HEGEL AND THE SEVEN PLANETS

My reason for raking up this story is that no one in this country seems to have got it right. It also, I think, contains material of some interest to historians and philosophers of science, and to all interested in Nature and Human Nature. The reader will also understand that biographical details are merely introduced as a way of opening out the subject.

One of the first phrases I heard McTaggart utter was "I am a Hegelian". In a later book on Hegel's logic he expressed the opinion that Hegel had come nearer to the true nature of reality than any other philosopher before or since. Now all young wits in their first year enjoy nothing better than a(ny) story which reflects in any way on their elders, especially those of some repute. Here was one! "Hegelian, is he: why, that's the man who gave an *a priori* proof that there were, and could be, only seven planets." And some versions added the surprising news. "And in that very year the eighth (or maybe *an* eighth) planet was discovered." As I knew nothing then of the dates, I accepted the story, and as one of the would-be wits, passed it on.

In later life, having discovered that this same Hegel had a volume of 700 pages on the Philosophy of Nature, and knowing of no other philosopher who goes anything like so far to meet the naturalist, I decided to look into the matter. I found much that was weird and wonderful, and here and there some quite good empirical material, even about the planets, but nothing approaching such an *a priori* proof as I was looking for. There did not even seem to be anything which could be misunderstood or twisted into such. But there was a reference to a much earlier "Dissertation on the Orbits of the Planets", with a remark that Hegel no longer held some of the opinions there expressed. And as the Dissertation was in Latin I had to let the matter drop.

But other people still kept flogging the dead horse. Neurath of Vienna in *Erkenntnis* about 1930, repeats the story about both the *a priori* proof, and the contemporary discovery of an eighth planet. And Sarton in a quite recent book pours sarcasm on Hegel apparently believing in this alleged proof. Meanwhile, I had come across and read Lasson's German translation of the Dissertation. The translation is very free, and the work itself does not give one a very good impression of German university standards round 1800.

I shall attempt to give the reader the historical background for appreciating the point at issue. The Pythagoreans had discovered the connexion of mathematics with musical scales. Kepler and other moderns were greatly interested in such harmonies. Newton gave us his seven colours, later correlated with wave-lengths of light. Then there were intervals between the planetary orbits;

surely there must be some plan in them, some simple law or laws, in finding which we should be " thinking God's thoughts after Him ". For long all efforts were baffled ; then in 1772 came a ray of light, Bode's Law. Studying the not very accurate data then existing, Bode found a rule which fitted fairly well. If we call the average distance of Mercury from the Sun " a ", and that of Venus " a + b ", and take a = 4, and b = 3 ; then for the planets known in 1772 we get :—

	Bode's Law		Actual Distances : E = 10
Mercury	a	4	3·87
Venus	a + b	7	7·23
Earth	a + 2b	10	10·00
Mars	a + 4b	16	15·24
	[a + 8b]		
Jupiter	a + 16b	52	52·03
Saturn	a + 32b	100	95·39

Note that the " b "s are as $2^0 : 2^1 : 2^2 : [2^3] : 2^4 : 2^5$. Notice also the gap for " a + 8b ", for that is the cause of all the trouble. God surely wouldn't leave a gap in such a delightful scheme. Now if we go in thought another step we shall get :

Bode's Law		Actual Distance	
a + 64b	196	191·90	Uranus (1781)

Thus Uranus, discovered after the rule, also conforms approximately. So when Hegel took up the matter there were eight terms, but only seven planets. But there were *a priorists* in those days who were not content with this. They (not Hegel) said : " There *must* be *an* eighth planet ; not eighth in the series, but between Mars and Jupiter (*i.e.* 5th). Admittedly, it is quite invisible with existing instruments, and exercises no gravitational perturbation. But it must be there ! "

To complete the historical sketch : two other planets have been discovered since Hegel's death ; and precisely by means of the perturbations exercised (at least this is true of Neptune, 1846, if not also of Pluto, 1930). This completes our table.

	Bode's Law		Actual Distances
Neptune	a + 128b	388	300·70
Pluto	a + 256b	772	394·60

Note that *the* eighth planet came 15 years after Hegel's death, so cannot be the one referred to in the story. And even the approximate rule no longer holds.

But we must now return to Hegel and 1801, and forget Neptune and Pluto. Some readers may be surprised that Hegel was not on the side of the *a priorists*. He accepted Uranus on the empirical evidence, and there is every reason to believe that he would have accepted, or even welcomed, Neptune, as I shall show later. But he decided to beat the *a priorists* at their own game. There is a much simpler *a priori* series of powers in Plato's *Timaeus*, stemming from the Pythagoreans.

1, 2, 3, 2^2, 3^2, 2^3, 3^3 } etc. (this series need not be limited to 7 terms).
1, 2, 3, 4, 9, 8, 27 }

Now Hegel substitutes 16 for 8, and so fakes a series of 7 terms which approximately (or so he tries to show) fits the existing 7 planets. And his quite good conclusion is: "There is no need to worry about the missing eighth (or fifth) planet."

Now what was it that happened in the same year 1801, for it was not the discovery of *the* eighth planet? But something was discovered that year, on New Year's Day; a small piece of rock called Ceres, in the gap between Mars and Jupiter, "a + 8b". This, and many similar fragments discovered since are variously termed "asteroids", "planetoids", or even "minor planets". But they are *not* counted in the series of planets. But Hegel accepted them as closing the gap, and (for him) the argument. Note "a + 8b" = 28. Humboldt in his "Cosmos" gives the actual distance as 27·68.

It only remains to refer briefly to what Hegel did say about the planets in his lectures on "Philosophy of Nature". He gives (*a*) an inner series of 4: Mercury, Venus, Earth, Mars; (*b*) the asteroids Ceres, Pallas, Juno, Vesta, also 4, which happened to be all Hegel knew; (*c*) an outer series, Jupiter, Saturn, Uranus (and . . . ?). I think Hegel would have welcomed Neptune as completing his 3rd set of 4. Sets of 12 are not unknown even in the Logic. Three, not seven, is Hegel's number; and often in the field of Nature four. It was Newton, Hegel's bugbear, who went in for seven! Whereas 12 can be made up of 3 fours or 4 threes, 7 would have to be 3 and 4 and this only gives 2 terms. Hegel would not have liked 7 in one row like the spectral colours. Even the five senses have to be triadised: (1) Touch, (2) Smell and Taste, (3) Sight and Hearing.

To sum up: Had Hegel any special weakness for the number 7, he could rightly have dismissed Ceres etc. as not being genuine planets. Instead he accepted without demur, the *empirical* evidence that there was something in the gap; and later gave a list of 11, including 4 planetoids. If then I have got the story right, he was not trying to prove anything, *a priori* or otherwise. He was merely demurring to the *a priori* assertion that there were 8, made before there was any empirical evidence. If, as is possible, I have not got the story right, I hope someone will correct me.

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