

Observation

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English speaking people, even those who use correct grammar and an attractive style, often do not know the rules of grammar as well as a foreigner who has deliberately studied them. An accomplished musician also and a skillful painter may not know very much about art. Similarly a practicing and brilliant scientist may be relatively hazy on the grammar of science.

At the joint meeting of the ASA with the Evangelical Theological Society in 1961, one of the scientists asserted that observation was *the* authority in science. Two or three other speakers confirmed the idea that science depends on observation, and in a context that suggested that observation is the only basis and authority in science. Since such an idea carries with it important conclusions for the philosophy of science and strongly colors one's views as to the relation of science to theology, this paper will advance certain negative considerations.

To avoid misunderstanding at the outset, it must be said that this argument does not deny that observation is an authority in science. The thesis is that observation is not the sole authority. There are other factors, other grammatical rules, other bones and sinews that determine the form of scientific law.

The simplest example is no doubt the use of the arithmetic mean. After the experimenter collects a list of readings, he adds them and divides by the number of readings. No observational necessity dictates this step. So far as experimentation is concerned, he could have used the mode or the median, instead of the mean. Similarly, to take a slightly more complex example, when a scientist uses the standard deviation, he squares the *x*'s; but there is no observational necessity that prevents him from cubing them. If the scientist should reply that the standard deviation ties in with the principle of least squares, one need only ask him why he does not choose to use the principle of least cubes. Many other examples could be mentioned. Now, since the laws of science depend on the mathematical forms chosen, and since different mathematical forms could be chosen, it follows that scientific law does not depend wholly on observation.

Ordinarily one might say that observation places certain limits upon the range of choice. The arithmetic mean leads to the use of a plus or minus variable error. Such values, transferred to graphs, become areas and not points. Through a series of areas any one of an infinite number of curves can be passed. Therefore there is no observational necessity for choosing one scientific law rather than any other that passes through these areas. Although this permits an infinite range of choice, it also excludes an infinite range. Observation prohibits the choice of a curve that falls outside the limits of the variable error. Hence observation is *an* authority, even though it is not *the* authority.

But while this is the ordinary situation, it is not always true that the scientist chooses within the range of observation. Perhaps the most famous example is that of the Copernican astronomy. When Copernicus resurrected the heliocentric theory of Plato and Aristarchus, the Ptolemaic mathematics could more accurately predict the positions of the planets than the heliocentric theory could. Moreover, the heliocentric theory implied a stellar parallax, and there was none observable. To be sure, a stellar parallax was observed three hundred years later. But for these three centuries the heliocentric theory made its way in spite of observation. The charm of the mathematics overbalanced the force of the visible data.

At the last joint meeting of the ASA-ETS not only were there speakers from the physical sciences, there were also representatives of the social sciences, and these too stressed observation. Whether or not these speakers actually asserted that observation is the only authority in science is beside the present point; the present point is that social science can even less proceed on blind trust of observation.

One difficulty in sociology is that so few fundamental measurements can be made. The units are so often very poorly defined, or not defined at all. Therefore numerical laws and derivative measurements are impossible.

But the factor which removes sociology from sole dependence on observation, and which does so more obviously than in the case of physics, is the prominent part played by ethical norms. No one is satisfied to count the number of divorces or the number of burglaries. Everyone, and sociologists above all, rush to explain the cause and the cure. But these proposals are essentially ethical and political principles. They are assertions of what ought to be; they are not descriptions of what is. For this reason ethics is not an observational science. Norms cannot be obtained by descriptive methods. Yet so often a sociologist refuses to justify the norms which he uses.

There are some philosophers who do indeed claim to raise norms on a descriptive basis. The argument against them cannot be detailed here. My ideas on this point can be found in the references (1, Chaps. 3-4; 2, pp. 13-41). But enough has been said, I hope, to establish the need for a philosophy of science that will define the role of observation and indicate what other factors must be brought in play.

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REFERENCES

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