Letters

The Scientific Method

Some months ago (25 Oct., p. 391), editor Daniel E. Koshland, Jr., wrote an editorial voicing a view (identified in the philosophical literature as "scientism") that the success of science and high technology in improving life conditions demonstrated that the scientific method is a universal method applicable to social problems. In particular, he stated that any scientist (knowing scientific method) could formulate a null hypothesis about a social problem, such as the teaching of math or the treatment of prisoners, undertake an experiment in a real-world situation, and, by statistical testing, determine the best course of action.

Three letters were published (20 Dec., p. 1410) commenting on the editorial, two laudatory and, if anything, more extreme in viewpoint, and one critical. The last, by a statistician, correctly pointed out a flaw in the design of the experiment. It strains credulity to believe that there was but one mildly critical letter about a subject on which there is an immense literature in statistical theory, philosophy, and public policy, pointing out the hazards of experimenting in the real world.

Indeed, I hope the editors of *Science* are not unaware that there are epistemological, ontological, logical, and ethical aspects of the subject of science and the scientific method. Scientism, a populist version of logical positivism, has been largely abandoned by the philosophical community. In a sense, the Koshland position is not surprising: every natural scientist seems to harbor a secret belief that potentially he is a master of every social science and could find the answer to every social problem.

It should be obvious to any scientist, however, that science could not consist solely of testing hypotheses by statistical means. If that were true, ordinary knowledge about how to start a car or open a can would be science. To be worthy of respect, science must claim to assert a lawlike relationship. In order to do so, it must be able to assert that its variables are homogeneous, and to do that, it must have some standard of comparison or evaluation, a function served by theory. It is therefore impossible to have science without theory.

Although it sounds reasonable to recommend that school children be offered courses in scientific method, it turns out that the subject, in its generality, can be approached best through philosophy, and then only at an advanced level. Anything else turns out to be history of science, introductory statistical methods or, sometimes, logic. What actually would be more to the point is to have people who have completed their scientific degrees take courses or do reading in the philosophy of science. The objective would not be to make scientists more socially conscious—although that would be a big plus—but to make them better scientists.

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Demography of China

A large-scale sample survey of the fertility of Chinese women, known as the 1/1000 Fertility Survey, was conducted in 1982. The survey, in which 311,000 women from 15 to 67 years of age supplied detailed lifetime histories of marriage and childbearing, has yielded an extraordinarily accurate record of changing nuptiality and fertility in China since 1940. The results at the national level were the basis of a 1984 analysis of population change in China (*1*).

The Chinese have also published a report on the survey (*2*). Although this report includes thorough documentation at the national level of changing age at marriage and rates of childbearing by age of women, the practice of different forms of contraception, and indications of differentials by rural-urban residence, education, occupation, and ethnicity, it could not fully utilize the enormous store of valuable information the survey contains.

This year computer tapes containing the individual responses of all women interviewed within each of the provinces in mainland China (except those in Tibet) were analyzed jointly by statisticians and demographers from China and staff members and consultants of the East-West Population Institute in Honolulu. These data are a demographic gold mine. The average number of respondents (11,000) per province is greater than in most national surveys; because of the precision with which Chinese respondents can report the date of birth and the extremely efficient organization of the survey, the data are complete and accurate. All eligible women were interviewed in each of 815 basic sampling units, which were production brigades in rural areas and neighborhoods in urban areas. It is therefore possible (by combining experience for several years) to compute fertility rates and other aggregate characteristics for each of these basic social units. Having, in effect, data for a probability sample of rural production brigades provides an unprecedented oppor-