do not regard Aristotle's argument as silly. It is difficult to see that the incapacity of physical matter to be received beyond the furthest star does not imply a corresponding *incapacity* of anything so to receive it. It implies only that nothing will have the *opportunity* so to receive it. But given two correlative possibilities it is often difficult to decide when the absence of one implies the absence of the other. If evolution removed all eyes from the universe, so that there were no beings left which could see, would logs still be visible? If evolution made everything permanently immune to cobra bite would cobras still be lethal?

Posidonius also argues against Aristotle in favour of there being vacuum beyond the furthest star. The Stoics believed that periodically the universe would be burnt up in a conflagration and would then have to expand. Posidonius argues that there must be vacuum outside in order to allow for the expansion. Posidonius did not insist that the vacuum would be infinite, but Cleomedes developed his point. Even if the expansion did not really happen. The mere fact that we can conceive it shows that we need to allow for the existence of vacuum.

Other late Stoics: Panaetius, Seneca, Epictetus

Panaetius was the teacher of Posidonius in Athens. Panaetius is probably the one who introduced ideas very much in contrast with Kant in modern times. When we are deciding how it is right to act, we should take a very thick concept of who we are. We should consider all of our personae. The first persona is the only one that Kant considers, our persona as a rational being. But we also need to consider the particular history of our lives. This brings it about that it was right for Cato to commit suicide, when Julius Caesar won the civil war, whereas suicide in the same circumstances would not have been right for anybody else. I discussed in an earlier week the contrast with Kant's principle that what it is right for me to do now would need to be right for anybody else in the same circumstances.

Two other Stoics both of the first century AD, Seneca and Epictetus, have had enormous influence on European thought, but are now waiting to be rediscovered. Seneca is often innovating in his presentation of Stoicism and we saw a striking example in his idea of initial shocks in emotion which he called "first movements". For the purpose of calming emotion, he thought it very important to distinguish these involuntary shocks from the real emotion itself, since the emotion, unlike the shocks, could be calmed by taking thought in the right way. This idea of shock or first movements proved very influential for the Christian treatment of initial temptation.

Epictetus, we saw in an earlier week, developed the concept of an inviolable self. If you identify your self with your will, completely excluding your body, no one can violate you. Epictetus' *Handbook* was used both in Christian monasteries and in the pagan Neoplatonist school of the sixth century AD. His precepts were followed in Vietnamese prison camp under physical torture by an American war hero Admiral Stockdale.

It is time that these giants of late Stoicism returned to the standard curriculum and were more widely known.

Porphyrus

Over two hundred years after these Stoics, Porphyry, a Neoplatonist, joined Plotinus, whom we regard as the founder of Neoplatonism, in his seminar in Rome in the third century AD. He became Plotinus' biographer and the editor of his works, and Plotinus personally deterred him, in a period of depression, from committing suicide. Porphyry had a very questioning mind. He describes how he started by writing two essays questioning Plotinus' view that the higher realities of the universe are to be found within ourselves. Plotinus made him write three essays and face criticism from fellow students. In the third essay, he was finally convinced of Plotinus' view

Porphyry also defended Aristotle's theory of categories from Plotinus' attack. Aristotle had divided the things in the universe into ten categories. There were substances, and then there were their qualities and quantities and there were relatives and so on up for up to ten categories. Plotinus rejected this basic scheme of Aristotle's largely because he thought it was inapplicable to the highest realities, the ideal Forms of Plato. He retained only four of Aristotle's categories in a very modified form for describing the physical world. Porphyry replied that Aristotle's treatise, the *Categories*, was written for beginners and so was about words which are applied primarily to things in the *physical* world. Aristotle, Porphyry said, was not necessarily in disagreement about all of the higher realities, but was simply not discussing them in his introductory treatise. Porphyry wrote an *Introduction* to Aristotle and also wrote commentaries representing his own lectures on Aristotle's works including the categories. He thus established Aristotle on the philosophical curriculum of the West once and for all.

