

1 Rival Paradigms

“Just the facts, ma’am. Just the facts!” This famous directive by Sergeant Joe Friday – apparently never actually made in this form – is from the television series *Dragnet*. Unfortunately, while this may be adequate for detecting and solving crime, not so elsewhere. The idea that science is simply a matter of recording empirical experience is hopelessly inadequate and misleading. Science is about empirical experience, but it is about such experience as encountered and interpreted – and with effort and good fortune – as explained by us. To this end, we view the world, external and internal, through the lenses, as it were, of modes of understanding. Above all, metaphorical modes of understanding. In scientific thinking, there have been two major metaphors: what linguists call “root metaphors,” what – borrowing and somewhat extending the ideas of Thomas Kuhn – philosophers call “paradigms.” Two world interpretive visions. There is the root metaphor or paradigm of the world and its parts as organisms. The organic paradigm. *Organicism*. And there is the root metaphor or paradigm of the world and its parts as machines. The machine paradigm. *Mechanism*. These metaphors or paradigms and their differences will structure the discussion of this book. Let’s get straight to work, looking at the metaphors in their historical contexts.

Plato and Aristotle

The organic metaphor was the dominant vision for the Ancient Greeks. No surprise, really. It is nigh impossible to give accurate population sizes, but around 400 BCE, the time of the great philosophers, there were about two million people in Greece proper – considerably more if you count all the Greek-settled areas (like Sicily). The population of its biggest city, Athens,

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was about 150,000, taking in slaves and foreigners and the like. Including suburbs, twice that size. Even by the most generous estimate, the important point is that most people lived in rural areas, close to the land and the heavens, particularly the night sky in a land with no technically advanced lighting. It was natural to think in organic terms. Spring, birth, and the early years; summer, growth to full maturity; autumn, appreciating one's achievements, but slowing down; winter, death, but with the prospect of renewal and spring again, generation after generation. And the parts and processes of the world can be given an organic interpretation. Water, the life blood – rain, fertilization, rivers carrying things away, lakes, seas, oceans. All can be understood in organic terms. One must think in terms of wholes – what the soldier, statesman, philosopher, the South African Jan Smuts, at the beginning of the twentieth century was to call “holism.”

Plato presented this vision somewhat more formally in his dialogue *Timaeus* – “more formally” in the sense that Plato presented his thinking against the background of his metaphysical Theory of Forms. Especially in the *Republic*, Plato argued that this world of ours is one of change, transient, and a kind of state of being between nothingness below and mathematics and the Forms above. Forms have many roles – too many at times – but they are standards and also function as universals. “Dobbin” is the individual; “horse” is the Form. These are the truly real and they exist in a kind of world of rationality, and, as the truths of mathematics, eternal, unchanging. The Forms are ordered, and at the top, giving life to all the others, is the Form of the Good. Much influenced by Pythagorean thinking, Plato likened the Form of the Good in the world of rationality to the sun in our world of change. Just as the world thrives and has its ultimate being because of the sun, so likewise the Forms have their ultimate being because of the Form of the Good (*Plato: Complete Works*).

The *Timaeus* accepts this thinking as background. The world of the Forms is unchanging and good. Our world, the world of becoming, owes its existence to the world of the Forms. The Creator made the world an organism, so that it could be as good, as perfect, as possible. It is valuable:

God desired that all things should be good and nothing bad, so far as this was attainable For which reason, when he was framing the universe, he put intelligence in soul, and soul in body, that he might be the creator

of a work which was by nature fairest and best. Wherefore, using the language of probability, we may say that the world became a living creature truly endowed with soul and intelligence by the providence of God. (*Timaeus* 30b, in *Plato: Complete Works*)

What is the nature and status of this Creator? A kind of principle of ordering, identical with or perhaps emanating from the Good, in the *Timaeus* called the “Demiurge.” From the Good come the other Forms, hence it is the Forms in general on which our world is patterned. “Well, if this world of ours is beautiful and its craftsman good, then clearly he looked at the eternal model.” The oak tree is good because it is modeled on – what Plato in the *Republic* says “participates” in – the Form of the Oak. But why should we think or judge this way? What is the fairest and best, the beautiful? In the *Phaedo*, Plato makes it clear that he is thinking in terms of ends, of what today is known as “teleology.” You cannot understand just in terms of things happening. You must ask about results.

