Plato's Structure of Reality in the *Timaeus*

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Plato's *Timaeus* is a complex account of the origin of the *kosmos* or universe and all living things and of the underlying structure of the *kosmos*. Plato claimed that before an ordered universe was created there existed three things: firstly, the Eternal Forms or the paradigmatic eternal model on which our universe is copied, secondly, Space or that in which the perceptible universe was created, and thirdly the ever changing and perceptible universe. For Plato, as for Empedocles, the universe was made out of the primary elements of fire, earth, air and water. Plato introduced a geometrical atomism into this account claiming that the underlying and basic constituents of these primary elements are triangles.

In this paper I will give an account of how the universe is constructed using the irreducibly fundamental constituents of the triangles. Teleology and a geometric atomism comprise the centrepiece of Plato's account of the formation and structure of the universe.

Introduction

Plato's structure of reality offers a coherent teleological explanation for the nature of the universe and it is his assumption of a dualistic ontology that justifies the external teleology and geometrical atomism of the *Timaeus*. Plato's introduction of dualism and teleology in his explanation of the nature of the universe has fuelled Christian theology, and his account resonates with contemporary natural scientists who attempt to use science as a means of justification for their belief in god; whilst it is summarily dismissed as implausible by those who argue that there is no need for dualism or teleology to explain the nature of the universe.

Richard Dawkins[1] and Ernst Mayr claim that Plato's "dead hand" of essentialism held back the development of evolution for centuries until the publication of Charles Darwin's *Origin of Species* in 1859. Darwin argued that his theory was one long argument for the transmutation of species and against essentialism. Plato's Eternal Forms

[1] Dawkins, 2009:21.

may have contributed to the long held belief in essentialism yet the immediate empirical evidence available to him provided no good reason to believe in the transmutation of species. In recent times Simon Conway Morris, an esteemed palaeobiologist, has argued that evolution is directed towards "archetypal biological properties" that exist before the Big Bang, and that the evolution of intelligent sentient humanoids is inevitable. From this he infers the existence of a divine creator.[2] Simon Conway Morris has applied the Platonic thesis to evolutionary biology in an effort to combine the theories of science with the beliefs of religion.

Plato's account in the *Timaeus* is itself divided into three areas. The dialogue is complex in structure and content and weaves a pattern with three dominant strands.

(i) The first strand is a two-world ontology. Plato distinguishes between the perceptible world, our universe, which is ever-changing, is only grasped by opinion and belief; the eternal world, or the realm of Forms, which is changeless is apprehended by reason and is the source of true knowledge.

(ii) Teleology pervades this dialogue and is the dominant thread in this account of the creation of an ordered universe, the *kosmos*, and the origin of species. Reason, personified as the *Demiurge,* fashions the *kosmos in* the image of the Eternal Form and as Reason can only act for the best, the universe is the best possible *kosmos*.

(iii) The epistemological problem of how it is that we can truly know the perceptible world is yet another strand in the pattern of the *Timaeus.* Plato introduces geometrical atomism to explain the formation of the universe. Geometry and mathematics are for Plato objects of *a priori* knowledge and are apprehended by reason not sense perception, thus geometrical forms are the primary principle of the universe in Plato's account and allows for an explanation of how it is that we can have knowledge of the physical universe.

Two world ontology

Plato opens the account of the nature of the universe in the *Timaeus* by distinguishing a dualistic ontology, "that which always is" and "that which becomes but never is". The former is the world of the Eternal Forms that exist only in our understanding and are apprehended by a reasoned intellect. As these Forms are never-changing their apprehension results in true and certain knowledge. Whereas the latter is ever-changing, it comes to be and passes away and so never really is; this is the perceptible physical world, which can never be the subject of certain knowledge as it is learned by experience and fallible sense perception and so can only be grasped by opinion and belief. Plato argued that our world is an imperfect copy of a paradigmatic eternal

[2] These "archetypal biological properties" include the sense perceptions, intelligence, mammalness, and behavioural characteristics such as eusociality and ariculture (Conway Morris, 2003).

universe in which there exists an Eternal Form for each thing. The natural world is a shadow or reflection of the unchanging Eternal Form. The world of the Forms is the world of the ideal, of the paradigm, of the "essence". In *The Republic* Plato gives a clear account of the two realms, using as an example the geometer who draws geometric forms, such as the square, the triangle and the circle:

