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**HERITAGE FROM PLATO  
THE SIGNIFICANCE OF PLATO TODAY**

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The topic, which is here to be taken up for discussion: *What is the significance of Plato for posterity, and for us today?* - is so comprehensive and so demanding that a whole long life of study would not suffice for a satisfying answer. No mortal individual can aspire to be able to survey such riches, nor to communicate it to other persons; but in the least we have been accorded some twenty minutes to dig up a few grains of gold. Allow me to begin by reproducing a saying of the famous scholar Paul Friedländer:

*Der 'Timaios' wird vielleicht immer das unvergleichlichste Werk Platons bleiben, wie er die längste Zeit als sein Hauptwerk gegolten hat. Keine wahre Naturwissenschaft kann bestehen, ohne um ihre eigene Geschichte zu wissen. In dieser Geschichte aber gibt es wohl kein einzelnes Schriftwerk, das so tief und so weit gewirkt hat wie der 'Timaios'. Die Geschichte seiner Wirkung zu schreiben, wäre eine grosse Aufgabe.*

I will here try to outline a few main features of this history. I have already given some hints to the intimate, but strained, relation between Plato and his pupil Aristotle. But it is also worth mentioning that Platonism in the Middle Ages mainly manifested itself as neo-Platonism, a motley mixture of Platonic and Aristotelian elements with a woof of Pythagorean speculation. It was in this form that Platonism eventually stamped the medieval attempts to create a synthesis of Greek philosophy and Christian theology. Decisive for this was, that *Timaios* at that time was the only known work of Plato.

Throughout the Middle Ages, Christian neo-Platonism emitted some strong and vital stimuli which contributed to dominate the mental and cultural climate of the time. There is an intimate connection between the longing for eternity of Christian mysticism and the Platonic concept of eros (*έρως*). This synthesis of Christianity and Hellenism perhaps found its most beautiful expression in the lofty spires of the Gothic cathedrals. While the intellectual progress in the high Middle Ages was predominantly influenced by the rediscovery of the writings of Aristotle, Plato remained largely unknown until the dawn of the renaissance. Up to that time the widespread dominance of Aristotelianism threatened to reduce Platonism to an insignificant strand of clerical subculture.

Decisive for the outcome of this struggle was, that the two traditions competed at almost equal terms in the quiet contest between the representatives of the two medieval mendicant orders, or *fratres minores*: Franciscans and Dominicans. Franciscus and his brethren preferred to live in humble harmony with nature as created by God, whereas "the dogs of the Lord" (*domini canes*) prepared themselves by learned studies to serve faithfully as instruments for the papal inquisition. It is no wonder, then, that some of the most important impulses to the revolt against Aristotelism and the founding of a new science of nature came from the spiritual castle of Franciscans, the university of Paris.

The renaissance raised a new interest in Platonism, which soon spread all over Europe. Shortly before 1500, the Polish priest and astronomer Nikolas Kopperrigh became dissatisfied with the antique planetary system devised by Ptolemy. He accepted the Platonic obligation to save the phenomena by the simplest possible assumption, but conjectured that the geocentric hypothesis had to be replaced by the heliocentric one. Despite the greatness of this new idea it is probably best to view Copernicus as the one who closed the medieval epoch. The founding fathers of the new natural science were Kepler and Galileo. First with Newton classical physics came to full maturity, however; by creating its classical paradigm, he sketched the program for future progress.

Ignoring individual disparities, one can say that the trifoil Kepler, Galilei, Newton jointly worked out the method of modern science. In this there is a hypothetic-deductive element which goes directly back to Plato. What is new is the experiment - an element which is foreign to Platonism. In case one wishes to focus upon the heritage from Plato, in order to evaluate the similarities and dissimilarities in the thinking of these scientists, one will need to consider their respective views of the use of hypotheses in science. How are their positions as regards the hypothetical element in science?

