STATISTICS AND CAUSALITY

In a recent number of BLACKFRIARS (July, 1949) Dr A. W. Gledhill has discussed very competently some aspects of the statistical method as used in modern physics. He has tried to show there 'that modern physical theory does not contradict the principle of causality'. Having made a study of this subject over quite a number of years[1], the writer, while agreeing with some of Dr Gledhill's conclusions, feels nevertheless that there are a few points which have not been covered as adequately as the importance of the subject for modern philosophy seems to warrant.

In order to understand the controversy about the validity or non-validity of the principle of causality, which has been initiated by Heisenberg's uncertainty principle, it is necessary to realise, first of all, that when a physicist speaks about causality, he usually does not mean the same thing as a scholastic philosopher. In scholastic philosophy one distinguishes different kinds of causes, such as the material, the efficient, the final, as well as the formal and exemplary causes. The classical physicist, on the other hand, since the time of Galileo, admits only efficient causes. Let us therefore give a brief sketch of the development of this concept of scientific causality and show the reasons for this limitation.

The purpose of a scientific theory is the prediction of events among the natural objects which form the field of enquiry of the particular science concerned. Evidently, the more certain the prediction, the better the theory on which it is based. To permit predictions with absolute certainty it is first of all essential to assume that the nexus between cause and effect is a necessary connection. This assumption is admissible only in objects which, by definition, have only actual, but no potential qualities. An inert molecule of iron is supposed to act always in a self-identical way. It acts because it cannot *not* act. A living object, on the other hand, acts because it *can* act. A man walks because he *can* walk, he has the *potentiality* for walking, but this potentiality need not always be actually realised.

Secondly, a necessary nexus between cause and effect can exist only if the totality of causes is *identical* with the effect, so that the process is completely reversible. For this reason Leibnitz says: 'The total effect can produce the total cause or its equivalent'[2].

This Leibnizian postulate is the reason for the physicist's attempt to explain all phenomena in terms of movement. For if an object

1 E. Taschdjian, *Modern Physics and Biological Theory*. (Scientia, Milan, 1939).
2 E. Taschdjian, *Dialectic Realism*, p. 94. (The San Yu Press, Peking, 1940).

is moved from one point to another in space, this movement is a reversible process and the body may be brought back to its original position. This is also the reason for the chemist's expressing all chemical changes in the form of equations, using the sign $\rightleftharpoons$ to express their assumed reversibility.

But this postulate of reversibility came up against a difficulty when it was realised, mainly due to Michelson's famous experiment, that time is irreversible. When a body is moved at the moment a^1 from the point A and reaches the point B at the moment a^2, the reversion of this movement will bring the body back to A not at the moment a^1 but at the moment a^3. To circumvent this difficulty, the physicists assume with Einstein that our knowledge of time is based exclusively on external perceptions, specifically on the readings of the movements of clocks, stars or other moving bodies; once this is admitted it becomes possible, with the help of Einstein's theory of relativity, to abolish the irksome irreversibility of time. For if the hands of a clock send a certain light signal at, say, 9 o'clock to an observer moving away from the clock with the velocity of light in the same direction as the light ray, this observer will evidently see the clock always in the position indicating 9 o'clock and if he moves faster than the light ray, he will actually see the clock turning backwards, since he will catch up with light rays emitted at previous moments. In this way the crack in the edifice of classical physics was successfully patched up and the theory of relativity is therefore not, as is usually maintained, the beginning of modern physics, but rather the last attempt to safeguard the foundations on which classical physics was built.

The physical postulate of reversibility evidently does not apply to the organic realm. The transformations of an organism in time, from the egg to the adult, are irreversible and a de-veloped cock cannot en-velop itself again and become an embryo. To put it another way, scrambled eggs cannot be de-scrambled. This is due to the fact that organic transformations are not merely movements of self-identical particles, but irreversible or incompletely reversible actualisations of potentialities. Furthermore, as Lecomte du Noüy has shown, biological time does not move with the uniformity that characterises astronomical time[3].