> The forms which they draw or make, and which have shadows and reflections in water of their own, are converted by them into images, but they are really seeking to behold the things themselves, which can only be seen with the eye of the mind.[3] (Plato, *The Republic*: 510d)

This account suggests that the world of the Forms exists only in the mind and yet in the *Timaeus,* Plato asks:

> Is our perpetual claim that there exists an intelligible Form for each thing a vacuous gesture, in the end nothing but mere talk?[4] (Plato, *Timaeus*: 51c)

He provides a clear and unequivocal answer:

> If understanding and true opinion are distinct, then these, "by themselves" things definitely exist — these Forms, the objects not of our sense perception, but of our understanding only. (Plato, *Timaeus*: 51d)

They exist but can only be apprehended by reason, Plato goes on to add that "understanding always involves a true account" which can only be shared by the gods and a select few people educated and learned in philosophy, geometry and arithmetic.

In *The Republic* Plato argues that knowledge of mathematics uses "pure intelligence in the attainment of pure truth and that the knowledge of which geometry aims is the knowledge of the eternal, and not of aught perishing and transient ... geometry will draw the soul toward truth" (Plato, *The Republic*: 526–528). Thus to fashion the universe using mathematical and geometrical structures is a means for us to move towards true and certain knowledge of the universe.

Having distinguished the two realms, one of certain knowledge and the other of fallible opinion and belief, Plato leads us carefully to the next step in his account which is the establishment of a cause of the "coming to be" of the physical world. He argues that as it is impossible for anything to come to be without a cause, that which comes to be must come to be by the agency of some cause. In the *Phaedo* Plato had eagerly grasped the claim by Anaxagoras that *Nous* or mind was the cause of everything; it is rational intellect that will determine what is for the best and act accordingly. Plato claims that the cause of the coming to be of the physical world is thus determined as rational intelligence, a disembodied intelligence. The Eternal Forms and the agency of the cause of the "coming to be" of the universe exist outside the realm of the perceptible universe.

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[3] Plato, *The Republic* trans. B. Jowett.

[4] All translations of Plato's *Timaeus* are from the translation by Donald Zeyl.

The *Demiurge*

The universe has order, harmony and coherence thus its cause could not be chance but a cause with intelligence and purpose. The world is most beautiful thus it was crafted in the image of the best of models, one that is changeless and always is, an Eternal Form of the universe. In order to determine the cause Plato has already rejected chance or necessity as not sufficient to bring about order, coherence and harmony and has argued that some form of rational intellect acting for the best is such a cause. Plato then goes on to identify a possible cause that of the *Demiurge,* a divine craftsman, *who* combines skill and rational intellect. By arguing that the universe requires a maker that is a craftsman he has made a quick assumption that the cause of the nature of the universe is external to the universe and quickly dismisses any earlier notion of the earlier natural philosophers that the nature of the universe was caused by the internal relations of the atoms and primary elements moved by the motion of the void or the motive forces of Love and Strife.

Plato's next step is to determine what kind of a world has been made and what kind of model was used in order to fashion the world. Our world, Plato asserts, "of all things that have come to be, our world is the most beautiful". In order to model such a world of beauty, order and harmony, these qualities, he argues, would need to be clearly apprehended and copied from the model. In *Republic X,* Plato discusses the notion of the craftsmen using the idea or form of bed to design and then make a bed. He argues that the idea or form of the bed is the essence of the bed and is the reality; the form is real, whilst the individual bed made by the craftsman is only a particular semblance of the existence of bed. He argues that if the real artist had the capabilities they would not make the copy but the true and real bed. Plato claims that a model that was ever-changing would lack beauty, order and harmony and these qualities could not then be impressed onto the craftsman's finished product. Thus as the world has these qualities it can be concluded that a changeless model, an Eternal Form, was employed as the model by the *Demiurge.* Plato concludes:

> This, then, is how it came to be; it is a work of craft, modelled after that which is changeless and is grasped by a rational account, that is, by wisdom. (Plato, *Timaeus*: 29a)

With these three claims — a dualistic ontology, a causal necessity for the formation of all things that are perceptible, and a craft analogy for the causal agency as the maker of the perceptible universe — Plato has placed teleology as the central theme and framework for his account of the origin and structure of the universe. He adds an important codicil by claiming that this account is not certain but likely or plausible, and "as irrefutable and invincible as any account may be". He explains that as the account is itself a likeness it stands in a similar proportion as the likeness is to the model — "what being is to becoming, truth is to convincingness". Thus he considers his account to be the best available thesis to explain the nature of the universe.