We can establish that they agree on the following points: A scientific hypothesis is primarily distinguished by its mathematical character. A hypothesis is only relevant in so far as it can help us to discern *the formal structure of reality*. Scientific knowledge emerges from viewing *empirical phenomena* in the light of *mathematical hypotheses*. Those are the best ones which save phenomena in the simplest and most probable way. Of all these points it holds that they go back to Plato or, at least, to Platonism.

Also a fifth point should be mentioned, both because it derives from Plato, and because it, strictly speaking, is a consequence of the first four ones. It is a misjudgment to ask for the truth-value of a mathematical hypothesis: a hypothesis which aims at the discovery of structural laws valid for the world of phenomena can never be true or false, but only more or less probable. Expressed in Platonic terms: one cannot obtain *epistéme* regarding nature, only *dóxa*. As we shall see, this was an issue of disagreement.

Both Kepler and Galileo associated themselves to Plato. Kepler somewhere said: *It is not the observation of the heavens which has brought these insights forth in me. In correspondence with the teaching of Plato they were at rest at the bottom of my soul and were only called forth by my perception of reality.* Galileo expressed himself yet stronger: *On the title page to my collected works should be written: Here it is shown by countless examples which great use can be made of mathematics with respect to conclusions in the field of natural science, and how impossible it is to philosophize in a competent manner without geometry, as was also claimed by Plato.*

But even if they had not admitted their debt to Plato, it would have been possible to deduce it from their thoughts, their ideas. On a par with Plato, Kepler considered the Sun to be an image of God (cf. Plato's parable). This idea he utilized as an argument for the truth of the Copernican hypothesis. The Sun, being situated in the very center of the universe, must be the most dignified of all heavenly creatures. From the Sun a power appears to determine the motions of planets in their orbits. But why six planets?

Plato taught that the universe is created by means of mathematic and geometry. Everything in the world is ordered harmoniously by numerical proportion and analogy. If we accept the hypothesis that the relative distances of planetary orbits are determined by the regular polyhedra in such a way that they are inscribed in and circumscribed by orbital spheres after model of chinese boxes, then the five polyhedra correspond exactly to the interspaces of the six planetary spheres. *Heureka!* thought Kepler, and calculated. By changing the natural order of the polyhedra a few times, he eventually succeeded in making his calculation fit the observations fairly well. This he considered as a brilliant confirmation of the Platonic view of the significance of mathematical harmony.

Judged in one way, one can say that Kepler reached his brilliant results in spite of his Platonism. Seen from another angle, one can say that Platonism is not at stake, since his use of the five polyhedra is no more Platonic than his formulation of his famous three planetary laws. In the end he found himself forced to give up an important element of Platonic method: he had to replace circular orbits with elliptical orbits, and uniform motion with the law of equal areas described by radius vector in equal intervals of time. In other words, he realized that a certain element in the method was better understood as a hypothesis, and that this hypothesis should be replaced by a better hypothesis.

I have already characterized the Platonic program as mathematical in contrast to the Aristotelian one which was empirical. One would perhaps conjecture that Galileo, the clever observer and experimenter, might have sided with Aristotle, against Plato. However, as the facts show, just the opposite was the case. How could this happen? Was not Galileo an empiricist, after all? Hardly, if the world is used in its modern sense. What shall we make of the fact that Galileo expressed his unrestricted admiration for

Aristarchos and Copernicus precisely because they stuck to the heliocentric hypothesis, in spite of overwhelming empirical evidence for the geocentric one, and thus allowed reason "to exert force against the senses" instead of making it "a slave to superstition"?

Nevertheless there is also a significant difference which brings Galileo more in line with Aristotle. Contrary to Plato, he constantly stressed the possibility of obtaining true insight in the secrets of nature. Like Plato, he spoke of God as a divine geometer. The great book of nature, which lies open to our senses, is full of divine wisdom and is expressed by mathematical symbols. Thus all true knowledge of nature is mathematical. God's wisdom is infallible, just as his will is immutable. Nature being a mirror of God, its laws must be immutable and infallible too. Galileo is unwilling to accept with Plato that the universe is imperfect, due to its resistance to being made rational.

