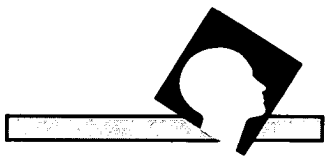
Adventures in Science and Cyclosophy

CORNELIS DE JAGER

Abstract: I discuss the methods of scientific research and illustrate this by describing the way astronomy emerged from astrology. I list some of the criteria used in modern scientific research, and I describe some of the main errors of pseudoscience. The "religion of the Great Pyramid" is based on the accidental coincidence of certain structural data of the pyramid with fundamental astronomical data. I show that this applies to my bike too.



"A rumination on the astrological roots of astrophysics and on the scientific method and pseudoscience leads straight (or roundly) to consideration of my bike."

1. The Astrological Roots of Astrophysics

Astrophysics certainly has its astrological roots. For the ancients, living, as they thought, on a flat earth, the firmament of fixed stars could be no more than a dome over the then known parts of the earth, an area with a radius of a few thousand kilometers. Surprisingly, there were amid these stars other objects, the wandering stars or planets, most of them brighter than the fixed objects, and roving along seemingly irregular paths through the starry vault. It is a logical deduction, in the philosophy of the ancients, that these planets were conveying messages of the gods to the mortals below. It was therefore imperative to decipher these messages; hence careful observation of the planets was a primordial task. (Besides, a fair degree of curiosity may have also been at the basis of the ancient studies of the planetary motions.)

In the course of these studies certain regularities were discovered in planetary motions, and an analytical approach to the study of planets gradually developed. Thus astrology

changed into astronomy. Models of the planetary motions emerged—that of Ptolemy being best known; but throughout ancient times the astrological roots were clearly there and often intertwined with astronomy. For a long time, there was even no distinction in the name. In addition, concepts of the universe were nearly exclusively based on the Platonic ideas that there must exist an ideal world, and that the observed reality is some kind of primitive and incomplete reflection of that ideal: our minds are supposed to have certainty of the reality, because it is thought that we should be able to understand the true contents of the changing appearances.

In that connection the question arose occasionally in the scientific literature of whether Ptolemy was a fraud: it is known that he sometimes chose those observational data that best fitted his model predictions, in order to illustrate his theory, and it seems that in other cases he even did not hesitate to change the data to obtain a better fit. In present times this approach would certainly be considered as a clear proof of fraudulent science, but in the light of the Platonic ideas of the Greek era such a behavior was legitimate.

The basic notion that research should be empirical—hence the idea that observations come first and only thereafter come interpretation and the establishment of regularities and "laws"—appeared in clear form only at the end of the Middle Ages, although there were enlightened minds in earlier times already. Reversely, Neoplatonic ideas continued to be entertained, even till the present time.

The Renaissance and the period thereafter show many examples of the struggle for a clear concept of the scientific method. Copernicus, on one hand the proponent of a revolutionary idea, still had Neoplatonic ideas, e.g., the assumption that the planets move in circular orbits. This was assumed to be so because the circle was considered to be the most perfect structure and "the Divinity always acts geometrically" (Pythagoras). Brahe's system, seemingly a step backwards as compared with that of Copernicus, did indeed better fit the observations. This may be another reason it took more than half a century before Copernicus's ideas got accepted—yet by a small group. Actually, only after Galileo and Kepler did his ideas get more generally accepted, albeit in an improved and modified form.

That Roger Bacon (13th century), but also Tycho (16th century) and even Newton, practiced alchemistry may seem strange in our eyes, but the study of alchemistry had the virtue of stressing the empirical approach—contrary to astrology.