Having established teleology as the dominant theme of the dialogue, Plato then sets out to explicate more fully this account. The first question he poses is why the *Demiurge* made the world. The answer is because he was good. John Cooper writes that this "curious entity" goodness, can be understood as a "perfect example of rational order, conceived in explicitly mathematical terms; a complex, ordered whole, whose orderliness is due to the mathematical relationships holding among its parts" (Cooper, 1999:144). According to Plato, all that is good wants to share the goodness and thus the *Demiurge* made it all as like himself as possible. Order, harmony and beauty made the universe as "supreme as its nature would allow", he then endowed it with intelligence and soul. His reasoning was that as intelligence is better than a lack of intelligence, the universe needed intelligence; however as intelligence can only be possessed by soul he put intelligence into soul and soul into the body of the universe. The universe was fashioned as a living being.

Space and Matter

Plato claims that prior to the intervention of the *Demiurge* the visible and tangible world was discordant and chaotic not at rest, always changing but without order, coherence or harmony. For Plato and all the early philosophers there was a fundamental principle of nothing comes from nothing. The Christian notion of the creation of the world *ex nihilo* had no place in Greek philosophy. The universe came about from already existing elements or atoms or as Aristotle claimed it was eternal. In order for an ordered universe to come into existence, Plato's account required an intelligent craftsman; as a sculptor finds form from the marble so the *Demiurge* imposed form on the disordered elements.

> For this ordered world is of mixed birth: it is the offspring of a union of Necessity and Intellect. Intellect prevailed over Necessity by persuading it to direct most of the things that come to be toward what is best, and the result of this subjugation of Necessity to wise persuasion was the initial formation of the universe. (Plato, *Timaeus*: 48a)

The two causes of the formation of the ordered universe were intelligence, personified by the *Demiurge,* and necessity, explained as the materials and their powers. Before the divine craftsman set to work Plato identifies three entities, Being, which is the realm of the Eternal Forms, the *chora* or Receptacle, and Becoming, which is the materials and powers that would form the matter of the universe. The *Demiurge* is not mentioned as one of the entities that existed before the universe came to be, which has given some support to those who hold that the notion of the *Demiurge* his purely a symbol and not to be taken literally (Cornford, 1937:56); whilst Johanssen argues that the *Demiurge* is a personification of craftsmanship rather than a divine being (Johansen, 2004:69–86). Although these interpretations find some support in the text it seems more plausible that, just as Plato had argued that the Eternal Forms had a real existence so also does the *Demiurge,* who is not to be compared with the

Christian god but as a divine intelligence with the purpose to craft a universe according to the Eternal Forms using only the material elements already in existence.

Plato accepts the Empedoclean account of fire, earth, air and water as the primary elements of matter; he then identifies the fundamental constituents of these elements as elementary triangles. These two dimensional geometric structures are the principles and the nature of the material of the universe which are apprehended by reason, and when the triangles come together and form three dimensional solid entities they are perceptible and are understood by sense perception.

The geometric properties of the triangles are insufficient by themselves to form regular three-dimensional objects. Without direction these triangles, according to Plato, will never accidentally form a regular ordered universe. Plato argued, that in order for the two dimensional triangles to come together and form regular three dimensional objects and be crafted into an ordered harmonious universe, is necessary to "persuade" and direct the fundamental triangles to come together to form regular and stable three dimensional solids. The *Demiurge* as the personification of reason provides purpose and direction. The reasoned purposiveness of the *Demiurge* is the mediating influence between the realm of the eternal forms the source of true and certain knowledge and the world around us grasped by fallible sense perception. Thus reason crafts an ordered universe by purposively directing the two dimensional triangular surfaces, employing necessary geometric principles, to form the primary elements which constitute the perceptible universe.