Nor can the postulate of identity between cause and effect be applied to living activity. When I give an order to a man and he carries out this order, I am justified in maintaining that I am identical with this activity. The movements of an inert body are wholly conditioned by the external forces of push and pull which

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3 Lecomte du Noüy, *Biological Time*, 1937.

act on it, and if these forces are fully known, it becomes possible to predict with absolute certainty the resulting movement. This view was expressed by Laplace when he spoke of the 'iron, eternal laws' of the universe and said that an intelligence which would know the condition of the universe at a certain moment could predict with absolute certainty its condition at a later moment. The actions of living bodies, on the other hand, can never be predicted with absolute certainty, but only with a certain probability. When I give an order to another man, I do not pro-duce his action, but I in-duce in him a certain tendency. In other words, I increase by such a normative order of the type 'you should' the probability of that action in comparison with all the other actions which, without this order, were equally probable. Such induction effects presuppose that the inducing and the responding entity have internal and not only external relations with each other and constitute thereby a 'common ground' of action. The two reacting entities thus become part of a common whole and this new entity which emerges from the interaction is in no way identical with the mere sum of its constituting elements[4]. This whole has a normative regulating effect on its parts and may be illustrated by the influence of the statutory laws of a society on its members or the influence of a specific entelechy on its representatives. Such effects, however, can only be predicted with a certain probability and never with absolute certainty and we use for their evaluation the statistical methods which are applied in biology, sociology and the other normative sciences. In other words, we express the connection between cause and effect by a correlation instead of by a function[5].

The discovery by quantum physics and wave mechanics that subatomic events can also be predicted only with a certain probability and that the laws of classical physics are nothing but statistical laws based on a large number of individual events has re-established the common foundation for both the natural and the normative sciences which had been broken up by the illegitimate attempt of classical physics to explain the whole universe in terms of movements of inert particles. But this discovery has no bearing whatsoever on the general principle of causality according to which the effect is not identical but only equivalent or adequate with the cause and constitutes (in the words of Whitehead) a new 'emergent'. Heisenberg's principle of uncertainty merely implies an abandon-

4 E. Taschdjian, *The Bionomics of Procreation.* Catholic University Press, Peking, 1942.

5 E. Taschdjian, *Typology and Topology.* Catholic University Press, Peking, 1941. E. Taschdjian, *Typology and Factor Analysis.* Catholic University Press, Peking, 1943.

ment of 'scientific' causality, which is a concept of causality the correctness of which philosophers, and not only scholastic ones, have practically always denied. It seems therefore that Dr Gledhill's apologetic effort to safeguard causality really misses the fundamental point. Statistical physics in no way endangers the validity of the true principle of causality, but it does invalidate the principle of scientific causality.

It is unfortunately true that the languages used by different disciplines have diverged so far that the philosopher, who is called upon to produce a general synthesis from their data, is often at a loss to understand the correct meaning of a scientific statement. Nothing could better illustrate the urgent need for persons who are trained both in philosophy and in the various sciences and if these lines could contribute to the realisation of this, their purpose will have been amply fulfilled. EDGAR TASCHDJIAN.

POLISH CHRISTMAS CUSTOMS

GENERALLY speaking, we may say that it is the conviction of the ordinary people of Poland that no country has been more entirely Christian from the beginning than their own. Our Lord was born in Poland, they might say, in the midst of a snowy winter and in a thatched cottage such as we still see today, and resembling those found in Ireland, in some isolated place in a distant forest. Although there are caves in certain rocky and mountainous regions in Poland, nevertheless they are remote from the daily life of the majority of the people, and so scattered as to pass unnoticed. Moreover these caves have horrible stories attached to them. Either they are the more or less magical property of the devil who hides in them treasures of uncertain origin, or else they were used by the notorious brigands of the Tatras Mountains who have such a romantic history.

So then the infant Christ came into the world in the heart of the Polish winter and in a thatched cottage or perhaps under the tumbledown roof of a barn or in the stable of some poor peasant. *Szopka*, a classical word meaning 'Christmas Crib' or a marionet theatre proper to the Christmas season, comes from *szopa*, a stall. The word seems to be connected with the French *échoppe*—like the word 'shop' in English for the pronunciation is the same, 'sz' being pronounced like 'sh'. At any rate, in the *Quo Vadis* of Sienkiewicz, the giant Ursus in speaking of Christ ejaculated: 'Oh, if only our people had been at Golgotha, they would have soon rescued the