If mind is the disposer, mind will dispose all for the best, and put each particular in the best place; and I argued that if any one desired to find out the cause of the generation or destruction or existence of anything, he must find out what state of being or doing or suffering was best for that thing, and therefore a man had only to consider the best for himself and others, and then he would also know the worst, since the same science comprehended both. (*Phaedo*, 97 c–d)

The Good wanted to make the world as good as it could be. To do so, it had to make the world into an organism. But why would this be the best? Because this is the most desirable.

Turn now to Plato’s student, follower, and critic, Aristotle. Like Plato he saw a being, or rather a Being, as the secret behind, the cause of, the way the world works. Like Plato, he saw (as a consequence) the need and possibility of explaining things in terms of their ends – teleology. “Nature never makes anything without purpose.” But from there, the differences could not be starker. Aristotle’s God or Creative force, known as the “Unmoved Mover,” is the cause of everything. It is the ultimate Being, that which is cause of itself and infinitely good. “The first mover, then, of necessity exists; and in so far as it is necessary, it is good, and in this sense a first principle” (*Metaphysics* 1072b10–11). It is that which motivates everything.

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There is, then, something which is always moved with an unceasing motion, which is motion in a circle; and this is plain not in theory only, but in fact. Therefore, the first heavens must be eternal. There is therefore also something which moves them. And since that which is moved and moves is intermediate, there is a mover who moves without being moved, being eternal, substance, and actuality. (*Metaphysics* 1072a22–6)

The rest of existence is directed toward the Unmoved Mover, wanting in some sense to get close to it and share the perfection. Reproduction has a key role here. Organisms do not become eternal. However, through reproduction, they get as close to the eternal as possible, and that in itself is a good.

The acts in which [the soul] manifests itself are reproduction and the use of food, because for any living thing that has reached its normal development . . . the most natural act is the production of another like itself, an animal producing an animal, a plant a plant, in order that, as far as nature allows, it may partake in the eternal and divine. That is the goal to which all things strive, that for the sake of which they do whatsoever their nature renders possible. (*De Anima* 415a25–415b1)

Not only in the nature of the ultimate Being but in the way the system works, Aristotle differs significantly from Plato. They both think in terms of ends, but whereas for Plato the ends come from the Designer – external teleology – for Aristotle the ends come from within, they are produced by the way that things are – internal teleology.

Famously, in his *Metaphysics*, Aristotle distinguished four kinds of cause. Consider making a statue, for example a British foot soldier – a “Tommy” – from the First World War. You have the *efficient* cause, the modeler or sculptor who actually made the statue. You have the *material* cause, the substance from which it is made (bronze or marble or what?). You have the *formal* cause, somewhat akin to a Platonic Idea (without committing oneself to the reality of such an Idea). You would not have the soldier wearing a *Pickelhaube* (German helmet with a spike). And last, but far from least, you have the *final* cause, the teleological element giving the reason for the statue. Why is the statue being made now? So that future generations can remember and give thanks for the sacrifices of him and his comrades. Note something distinctive about final causes as opposed to the other causes. An efficient cause is happening now to

make a statue now for remembrance later. Even if no one ever saw the statue, it would still have the efficient cause of the modeler or the sculptor. In the case of a final cause, however, the reference is to the future, and there is always the chance that that future may never occur. An accident on the way to the memorial site means the statue is destroyed and never brings on memories. This is known as the “missing goal object.” In the case of external teleology, it is the idea that counts, and this in its way is an efficient cause. It refers to the future – let’s make a statue to honor our troops – but it is a reference, not the actual future. In the case of internal teleology, no such easy escape. You just have to say that nature is inherently teleological, even if things don’t work out as hoped and expected.

One final question of both Plato and Aristotle. What about our own species? What about human beings? Organisms grow, from oak to acorn, from tadpole to frog. There is direction and usually, if not always, it is thought to be a progressive direction, from lesser to greater, from little worth to great worth, from “monad to man.” One expects to find – one would be flabbergasted not to find – that our two philosophers agreed entirely with this summation. As so it proves.

God gave the sovereign part of the human soul to be the divinity of each one, being that part which, as we say, dwells at the top of the body, inasmuch as we are a plant not of an earthly but of a heavenly growth, raises us from earth to our kindred who are in heaven. And in this we say truly; for the divine power suspended the head and root of us from that place where the generation of the soul first began, and thus made the whole body upright. (*Timaeus* 90b)

Not much ambiguity there. Nor is there in Aristotle. We may infer “that, after the birth of animals, plants exist for their sake, and that the other animals exist for the sake of man Now if nature makes nothing incomplete, and nothing in vain, the inference must be that she has made all animals for the sake of man” (*Metaphysics*, 1256b15–22). Likewise, explaining why humans alone are bipedal: “of all living beings with which we are acquainted man alone partakes of the divine, or at any rate partakes of it in a fuller measure than the rest.” Hence, “in him alone do the natural parts hold the natural position; his upper part being turned towards that which is upper in the universe. For, of all animals, man alone stands erect” (656a17–13).