The Receptacle

Plato introduces a further entity, the Receptacle in which the primary elements of the material world come to be. It is often referred to as space, and Plato claims that it is neither stuff nor empty but is apprehended by a kind of bastard reasoning that does not involve sense perception. It has no characteristics of the material world and yet the matter of the world imprints itself on it and in it; the elements of matter are perpetually coming in and out of being in the Receptacle. Plato endeavours to explain this entity which he claims is neither changeless matter nor eternal form.

1. It does not depart from its own character in any way. Unlike the triangles that form the solid bodies of fire, air and water it does not transform into any other thing.
2. It receives all things and resembles none of them as it does not take on any characteristic similar to any of the things that enter it.
3. It is available to anything to make its impression upon, and it is modified, shaped and reshaped by the things that enter it.
4. It provides a fixed site for all things that come to be.
5. "...the most correct way to speak of it may well be this: the part that gets ignited

> appears on each occasion as fire, the dampened part as water, and parts as earth or air insofar as they receive the imitations of these." (51 b–c)
>
> Donald Zeyl in the introduction to his translation of the *Timaeus* suggests we think of it as both stuff and also the room in which stuff moves, like a liquid and the currents that move through the liquid; whilst Brisson and Meyerstein[5] refer to it as some kind of hybrid entity "a spatial medium", and they note it was not until the 20th Century that any solution to the space matter problem was found with the discovery of quantum theory. What is space? What is matter? What is the relationship between space and matter? Plato attempted to answer these questions concerning space and matter with geometry and arithmetic and the invention of the Receptacle.

The Receptacle plays an integral role in Plato's teleological account of the universe of reality. The fundamental particles are two dimensional geometric structures that are continually being shaken by the non-uniform motion of the Receptacle such that on occasions the three dimensional structures of the primary elements of matter are momentarily formed. Without the direction of the *Demiurge,* no stable three dimensional forms of fire, earth, air and water are formed just occasional glimpses; no whole sensible particulars are formed, and no ordered universe of heavenly bodies and living creatures could come about. Without rational intellect to guide the formation the disorder and chaos would have continued without end.

Plato's triangles

The principle of the triangles is the centrepiece of the account of the formation of the primary elements. Although the *Demiurge* gave the primary elements their distinctive and particular shapes, the elements of the triangle existed before the *Demiurge* shaped the world. The *Demiurge* employed their formations and transformations to craft the four platonic solids that constituted the primary elements of the universe. Teleology and geometric forms are the cause of the universe.

In order to explain his systematic account of the formation of the universe Plato gives an account of the type of triangles and how they form the matter used in the structure of the universe. Plato claims that all bodily forms have depth, they are three dimensional, and depth and any surface bounded by three straight lines is composed of triangles. Every triangle, he argues, is derived from two types of triangles, the isosceles triangle and the scalene right-angled triangle. Therefore the triangle is the principle of the primary elements out of which the universe is composed. Fire, earth, air and water are the bodily forms of the four primary elements.

It is the elementary triangles that allows Plato to describe the composition of the three dimensional solids that constitute the primary elements and allows him to put

[5] Brisson and Meyerstein, 1995:17.

forward the claim that because air, fire and water are composed of the same kind of triangles they can transform into one another according to a formula of proportionality.

The basic regular three-dimensional bodies are constituted from isosceles triangles and scalene triangles. The triangles are of the proportion 1:√3:2 in order that they can combine to form the equilateral triangular faces of the tetrahedron, the octahedron and the icosahedron. The tetrahedron with four faces is fire; the icosahedron with eight faces is air; and the dodecahedron with twenty faces is water. The fewer the faces the sharper the edges which gives the power of cutting, whilst the greater the faces the more crushing power is exerted. The fourth kind, earth is constituted by right angled isosceles triangles in proportions 1:1:√2. Plato does not consider that any isosceles triangles can be divided into two scalene right angled triangles, thus the isosceles triangle is not basic and every right angled triangle whether isosceles or scalene can be divided into further smaller right angled triangles. If Plato's fundamental constituents of the universe are infinitely complex and can be infinitely divided then do they have magnitude or not and can they combine to form something with magnitude? (Zeyl, 2000:lxvi–lxvii)

Although the Platonic solids are formed by the *Demiurge*, Plato acknowledges that when the *Demiurge* had brought them to completion and exact perfection but only "to the degree that Necessity was willing to comply obediently" (Plato, *Timaeus:* 56c). In a sense the geometric principles override any direction to perfection that does not comply with the necessary truths of geometry e.g. triangles can never form the perfect sphere. The *Demiurge* is limited in the perfection that can be achieved and can only "persuade" the eternal triangles to form the less than perfect sense perceptible universe. This lack of perfection allows for the imperfection of the universe and a divine craftsman that is not omnipotent.