Porphyry questioned not only his own teacher but also the Christians. He wrote the most formidable critique in antiquity of Christianity known as *Against the Christians*. The work was burnt by successive emperors in 325 and 448 AD, which shows that the first burning had not been entirely successful. In his work, Porphyry re-dated one of the books of the Old Testament to show that it was written after the event and was not therefore a prophecy. Modern biblical scholars tend to agree with Porphyry. He also complained that when Christ cast the devils out of the man who was possessed, it was gratuitous to send the devils into the flock of Gadarene swine, who consequently plunged over a cliff. Even Saint Augustine was to be embarrassed by the case. Porphyry also complained of the words in John 6.53 in which Christ exhorts people to eat his flesh and drink his blood. He accuses the Christians of cannibalism. Yet, in many ways his pure and ascetic views were very close to Jews and Christians. He was against the killing of animals and his comment that the true sacrifice is not the sacrifice of animals, but of a pure mind, is close to some Jewish and Christian views. He also advocated from a pagan source the ideals of Faith, Truth, Love and Hope. Augustine paid the closest attention to him and thought that he had come close to recognising large areas of the Christian truth.

Porphyry also questioned the newly popular Egyptian religion. He addressed his doubts and questions very respectfully to an Egyptian priest in his *Letter to Anebo*. Here too he was distressed among other things by animal sacrifice. But he provoked a violent and extensive reply from one of his own pupils, Iamblichus, the philosopher of Apamea in whose university were installed the beautiful mosaics that I referred to earlier.

Porphyry's most fascinating work was called *On Abstinence From Killing Animals*. This treatise was divided into four books. In the first book, Porphyry describes the arguments in favour of killing animals. He then goes on to argue that if you understand gods, animals, and humans, you will realise that such killing is misplaced. The highest gods, he says, in Book One and Two, require nothing physical at all, merely thoughts, not even anything as physical as hymns. In the fourth book, he provides an anthropology of other races and argues that many of the non-Greek peoples, for example certain Indians and the Essene Jews, do not find it necessary to eat animals. The third book considers animals in their own right. The central question in considering how we should treat animals had, since the Stoics, been the question whether they are rational like us. Porphyry may be the first person to cite a consideration which I think more relevant, namely whether animals suffer, unless Porphyry was borrowing this point from an earlier Platonist, Plutarch. Porphyry also cites Theophrastus as having said that loss of life is itself a harm to animals. This would apply even to a painless and unexpected death. In this Theophrastus seems to have gone beyond both the modern Utilitarians, who are only against suffering, and against modern legislation which has begun to limit the suffering of animals, but does not regard a painless death as a genuine harm to them.

But Porphyry does also address what had come to be the central issue namely whether animals are rational, since it was widely agreed that, if they were, we should treat them with justice, just as we should treat each other. Porphyry follows the distinction between uttered reason, in other words speech, and inner reason, in other words thought. And he argues that animals have both. As regards speech, He considers that linguistic understanding is a very important part of it, and he argues that animals understand their masters and even understand *Greek*. I regret that Augustine, who studied Porphyry on many subjects, did not follow him on this. Instead, discussing the commandment, "Thou shalt not kill", Augustine reverted to the Stoic justification for killing animals, namely that animals lack reason and so

do not share in our community. Porphyry's is the fullest statement of the arguments on both sides, for and against killing animals, in the whole of antiquity. I am happy to say that an excellent new translation has appeared this year in a series of translations of late Greek philosophy which I am editing. I think of it as one of the two most interesting works of late Greek philosophy. The other most interesting work was written by the next philosopher to be considered, Philoponus.

Philoponus

Philoponus was, like Porphyry, a Neoplatonist, but a Neoplatonist with a difference. Although steeped in the pagan Neoplatonism of the city of Alexandria in the sixth century, he was a Christian, and he used the pagan Neoplatonist views in order to show that in reality Christianity was right. The pagan Neoplatonists had accepted a theory of the physical universe derived mostly from Aristotle and partly from Plato. Philoponus provided a Christian alternative to this largely Aristotelian science.