Against Aristotle, Galileo rejects the teleological conception of causality in favour of a mechanical one. But concurrently he claims, on a par with Kepler, that it is possible to obtain final knowledge of true causes (*verae causae*). By this move he replaces the *Platonic concept of hypothetical truth* with the *Aristotelian concept of categorical truth*. One can say that such stance was needed in order to ensure a steady progress of science. From now on, one had to search for an explanation regarding even small deviations from the accepted laws of nature. But this view is modified by an important proviso. When Galileo claimed the unconditional truth of his assumptions, it was always relative to "idealized" phenomena. From the point of view of Plato, this Galilean amphibian is nothing but a *chimaera*. But, as history shows: even chimaeras can be useful!

In conclusion it should be admitted that, both in Kepler and in Galileo, we find a tendency to blur the obvious distinction of Plato between conjecture and knowledge, *dóxa* and *epistéme*. There seems to be a hidden connection between this tendency and the similar one to blur the distinction between necessity and reason, *anáanke* and *nous*. Taken together, *these two short-cuts makes up the condition for the notorious idea of a mechanistic universe governed by perfectly deterministic laws*. In principle, this idea would enable a superhuman intelligence to calculate the entire world course of *history* from the world *program*, and thereby to predict all events in the tiniest detail.

Having given a few samples of the impact of Plato on the history of physics and astronomy from antiquity to renaissance, I proceed to discuss his influence on modern philosophy, mainly represented by the names of Descartes, Leibniz and Kant.

Cartesian Platonism is primarily to be found in the assumption of so-called inborn ideas. All mathematical knowledge has been conveyed to the human soul before its birth in a body as an essential part of its nature. This is a modern version of the Platonic theory of "recalling" (*anamnesis*). The only difference seems to be that Descartes, in contrast to Plato, does not accept the pre-existence of the human soul. Also at another

point we find an important parallel. As we know, Descartes distinguished two kinds of substance, viz.: 1) thinking things (*res cogitantes*), 2) extended things (*res extensae*), 3) their temporal subsistence (*duratio*) constituting the *tertium comparationis*.

The legacy from Plato is disclosed by the fact that he identifies spatial extension with material substance, his philosophical point being that this identity enables us to describe matter in geometrical terms. Already Kepler had said that where there is space there is geometry. Descartes supplements this *dictum* of Kepler by introducing matter as the middle term, saying: *ubi extensio, ibi materia, et ibi geometria*. By this claim, his metaphysics ensured the truth of his most important mathematical discovery, viz., that *arithmetics* and *geometry* can be unified into a single science: *analytic geometry*.

The third point where a connection can be traced is in the Cartesian aether theory. Descartes offers a mechanistic explanation of the phenomenon of gravitation, referring to vortices in a cosmic aether. This reminds of Democritus; but it reminds of Plato too. In the *Timaios* we are given this explanation of the motion of matter in space, and hence of gravitation, that it is due to a kind a "shaking" of the cosmic sphere, "just like a man shaking grain in a sieve". The only problem was that the Cartesian theory was not given a mathematical form. Newton's theory was in much better accord with Plato's program. But Newton's attitude to Platonism seems to be of a much more problematic character: whether Plato inspired his "true, mathematical time (space)" is at least questionable.

Leibniz openly confessed himself as a Platonist. In fact, the similarities between the two philosophers is very considerable, comprising: 1) a hypothesis of inborn ideas, 2) a hypothesis of pre-natal & post-mortem existence, 3) a program for a mathematical science of nature, 4) a monadology that represents the micro-cosmos as a mirror of the macro-cosmos, 5) a hypothetical concept of truth relating to our knowledge of sensible phenomena, *etc., etc.* Referring the interested reader to my chapter on Leibniz, I shall be content to urge the similarity on a single point. Leibniz baptised his own philosophy: "the theory of the pre-established harmony". This harmony is a summary expression of the total world course of events in time and space, interpreted both *logically* as *program* and *empirically* as *history*. The parallel to the Platonic idea of the cosmic paradigm is, in fact, dazzling. It is therefore natural to suppose that Leibniz received inspiration to his idea of the pre-established harmony directly from the *Timaios* of Plato.