Platonic Solids[6]

The basic regular three dimensional bodies that are constituted by the triangles are:

1. The tetrahedron for fire with its sharp edge for cutting.

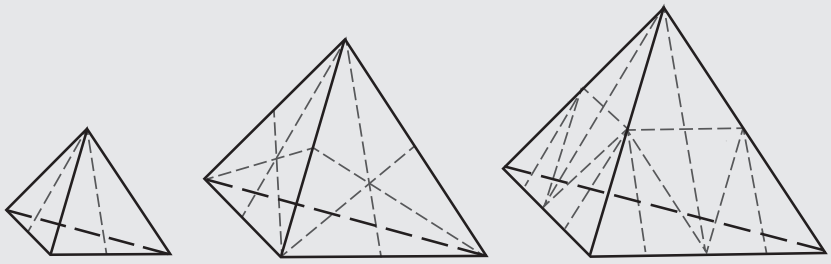

Fig. 1. Regular tetrahedra: corpuscles of fire

[6] Images taken from Friedländer, *Plato, An Introduction. Vol 1*. 1958.

2. The octahedron represents the fundamental particle, air.

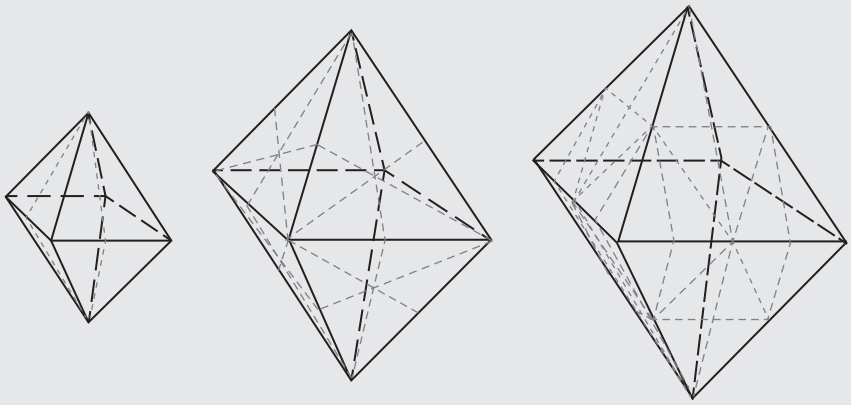

Fig. 3. Regular octahedra: corpuscles of air

3. The dodecahedron shape represents the fundamental particle, water.

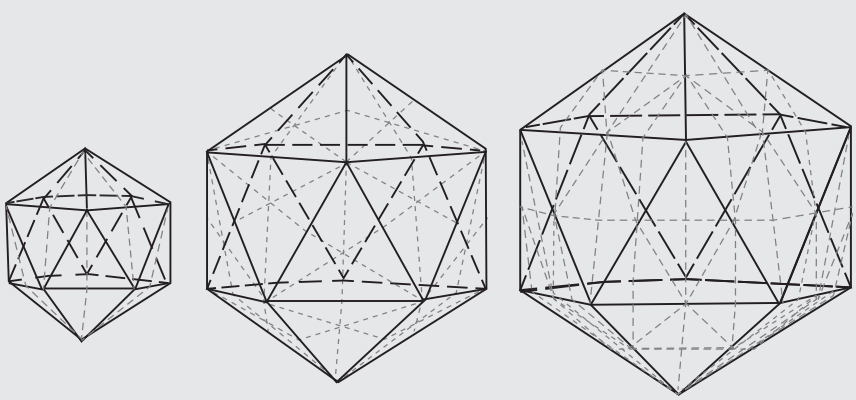

Fig. 4. Regular icosahedra: corpuscles of water

4. The cube for the solid earth which cannot be transformed into the isosceles triangles.

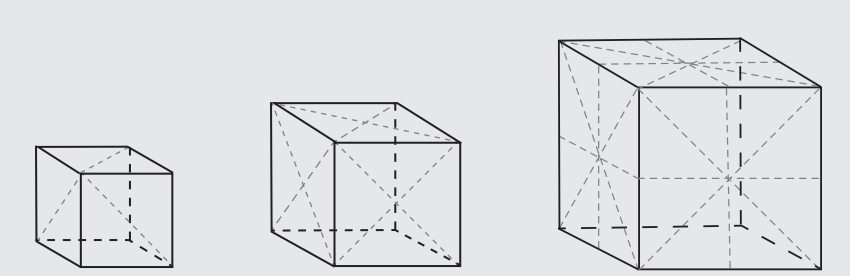

Fig. 2. Regular cubes: corpuscles of earth

Transformations

As fire, air and water are constituted by the same type triangles when they are broken up they can reform into a different configuration so that fire which has the fewest faces has the sharpest cutting edge could cut into air and water, whilst water has the greatest number of faces and could crush fire and air. In this way transformation of the primary elements occurs.

Fire has 24 triangles
Air has 48 triangles
Water has 120 triangles
So 5 Fire = 1 Water = 2 air + 1 Fire

The non-uniform motion of the Receptacle keeps the elements colliding with one another so that there is a continual transformation of the primary elements occurring. Because the *Demiurge* has used all the triangles for the matter of the universe which he then made into a body shaped as nearly as possible as a sphere, there is a continual compression of everything allowing no void to remain. Fire, the smallest of the elements, permeates the most spaces left by the compression of the larger bodies, whilst air being the second smallest permeates spaces to a lesser degree. Thus as the transformations occur through a process of combining and separating and the primary elements are continually shifting up and down.

> This, then is how and why the occurrence of nonuniformity is perpetually preserved and so sets these bodies in perpetual motion, both now and in the future without interruption. (Plato, *Timaeus*: 58b–c)

And so with the continual cutting and crushing, compressing and expanding of the primary elements the universe and all living things are formed. Thus teleology and geometry are the main cause of the structure of reality.

Conclusion