In his book *Against Proclus on the Eternity of the World*, he argued that on their own principles they ought to accept the Christian view that the universe had a beginning. Philoponus argued this by exploiting the Aristotelian concept of infinity which the Neoplatonists had accepted. Aristotle's treatment of infinity, 850 years earlier, was brilliant and influential. Aristotle understood, for example, the idea of a dense continuum. On a continuous line, between any two points, however close together, there is still an infinity of further points separating them. Aristotle also introduced the concept of infinity which is still taught to most students nowadays. Children are told not to be frightened of infinity because it involves merely getting as close as you like, or approaching a limit. This was Aristotle's idea. He thought that infinity was merely an ever expandable *finitude*. Aristotle's idea of infinity as an expandable finitude applies very well to future years. We shall see that it does not apply so well to past years. But as regards future years, if they are infinite, this is in Aristotle's sense, that, however large a finite number is added, there will be added a still larger finite number. A more than finite number will never be reached.

In Aristotle's view, you could never finish going right through the whole of a more than finite series. But however large a finite number of members of the series you had gone through, you could always go through a larger *finite* number. What you could not do was to go through a more than finite number. There was something wrong, Aristotle held, with the idea of a more than finite number. For he saw that, if you try to think of a more than finite number of numbers, the even numbers in the series, for example, will be just as numerous as the combination of odd plus even numbers. This would mean that a part of the series was as large as the whole, and he found that absurd. Not only can you not finish going through the whole of an infinite series, according to Aristotle, but even less could you go through *more* than an infinity.

Philoponus exploited these ideas on behalf of Christianity. He argued that if, as the Neoplatonists believed, the universe had no beginning then it would have finished going through a more than finite number of years. Moreover how many years would it have gone through by next year? Infinity plus one! This violated the Aristotelian principles of infinity, which the Neoplatonists themselves accepted. So Christianity must be right that the universe had a beginning. These clever arguments produced by Philoponus in the sixth century AD could not have been answered until the fourteenth century, eight hundred years later. It was then explained that there are two senses in which an infinity might be supposed to be larger than another infinity. Imagine the years from the year 2000 stretching away from your left eye in an unending column with 2000 closest to your eye and 1999 further away. Now imagine a column of years stretching unendingly away from your right eye, starting with the year 2001. And imagine that the years in each column are matched against each other. Thus 2001 up against your right eye is matched against 2000 which is up against your left eye. With the two infinite columns of years, we can see that one column is larger than the other, in the sense that it contains one extra year, namely the year 2001. On the other hand, in a *different* sense, neither column is larger than the other. For neither column *sticks out beyond the far end of* the other. This is for the simple reason that neither column *has* a far end. This would enable us to explain against Philoponus that even if by 2000 the universe had finished going right through a more than finite number of years, it could still go through a further year, 2001. The new collection would be larger, but only in the sense that it would contain the years in the other column plus one year *besides*. It would not be larger in the objectionable sense that one column of years would *stick out beyond the*

far end of the other. This contrast between *beyond* and *besides* shows the sense in which it is possible to exceed a more than finite number, but no one in Philoponus' time was in a position to give that answer. In my view, Philoponus was wrong. It would be possible for the universe to have finished going through a more than finite number of years and in addition to go through more years again after that. But nonetheless Aristotle's contrary conception of infinity is still influential and there was certainly nobody in the sixth century who could have disputed it.

Aristotle is shown up as inconsistent in failing to make the universe finite in time as well as in space. A defence was offered on Aristotle's behalf that he does not postulate an infinity of past years, but never more than one year, since past years are dead and gone. But this defence will not do. For Aristotle's objection to a more than finite collection of anything, that it makes the part as large as the whole, applies to all collections, even to collections of dead years.

