

Letters

Congress and Space Projects: Imbalance in Hearings

McDonald's letter (29 May 1964) calling attention to the unscientific approach to certain aspects of the lunar exploration program is most timely. I suspect that a large part of the difficulty stems from congressional procedures in allocating funds for space research. . . .

During the hearings on 10 and 11 June 1963 before the Senate Committee on Aeronautical and Space Sciences, testimony was taken from 12 witnesses. Of these 3 opposed and 9 were in favor of the space program. Furthermore, 8 of the 9 proponents either were receiving substantial grants from NASA or represented companies and universities that were.

The hearings before the House Committee on Science and Astronautics on the 1964 NASA authorization resulted in 3540 pages of testimony printed in five volumes. There were more than 100 witnesses, all associated in some fashion with NASA, and no witnesses who were critical of the fundamentals of the space program. In the hearings before the same committee on the 1965 authorization, 2840 pages of testimony were printed. Again, all the witnesses were associated with NASA, and there were no critical witnesses.

The danger in this unbalanced testimony seems clear. Proponents of the moon race can make all sorts of statements and claims which are not subject to rebuttal, since the congressmen are not scientists (although some appear to have sound engineering backgrounds). Two examples are of interest. On page 204 of the hearings on the 1965 NASA authorization, a NASA official, commenting on the search for life in space as related to the fundamental nature of life, said:

At this stage in the development of bioscience, the bioscientific community finds the pursuit of these basic discoveries and the development of an encompassing biological theory the most important single task of the day.

On page 503 of the same hearings, another NASA official, replying to a question about newspaper criticism of the Apollo program, said:

I think you will find there is a growing body of scientific opinion which has now begun to examine in some detail what, actually, one can do in space. . . . That growing body of scientific opinion is that it is, in fact, not only valuable but essential to have a man to make the selection to do the geological survey work. . . .

One wonders how these NASA officials know what the bioscientific community is thinking, or how general scientific opinion views the lunar manned-spaceflight project. I am not aware of any polls or questionnaires seeking our opinions. On pages 1662 and 1663 of the hearings on the 1964 NASA authorization, the chairman of the Subcommittee on Space Sciences says:

As I have said before, I think none of us really are qualified to interrogate scientists, because we ourselves are not scientists. I would say in the field of science we are probably less informed than other members of other committees are informed on the subjects before their committees. Another real problem which I see which makes it difficult for this committee to function properly is that we never get two sides of the argument. . . . We don't have people appearing before this committee in opposition to the manned lunar landing program, or the Orbiting Geophysical Observatory, or the Surveyor program, or whatever it is.

I would like to suggest a solution to this problem. Let the congressional committees invite scientists who are critical of certain aspects of the space program to testify before them.

SOLOMON GARB
*Department of Physiology and
Pharmacology, University of Missouri,
Columbia*

One-Tailed Test and Other Statistics

The excoriation of the one-tailed test of significance by W. Dixon Ward (29 May, p. 1089) underscores the fact that authors and teachers of statistics have somehow failed to make

clear just when this procedure is appropriate. It is not "a ploy in which the researcher claims partial precognition . . ."; it is the appropriate statistical procedure when the research worker is interested only in a unidirectional effect.

When a treatment is being investigated in which there is an equal interest in an increase or a decrease resulting from its application, a symmetrical (in the probability sense) two-tailed test is required. If more interest is associated with, say, an increase, an asymmetrical two-tailed test would be appropriate. When all the interest is focused on, say, an increase, the extreme of an asymmetrical test, a one-tailed test of significance, is the procedure of choice. Thus when the experimenter cares only whether treatment X produces an increase in Y or no effect, and *does not care* about a decrease in Y, a one-tailed test is appropriate, correct, and optimum.

The only "abomination" is the a posteriori selection of a one-tailed test; and, if the reader feels so inclined, he can transform this into a two-tailed test by the simple expedient of doubling the significance level quoted by the experimenter.

LLOYD S. NELSON
*General Electric Lamp Division,
Cleveland, Ohio 44112*

In response to W. D. Ward's letter I happily stand up to be counted as one of "those who go farther and say that the gathering of data must be preceded by a specific experimental hypothesis." Physicians are generally among those who believe that once a phenomenon has been observed it is fact and truth forever after. Consequently a sample size of one is sufficient. Such abominations as probability, inference, tests of significance, distribution theory, are all worthless window dressing, and who needs statistics (or statisticians) anyway?

While it is obvious that statistics is no panacea for poorly organized "research data," it is nevertheless a useful tool which most logical-minded, objective researchers embrace. When a scientist and a statistician talk over a problem (discuss an experimental design), aspects of the problem are very often uncovered which might have gone undetected had not the statistician needed to ask questions in order better to understand what it is the scientist is trying to learn. Often a statistician will be able to point out

each on the insistence of a coauthor, I have published a fairly long list of papers in this way. When it seemed desirable, we have footnoted the contribution of each author. This practice was once common (for example, Creed, Denny-Brown, Eccles, Liddell, and Sherrington: *Reflex Activity of the Spinal Cord*, 192), but has apparently become rare as a scientific ethic. By inference it is even classed as unethical by my own professional association! Why not consider a return to such a civilized custom?