The early atomists and physiologoi had argued that the structure of the universe could come about from the inherent nature of the atoms or primary elements and their chance combinations. In answer to their explanations Plato's account hinges on the world of the Eternal Forms, the divine intelligence of the *Demiurge* and a geometrical atomism, all unobservable entities; the reasons he offers for these entities are regularity, coherence and harmony. Regularity, coherence and harmony are features of the physical universe and Plato offers non-physical entities as reasons for these features. He argues that a disembodied intelligence directs the necessary geometric surfaces to form a coherent, organised universe.

Plato's *Timaeus* weaves a complex pattern that combines Reason and Necessity and grapples with the problem of how it is that we can know the physical universe.

Plato's account hinges on the world of the Eternal Forms, the universals, changeless and real. They are immaterial and exist outside of space and time; they are understood by reason not by observation and experience. Plato claims they have a real existence and are the source of all true knowledge. The physical world is visible, tangible and ever changing and grasped only by opinion and thus cannot be the source of true knowledge. The physical world left without direction would be disordered and chaotic but the world is ordered, regular, coherent and harmonious. In order to possess these features it needs intelligent direction, thus Plato introduces the *Demiurge,* the disembodied, divine, intelligent craftsman.

True knowledge is only found in the Forms, how then are we to have knowledge of the nature of the universe? Plato understands mathematics and geometry to be the way to true knowledge and he introduces the Receptacle and geometric atomism. For Plato the primary matter of the universe is two geometric triangular shapes, directed by the *Demiurge* to form the structures of the ordered world. Plato's account is the first cosmological work that proposes a mathematic/geometric model of the universe.

The *Timaeus* is a systematic coherent account of the origin and structure of the universe grounded in dualism, teleology and geometry, with the purpose of fashioning a harmonious and ordered universe. Plato's teleology is not pernicious as the aim of the *Demiurge* was not to create a universe from nothing but to order the irregular motions of space and matter such that the regular, coherent and harmonious universe would occur. The geometric nature of the space matter relationship provided a consistent account of the nature of the universe and explained how we could know the nature of the world — it is all geometry.

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