Philoponus also replaced Aristotle's theory of dynamics. Aristotle had asked, when you throw a missile, why does the missile continue to move after it has left your hand? For the first few feet the missile is pushed by your hand. But what happens when your hand comes to rest? Aristotle replied in effect that somehow your hand had transformed the air behind the missile so that it became a sort of unmoved mover. The air was capable of pushing the missile forward even though it was no longer being pushed by your hand. Philoponus had great fun ridiculing this theory. He said that if that was how missiles moved, an army would do well to perch its arrows on the top of a wall and bring up behind them ten thousand pairs of bellows. This would set a tremendous amount of air in motion, which should then be able to propel the arrows hurtling towards the enemy. But in fact the arrows would fall down the other side of the wall. In place of Aristotle's attribution of work to the physical *air*, Philoponus introduced the concept of a non-physical *impetus*, which Thomas Kuhn in *The Structure of Scientific Revolutions*, has called a scientific revolution. But Kuhn thought that it was an invention of the fourteenth century, and did not recognise that it was already used by Philoponus in the sixth. There is even an occasional earlier reference to such a theory, but Philoponus is the first person to use it systematically. Philoponus' idea of an impetus is the idea that the thrower of the missile imparts a force not into the air behind the missile but into the missile itself. This theory became widespread in the fourteenth century and remained standard until it in turn was replaced, whether by Galileo, by Descartes, or by Newton, with the theory of *inertia*. According to the theory of inertia, you do not need to postulate a force to answer Aristotle's question why the missile continues to move. It is just one of Newton's basic three laws of motion that an object will continue moving in the same state of motion unless a force acts on it to the *contrary*, or at least it will (and this is another part of his insight), if the motion is in a straight line. Force, on the theory of inertia, is needed to explain not the continuation of rectilinear motion, but a *change* in rectilinear motion.

Nonetheless, Philoponus' impetus theory was an advance on Aristotle's. Moreover he felt able to extend it to explain other forms of motion. Comets and meteors below the moon move in a circle across the sky because of the impetus derived from the orbiting sphere of the moon revolving above them. Eventually in an explicitly Christian work, Philoponus says that the Christian God implanted an impetus at the time of creation into fire and earth, in such a way that fire has an impetus to go upwards and rocks downwards and a circular impetus into the spheres that carry sun, moon planets and stars. He was thus able to unify dynamics under one explanation, the impetus, in place of the many different types of explanation that Aristotle had offered.

One of Aristotle's explanations invoked a fifth element whose function is to rotate. Philoponus rejected the need for Aristotle's fifth element. In this, he was not unusual since even members of Aristotle's own argumentative school had rejected the need for a fifth element. But Philoponus is able to replace Aristotle's fifth element, with its special capacity for rotation, by the idea that God, at the time of creation, implanted a rotating impetus into the stars. Philoponus thus transfers power to the one God of Christianity. The Neoplatonists by contrast had thought of the stars as being lesser gods. Philoponus, on behalf of Christianity, is removing divinity from the material heavens.

Philoponus also argued against Aristotle about motion in a vacuum. Aristotle had objected that a vacuum, so far from being required to make room for motion, would make motion impossible, since speeds in a vacuum would have to be infinite. It would be infinite because there would be no friction to slow down movement. Philoponus replied that everything takes

time to move. What friction adds is not the need for time, but the need for *extra* time. In a vacuum it would be the need for *extra* time that was removed, not the need for time. Philoponus also argues against Aristotle that he himself believes the heavens rotate without any surroundings to cause friction, and yet he does not believe the heavens rotate at infinite speed. These arguments seem to me to be excellent replies to Aristotle.

Philoponus argues against Aristotle's idea that rocks fall down and flames rise up in order to reach their natural place. He says that when an animal's head is pushed into the wrong position, it rights itself not because the head is seeking some natural place in the environment, but because the head needs to resume the right relationship to the *shoulders* and the rest of the body. Philoponus sees the physical universe as being like an organism. He thinks that its parts like earth and fire were assigned a natural relation to each other by God at the time of the creation. So, if rocks and flames have acquired the wrong relationship to each other, fire below or rocks above, they tend, no less than the parts of an animal, to assume their right relationship, in this case a god-given relationship. Philoponus is here developing an idea that may have been adumbrated earlier by Theophrastus.