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The Atomists

Did no one in the Ancient World want to challenge this teleology-impregnated view of the universe? As it happens, from the beginning – before Plato and Aristotle – there was a school of thought that wanted nothing to do with final causes. The pre-Socratic atomists – Leucippus, Democritus, and a little later Epicurus – believed that the world is made up of minute physical particles, buzzing around in the void, in empty space. Efficient causation explains all. Final cause thinking doesn't have a dog in the fight. The best account of this philosophy came some centuries later from the pen of the Roman poet Lucretius. Laying things out in *On the Nature of Things (De Rerum Natura)*, he focused on development, not just of individual organisms but of whole groups or species. Everything came about through blind chance, with no purpose or end thinking needed (quoted by Sedley in *Creationism*, 150–3):

At that time the earth tried to create many monsters
 with weird appearance and anatomy –
 androgynous, of neither one sex nor the other but somewhere in
 between;
 some footless, or handless;
 many even without mouths, or without eyes and blind;
 some with their limbs stuck together all along their body,
 and thus disabled from doing harm or obtaining anything they
 needed.

These and other monsters the earth created.
 But to no avail, since nature prohibited their development.
 They were unable to reach the goal of their maturity,
 to find sustenance or to copulate.

(De rerum natura V 837–48)

A hotchpotch individual thus formed, three legs, one attached to the back between the shoulders, no mouth or eyes but with six pairs of ears, was not going to last long. However, given time enough, even the improbable becomes actual.

First, the fierce and savage lion species
 has been protected by its courage, foxes by cunning, deer by speed of
 flight.

But as for the light-sleeping minds of dogs, with their faithful heart,
 and every kind born of the seed of beasts of burden,
 and along with them the wool-bearing flocks and the horned tribes,
 they have all been entrusted to the care of the human race . . . (V 862–7)

Only efficient causes here. No final causes. Eyes were not made for seeing or legs for walking. First came the eyes and legs, and then they were put to use. Denying this is to get things backwards:

All other explanations of this type which they offer
 are back to front, due to distorted reasoning.
 For nothing has been engendered in our body in order that we might be
 able
 to use it.
 It is the fact of its being engendered that creates its use. (V 832–5)

It scarcely needs saying that, ingenious though this may be, it hardly convinced anyone. Even given nigh infinite time, functioning eyes and mouths, arms and legs are not going to appear on the scene. Elephants don't fly; arms and legs do not appear by chance. An adequate approach, including one like the atomists', that wants nothing to do with Creators or Unmoved Movers or the like, must still explain final cause – not downplay or ignore it.

The Christians

With the arrival of Christianity, which sees everything in terms of ends, there was even less reason for atomism to make headway. The organicist paradigm is tailor-made for Christianity. It stresses the unity of all existence, central to the Christian vision, where all comes from and ever depends on God. "Great is our Lord and abundant in strength; His understanding is infinite" (Psalm 147:5). The world is of great value and worth. "And God saw every thing that he had made, and, behold, it was very good" (Genesis 1, 31). And, most importantly, all is temporal and there is an advance through time: acorn to oak; monad to man. "So God created man in his own image, in the image of God created he him; male and female created he them" (Genesis 1, 27) (Fig. 1.1).

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Figure 1.1 God creating man in His own image. (Michelangelo)

Note that God created. Hence, things do not have value in themselves. It comes from God. There is value, but it is imputed not discovered. To quote Calvin:

And concerning inanimate objects, we ought to hold that, although each one has by nature been endowed with its own property, yet it does not exercise its own power except in so far as it is directed by God's ever-present hand. These are, thus, nothing but instruments to which God continually imparts as much effectiveness as he wills, and according to his own purpose bends and turns them to either one action or another. (*Institutes*, 1, 16, 2)

Calvin was deeply influenced by the fourth-century Roman theologian St Augustine of Hippo, and what he wrote is equally precisely the position of neo-Augustinians today. "The earth is very good. Neither demonic nor divine, neither meaningless nor sufficient unto itself, it receives its meaning and value from God," according to the Evangelical Lutheran Church in America (*This Sacred Earth*, 245).