Unhappily, it now appears that *Index Medicus* has virtually mandated a non-alphabetic order for articles with more than three authors, since the names of the rest will be omitted (see Letters, 12 June, p. 1295). I hope that the editors can eventually find a way to cite all authors.

G. R. WENDT

University of Rochester,
Rochester 27, New York.

Behavioral Science Redefined

The title of John L. Kennedy's review (8 May, p. 683) of *Human Behavior—An Inventory of Scientific Findings*, by Berelson and Steiner, was most appropriate. "But what are the behavioral sciences?" is a question of increasing interest. Like many others, the authors of the book under review have defined the behavioral sciences as "those sciences that deal *directly* with human behavior" (our italics). Semantic difficulties aside, we feel that there is danger in such a narrow definition and that no particular advantage is to be gained by limiting the scope of the behavioral sciences to the study of one species.

Granted that human behavior is, in many ways, vastly different from that of other animals; nevertheless, a great deal of our present understanding of its underlying mechanisms has come from the study of other species. The danger in restricting the scope of the behavioral sciences is that this will tend to further isolate psychology, sociology, and anthropology from other disciplines concerned less directly with human behavior.

The oncoming scientific attack in the field of behavior should be as broadly based and as widely integrated as possible. It would be to the advantage of all concerned if this were formally recognized by the inclusion of relevant

ethology, ecology, physiology, neurology, comparative psychology, and so forth within the realm of the behavioral sciences.

A. J. READING
C. H. SOUTHWICK
R. L. PENNEY

School of Hygiene and Public Health,
Johns Hopkins University,
Baltimore, Maryland

White House Dinner

In a box headed "Science and society: White House tea for Academy wives" (1 May, p. 514), Elinor Langer detects warm feelings radiating toward science from the Johnson administration. Let us hope this omen, tea for the wives, speaks true love of science, but let us also keep the record straight. During the Eisenhower reign, E.L. says, "scientists were not considered very good company, and the appearance of one at a party would have been as surprising as a photo of Ike embracing Mao."

Actually it was Ike who made the grandest social gestures on behalf of scientists. Truman had invited the members of the National Academy of Sciences to the White House one afternoon, where they shook his hand and carried on a lively banter as only Harry could conduct it. But Ike really went overboard. In the middle of January 1958 a couple of dozen scientists received engraved invitations to attend a *state dinner* on 4 February. Ike had expressed to his science adviser, James R. Killian, the desire to become better acquainted with some of the scientists of the country.

In white tie and tails, amid notables in government and the military, the scientists trooped to the White House to be honored with high pomp and much circumstance. They got the full treatment.

An aide took your coat at the front door and led you forward to inspect a large plan of the seating arrangements for dinner. He also handed you a card with the name of your dinner companion. Then he led you to the door of the East Room, where you were announced, loud and clear, over a public-address system. This was the traumatic moment.

Once you were inside, however, the familiar faces of colleagues eased the shock, whereupon anxiety gave way to fellowship. When all were assembled—

some 47 couples—the Eisenhowers entered and shook hands with the guests as they formed a line and proceeded to the dining room. A magnificent dinner was eaten with the aid of gold forks, knives, and spoons in full array. The wines rose through four stages from sherry to champagne.

After dinner the men followed Ike to a reception room, for cigars, coffee, and talk. The talk was mostly about satellites and our first small success with one. The President asked many sharp questions and told how he had stayed up late to hear the news on the night of the launching.

The evening was capped by a warm and hilarious performance by Anna Russell. By the time the Eisenhowers said good night and took the elevator upstairs, a band of this country's scientists could rightfully claim the heady experience of feeling appreciated in high places.

S. S. STEVENS

Laboratory of Psychophysics,
Harvard University, Cambridge 38

African Archival Guide: Contributions Invited

The National Historical Publications Commission is sponsoring the preparation of a comprehensive guide to documentary sources, in the United States, of African history. An interdisciplinary group of Africanists chosen by the African Studies Association is serving as advisory committee; a grant for production of the guide has been made by the Ford Foundation. Complete in itself, the guide will also serve as the U.S. volume in the projected *Guide to the Sources of African History* sponsored by the UNESCO-affiliated International Council of Archives.

To maximize the coverage, I would appreciate receiving from readers information concerning the nature and location in this country of little-known archival and manuscript sources relating to Africa—particularly sources not likely to have been described in the standard finding-aid literature or, if there described, not identified as related to Africa. Africa is here defined as the entire continent plus the adjacent coastal islands (including Madagascar and the Mascarenes). There are no chronological limitations.

MORRIS RIEGER

National Archives and Records Service,
Washington, D.C.