Even with respect to Kant I am apt to believe in a close relation of dependence. What I am referring to is, of course, the Kantian concept of *the transcendental subject*, which is described as the instance which brings order to the world by conceptualization, just as the Demiurge is the instance which makes *kósmos* emerge from *cháos*. My thesis then is, that the transcendental subject can be viewed as a modern ("de-mythologised") version of *Plato's Mastergod*. In fact, the analogy can be followed in the tiniest detail.

Thus the Platonic *cháos* with its in-the-air-hovering sense qualities corresponds exactly to the Kantian manifold of sense qualities presented to intuition before their eventual conceptualization by reason. A parallel is likewise to be found between the ordering of *kósmos* by virtue of arithmetical proportion and geometrical structure in Plato and the constitution of the universe due to reason's use of its own categories in Kant.

In passing it deserves mentioning that Hegel invented a synthesis of the idea of the divine and the idea of the transcendental ego which he christened "Welt-Geist". Hegel's world spirit, of course, is inconceivable without the world spirit of the *Timaios*. Then the only thing left for us here is to point out that this Hegelian concept of "Geist" in the hands of Marx underwent a strange metamorphosis which changed the spirit of metaphysical idealism into a *durchaus materialistisch konzipierter Begriff der Kapital*. So the circle is closed: the divine Demiurge has been perverted to diabolic Mammon. As Whitehead said, "Western philosophy is a series of footnotes to Plato!"

#### **NOTE**

In W. Heisenberg: *Physik und Philosophie* (1972), we find the following considerations:

*Die Anschauungen der modernen Physik (sind) denen des Heraklit sehr nahe verwandt, wenn man das Element Feuer bei Heraklit als Energie interpretiert. Energie ist das Bewegende, sie kann als die primäre Ursache alles Wandels betrachtet werden, und die Energie kann sich in Materie oder Wärme oder Licht verwandeln. Der Kampf zwischen den Gegensätzen in der Philosophie des Heraklit kann hier in dem Wechsel zwischen den verschiedenen Formen der Energie sein Gegenbild finden. In der Philosophie des Demokrit sind die Atome ewige und unzerstörbare Einheiten der Materie, sie können sich niemals ineinander verwandeln.*

*In Bezug auf diese Frage wendet sich die moderne Physik .. gegen den Materialismus des Demokrit und entscheidet sich für Plato und die Pythagoreer. Die Elementarteilchen sind nicht ewige und unzerstörbare Einheiten der Materie: sie können tatsächlich ineinander ungewandelt werden .. Aber die Ähnlichkeit der modernen Anschauungen zu denen Platos und der Pythagoreer geht noch weiter. Die Elementarteilchen in Platos dialog 'Timaios' sind ja letzten Endes nicht Stoff, sondern mathematische Form .. In der heutigen Quantentheorie können wir kaum daran zweifeln, dass die Elementarteilchen letzten Endes auch mathematische Formen sind, aber solche einer sehr viel komplizierteren und abstrakteren Art. ..*

*Die Physik ist gerade in den letzten Jahren an die Stelle gekommen, von der aus man versuchen kann, das Grundgesetz für die Materie zu formulieren. .. Es handelt sich bei dieser Grundgleichung um eine nichtlineare Wellengleichung für einen Feltoperator der als mathematische Repräsentant der Materie .. gelten kann. .. Die mathematische Symmetrie, die eine so zentrale Rolle bei den regulären Körpern der platonischen Philosophie spielt, bildet auch den .. Kern jener Grundgleichung. Die Gleichung ist im Grunde nur eine mathematische Darstellung einer ganzen Reihe von Symmetrie-eigenschaften, die doch nicht so anschaulich sind wie der platonischen Körper. .. Die moderne Physik schreitet also auf denselben geistigen Wegen voran, auf denen schon die Pythagoreer und Plato gewandelt sind - und es sieht so aus, als werde am Ende dieses Weges eine sehr einfache Formulierung der Naturgesetze stehen - so einfach, wie auch Plato sich sie erhofft hat.*

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