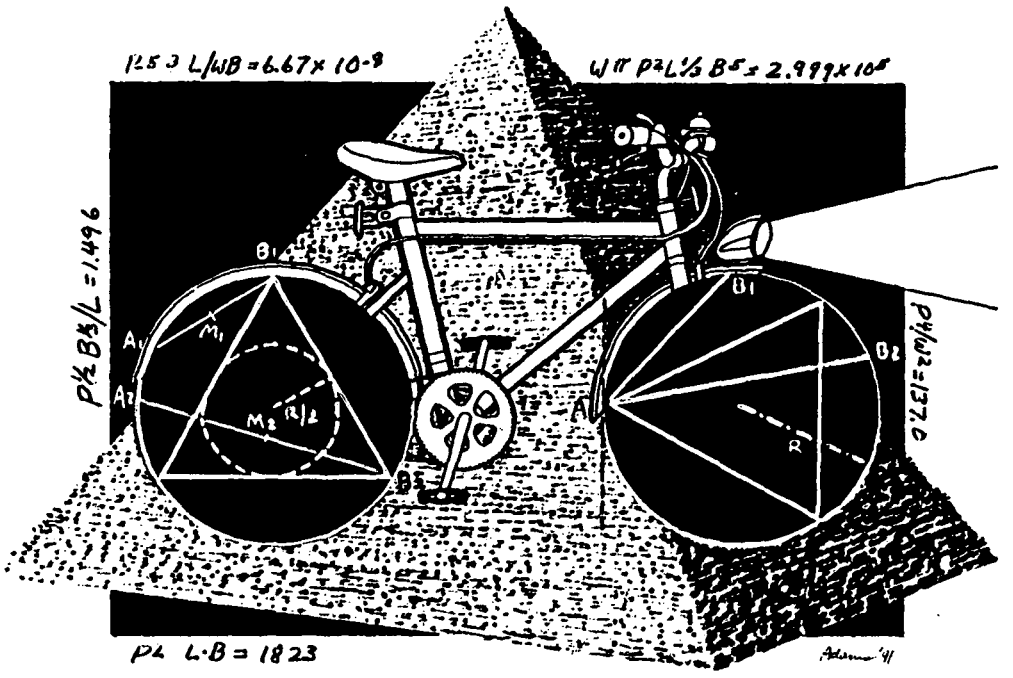
2. *The Scientific Method?*

Science is the ensemble of human endeavors to

—discover and describe the structure and origin of the surrounding reality and

—understand the causal relations between events and to establish the laws that govern them.

Hence science is based on the assumption that the same boundary conditions should yield the same results. However, exactly the same boundary conditions never occur twice in nature. Our laws are therefore abstractions. These abstractions are moreover only valid as long as their further refinement or correction has not been brought to light. In the course of time the domain and volume of mankind's knowledge has increased enormously, but there are levels and shades in our knowledge: while cer-



tain laws are very well established and can be considered as "certainly true" to a high degree of absoluteness, the interesting domains are the fringes of the area of our knowledge where the scientific battlefield is situated. It is there that the real adventure of scientific progress takes place, with all its great successes and disappointments.

The question then arises of whether a real and standardizable "scientific method" does exist. In my view it does not. Scientific research is the application of logic, common sense, and experience to the interpretation of the observations in their most general form. In the course of centuries mankind has developed and sharpened techniques for the deduction of "laws" from observations, or to check if a scientific conclusion (or a new scientific law) is closer to correctness than previous laws, but the methods are diverse and many.

Some of these criteria are:

—The argumentation should be logical and rational.

—The argumentation should be complete and adequate; there should be no voids in the argumentation.

—The hypothesis should be falsifiable; the experimental proof should be repeatable.

—The simplest assumption is often the best (Occam's Razor).

—The chance for accidental coincidence between data should be negligibly small.

—Very unlikely or extraordinary claims should be met with extreme care and built-in suspicion and must be supported by extraordinary evidence.

Yet one should not forget the dialectic aspect that the most successful and productive scientists are in many cases precisely those who dare to advance a new hypothesis on the basis of just-emerging new data or scanty or primitive information, often guided by intuition (which is just condensed and rich experience) rather than by overwhelming and convincing

evidence of the available facts.

The difference between science and pseudoscience is that in the latter some or all of the above criteria are not applied in the scientific process.

Pseudoscience—

—accepts results that lack proof of sufficient quality;

—deletes or changes empirical data that do not fit with a favorite assumption or theory, or selects only the best-fitting data;

—uses coincidences or correlation for proof, and takes correlation for causality;

—often gives excessive weight to a theory; expecting that it will allow one to explain everything still unexplained.

3. *The Religion of the Great Pyramid and My Bike*

The remarks above on pseudoscience can be illustrated. While astrology has had its days and has nearly disappeared from the scientific scene, other pseudoscientific beliefs related to astronomy are still around. One of these is the "religion" of the Great Pyramid, which arose when, in the first part of this century, the first explorers investigated the Egyptian pyramids. Particularly the pyramid of Cheops attracted attention. It has indeed some astronomical characteristics. It is oriented north-south with a high precision (1 in 3,000) and the ratio between height and base length is 1 to $\pi/2$. This first fact means that the ancient Egyptians had a precise notion of the points of the compass, and the latter has been interpreted as evidence that the ancients knew the number π already. I think this latter coincidence may be accidental, because later research has shown that earlier pyramids were built steeper but that these collapsed. After several experiments it was found that less steep pyramids survived.