Augustine, the very greatest of the early Christian theologians/philosophers, was an ardent Platonist, albeit at second-hand through the Hellenistic philosopher, Plotinus. In his *Confessions*, Augustine's characterization of God could have come straight out of the *Republic*. Necessary: "For God's will is not a creature but is prior to the created order, since nothing would be created unless the Creator's will preceded it. Therefore God's will belongs to his very substance."

Existing outside space: “no physical entity existed before heaven and earth.” Outside time: “Your ‘years’ neither come nor go. Our years come and go so that all may come in succession. All your ‘years’ exist in simultaneity, because they do not change; those going away are not thrust out by those coming in . . . Your Today is eternity.”

Faith is always going to be first for Christians. Yet it was hardly going to be the case that someone of Augustine’s incredible philosophical ability was going to turn his back on evidence and reason – what is known as “natural theology” as opposed to “revealed theology” or “religion” – and no more does he. He picks up what is known as the argument from design. “Even leaving aside the voices of the prophets, the world itself, by the perfect order of its changes and motions, by the great beauty of all things visible, claims by a kind of silent testimony of its own both that it has been created, and also that it could not have been made other than by a God ineffable and invisible in greatness, and ineffable and invisible in beauty” (*Confessions*, 53). Ours is a world of great value, created intentionally by a loving God.

There is one potentially awkward point that needs attention. Religions tend to have their sacred books, the truths of which are taken as absolute. In the case of Christianity, it is the Holy Bible – Old and New Testaments. Yet within its pages, particularly in the early chapters of Genesis, there are claims that must be taken on faith, but sit uncomfortably with reason. Even if reason does not have the all-conquering power it might have been thought to have, it is still important and needs attention. How do we deal with biblical claims, especially those claims about the biblical order of creation, that seem completely impossible, from the viewpoint of reason? Genesis tells us that light and dark were created on the First Day, but that we had to wait for the Fourth Day for the sun to make an appearance. Impossible! Augustine’s solution was very modern-sounding, or perhaps more generously we should say that our solution is very Augustinian-sounding. He argued that the Bible is true, through and through. But sometimes it is necessary to interpret it allegorically. Why? Well, for a start, the Ancient Jews were on the whole illiterate. They were not sophisticated thinkers like fourth-century CE Romans. Too literal, and they wouldn’t understand a word that was going on. So, God tempered the wind to the shorn lamb – or Israelite. God created, probably all at one time, and then explicated in a way that we can catch the important truths.

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St Augustine laid the foundation. Others built on this, especially in the realm of natural theology – most famously, St Thomas Aquinas. Like Augustine, accepting that God is the creative cause of all that exists, in countering the classic undergraduate counter – “What caused God?” – Aquinas argues that God has no need of a cause. He is outside time and space. He exists necessarily. It is part of His being that He cannot not exist. This is aseity: “it affirms that God is completely self-sufficient, having within Godself the sufficient reason for God’s own existence” (*New Catholic Encyclopedia*). This is not intended to be something new or radical. Far from it. It endorses the Augustinian position that God is not just eternal, but unchanging. Where Aquinas is distinctive is that he is much influenced by Aristotle, whose works were only now being translated from Greek to Latin. His thinking tended more toward internal teleology than external teleology. God works more as a principle of ordering than as an intervening hands-on designer. Either way, as we move out of the medieval era, organicism rules okay.

The Machine Metaphor

According to historian of science Eduard Jan Dijksterhuis:

At all times there used to be a strong tendency among physicists, particularly in England, to form as concrete a picture as possible of the physical reality behind the phenomena, the not directly perceptible cause of that which can be perceived by the senses; they were always looking for hidden mechanisms, and in so doing supposed, without being concerned about this assumption, that these would be essentially the same kind as the simple instruments which men had used from time immemorial to relieve their work, so that a skillful mechanical engineer would be able to imitate the real course of the events taking place in the microcosm in a mechanical model on a larger scale. (*Mechanization*)

A new root metaphor. The world as a machine. We are coming now into the sixteenth and seventeenth centuries. Why would the organism metaphor be falling out of favor, and why then would the machine metaphor be taking over? Because, on the one hand, society – European society – became far less rural and far more urban. The immediate appeal of organicism diminished. On the other hand, more positively, machines did start to come into their own!