Philoponus criticises Aristotle's idea of basic matter or prime matter. Aristotle thought that properties like hot, cold, fluid, and dry, colour, flavour, and weight, and quantities such as length breadth and depth, must all belong to a subject. The ultimate subject, which is the subject of *all* properties, can only be imagined by imagining it separately from all properties. This makes the ultimate subject, or prime matter, sound a mysterious thing. John Locke, who still believed in something of the sort in the seventeenth century, called it a 'something I know not what'. Philoponus said that we do not need to postulate something so mysterious. The ultimate subject which carries the other properties of a body may just be length, breadth, and depth. We are to think of a particular volume consisting of length, breadth, and depth while ignoring the particular number of inches. The inches will be one of the properties. This idea of length, breadth, and depth as the ultimate subject bears a relation to modern field theory. Physicists sometimes think of matter at the sub-atomic level not as a particle, but as an expanse, or field, which manifests various properties.

Philoponus also introduces a striking analogy to explain how it is that in vision our eyes are affected by distant colours and shapes even though no effect is detectable in the intervening air. He gives the analogy of how light can pass through stained glass without colouring the air it subsequently passes through. The full colour is nonetheless displayed when the light strikes a wall of masonry. His analogy was to be used again by the English medieval philosopher Roger Bacon in the thirteenth century.

Finally, like many others, Philoponus objects to the view of the second century doctor Galen that mental states simply *follow* from physiological states of the body. Like Galen's rival, the Aristotelian Alexander, Philoponus substitutes the word "supervene" (*epiginesthai*) for *following*. Nonetheless Philoponus does give some striking roles to physiology. He agrees with other Platonists that philosophising can counteract bodily tendencies, but he thinks it does so by affecting the *body*. For he says that those who attend philosophical lectures acquire lean and dry bodies which keeps their emotions under control. He also gives an importance to physiology in our understanding of other minds. For he says that physiological changes help the lecturer to tell whether he is being understood. We see here not only the importance that Philoponus was willing to attach to physiology, but also the interest he took in the process of lecturing and the probability that he lectured without reading from notes.

If we put all this together we see that Philoponus has offered a Christian alternative to Aristotelian science. The Christian God plays a role as the one who begins the universe and who implants the impetus which explains a large part of dynamics. Nonetheless Philoponus gave offence to the Christian authorities. His views were condemned and his name was not mentioned. He was condemned principally because he said that he did not understand the idea that the Christian god consisted of three persons. Aristotelian logic did not allow for the concept of persons. It allowed one to think that there were three substances, or three gods. This was condemned as a heresy. Philoponus was also thought to be too close to an earlier, and very brilliant Christian heretic, Origen. Most Christians thought that in the resurrection we would need in our bodies some little bit of the same matter as we had in our original bodies. But Origen had pointed out that, as we are part of a food chain, there would not be enough human flesh left for everybody to be resurrected. Consequently he had insisted that the Bible says there will be a 'new heaven and a new earth', and that

consequently we will have new bodies. They would be *our* bodies because they would have the same *form*, not the same matter. Philoponus agreed with Origen that we would have new bodies.

Because Philoponus was condemned by the Christians, it was not clear to later Christians when he was the source of their ideas. It has now been documented how Philoponus' argument against an infinite past was transmitted via Islamic and Jewish philosophers until in Latin translation it reached Saint Bonaventure in the thirteenth century. Bonaventure repeats the infinity arguments and modern scholars had thought until recently that he had invented them. In fact they came from Philoponus. Similarly it has recently been shown how the idea of an impetus was not invented by the fourteenth century, but passed, once again by an Islamic route, to the Latin-speaking philosophers of the fourteenth century. As regards motion in a vacuum, Galileo credits Philoponus at the end of the sixteenth century as recognising it as possible. Indeed in his early work, Galileo cites Philoponus more often than he cites Plato. Thus Philoponus' rejection of Aristotelian science in favour of a new Christian science of his own devising did prove influential in the end. But for a long time Philoponus' influence, though real, remained anonymous, because of the anathema that had been placed on him by his fellow Christians.

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Gresham College, Barnard's Inn Hall, Holborn, London EC1N 2HH
Tel: 020 7831 0575 Fax: 020 7831 5208
e-mail: enquiries@gresham.ac.uk