Piazzi-Smith and others advanced extreme claims. By introducing the "pyramid-yard" (p.y.), which was 1/20,000,000 of the earth's diameter (64 cm), it was found that the baseline length of the Great Pyramid was 365.25 p.y.—exactly the number of days in the year. Does this mean that the builders of the pyramid knew the earth's diameter? Or the precise length of the year? Note that accepting these precise numbers means that the base length of the pyramid had been measured with the surprising accuracy of 15 cm, which seems difficult in view of the actual state of the pyramid. It also appears that twice the diagonal contains 25,826 pyramid inches (one p.i. being 1/25 p.y.), which is the precession period in years of the earth's axis. Note again that those giving this number with this accuracy implicitly claim to have measured the diagonal with a precision of less than a pyramid inch, hence better than a centimeter!

But one of the more surprising statements was that a precise mathematical formula could be found relating the base length of the pyramid in pyramid yards with the distance between the earth and the sun in kilometers! This would mean that the builders of the pyramid already knew the length of the kilometer several thousand years before the introduction of the metric system! More such remarkable relations between structural data of the Great Pyramid and data from (astro-)physics or human history were advanced, and they provoked interest and surprise in the public at large. The religion of the Great Pyramid bloomed.

Several aspects of pseudoscientific reasoning are clearly apparent in this description. The most obvious one is the exaggerated belief in coincidences

between numbers and the underestimation of the possible number of mathematical relations between simple numbers.

To illustrate this I wish to advance here a new religion, based on my Dutch bike. Why a Dutch bicycle? Evidently because a bicycle has in my country, the Netherlands, virtually the same status as the pyramids have in Egypt. In my country we have 15 million Dutch, but we have 16 million bikes.

I measured the diameters of my bike's:

—pedals, symbolizing the forward-going dynamics;

—front wheel, which directs my ways into the unknown future;

—lamp, enlightening my paths;

—bell, through which I communicate with encounterers.

Thus I laid the building stones for a new holistic four-dimensional religion apt to the coming New Age of Aquarius: cyclosophy.

The measurements were expressed in Holy Bike Inches, being 17 mm. This is so since 1 is the first prime number and 17 the seventh, and because seven is the holy number.

Calling P, W, L, and B the four measured quantities, it turns out that

$$P^2 \sqrt{L \cdot B} = 1823,$$

which is the ratio between the masses of the proton and the electron. It seems surprising that such a simple relation between three of the parameters of my bike yields such a fundamental constant; this may indicate that the Creator of my bike was very gifted indeed. Maybe he had supranormal gifts, because he may not have been aware of the values of the masses of the proton and the electron?

But there is more. The "fine structure constant," a very important number in fundamental physics, is

137.0. It appears that

$$P^4/W^2 = 137.0.$$

The constant of gravitation is $G = 6.67 \times 10^{-8}$, while

$$P^{-5}\sqrt[3]{L/WB} = 6.67 \times 10^{-8}$$

My bike also shows relation to fundamental astronomical data. For example, the distance between the earth and the sun, expressed in units of 100 million km, is 1.496. I find that

$$P^{1/2}\, B^{1/3}/L = 1.496.$$

The velocity of light is 2.998×10^5 km/second. My bike parameters yield

$$W^{\pi}\, P^2\, L^{1/3}\, B^5 = 2.999 \times 10^5.$$

May I suggest that the difference in the last digit should be a reason for physicists to reconsider measuring the velocity of light. For indeed: in the light of the foregoing coincidences it seems very unlikely that the error is with my bike.

I could give a much longer list of combinations, relating my bike to any arbitrary number ranging from the age of Santa Claus to the number of flowers in my garden. They should all fit perfectly.

4. *Comments on Cyclosophy*

There is nothing peculiar either with the Great Pyramid or with My Bike.

Let me choose four numbers A through D, aribitrarily chosen and arranged in the form

$$A^a \cdot B^b \cdot C^c \cdot D^d$$

where a, b, c, and d can have all integer values from −5 to +5, with the addition of the numbers + and − pi, ½ and 1/3. There are then 83,521 such combinations possible, and the chance that one of them fits with the measured quantity to within 0.01 percent is about unity. (Note that in the previous section I was careful enough to give all measured quantities in no more than three or four digits). A simple computer program suffices to print all those combinations that fit with the measured quantity to within, say, 0.1 percent. In most cases, some ten possible combinations are then printed, out of which I selected the best. A more sophisticated computer program than mine, with some more variables or a few more formulas, would do much better.

Coincidences occur regularly in numerical experiments, as in daily life. Those who do not realize that such coincidences are not "rare" often incorrectly use them to imply paranormal events. Most people greatly underestimate the enormous amount of possible combinations between numbers. And that has helped make it easy for many pseudoscientific misconceptions to arise and grow, and gain public appeal.

Cornelis de Jager is an astrophysicist with the Laboratory for Space Research, Sorbonnelaan 2; 3584 CA Utrecht, The Netherlands. This article is based on his paper at the International Skeptics Conference, Free University of Brussels, Belgium, August 10-11, 1990.