Letters

Bees Are Easily Distracted

Wenner and his colleagues (*1*) presume to challenge findings of a great biologist. There is of course nothing wrong with this as such, but reliance on an elementary logical fallacy in doing so should not be encouraged in your journal.

In a characteristic quotation they state: "Recruited bees arrived at sites in apparent disregard of any dance information that they could have acquired before leaving the hive. Such data are not only incompatible with a language hypothesis. . . ." This nonsequitur is akin to one which faced von Frisch (*2*) earlier in his career, when von Hess asserted that bees were color-blind because he had found an experimental situation in which they ignored color.

Suppose a man tells me there is a bar three blocks down the street on the right. I set off thirsty, but on the way a strong smell of beer distracts me to another bar hidden up a side alley. Does this prove that human language does not communicate information?

Von Frisch and Lindauer (*3*) did an experiment in which a terrestrial landmark, the edge of a forest, competed with the sun as an orientation cue for bees. They found circumstances in which such a terrestrial cue overruled the sun: the bees appeared to ignore the sun completely. To conclude from this that bees do not use a sun compass would have been wrong, even if there had been no other evidence for a sun compass. The fact is of course that bees have alternative methods of orientation.

Similarly, it is entirely reasonable to suppose that bees have alternative ways of finding food—among them, the dance, smell, and the presence of other bees—and that each of these cues may predominate under different circumstances. For example, the artificial use of strong scent might cause olfactory cues to prevail, while the artificially engineered presence of large crowds of bees at control feeding stations might well distract foragers from other cues.

In brief, bees are easily distracted. This modest and uncontroversial conclusion is all that can be drawn from the experiments purporting to disprove von Frisch's classic work.

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References

1. A. M. Wenner, P. H. Wells, D. L. Johnson, *Science* **164**, 84 (1969).
2. K. von Frisch, *Bees, Their Vision, Chemical Senses, and Language* (Cornell Univ. Press, Ithaca, N.Y. 1950), p. 4.
3. M. Lindauer, *Communication Among Social Bees* (Harvard Univ. Press, Cambridge, Mass., 1961), p. 126.

Oceanography: An International Laboratory

The Commission on Marine Science, Engineering, and Resources in its recent report "Our Nation and the Sea" recommended the creation of several national laboratories of oceanography within the United States. Such organizations would make their resources available to universities and individual scientists who otherwise would not have access to the facilities necessary to carry out work at sea. Our discussions with foreign oceanographers have convinced us that this concept should be extended to the establishment of one or more international oceanographic laboratories which could serve scientists and smaller laboratories throughout the world. The need for such facilities is clear when one considers the large scope of various plans projected by UNESCO and individual nations such as those outlined in the Global Ocean Research Report of the Scientific Committee on Oceanic Research, World Meteorological Organization, and Advisory Committee on Marine Resources Research and in the U.S. National Academy of Sciences' "An Oceanic Quest."

The scale of the projects and the resources proposed for ocean exploration would overtax the capabilities of the world's existing facilities, even if they were directed to these ends alone. For example, proposed international programs over the next 10 years would require for their implementation as many as twenty-five hydrographic survey ships, forty oceanographic and fishery research ships, ten fishing vessels for systematic resource surveys, eight weather ships, an aircraft carrier with two escort ships, three deep-sea drilling vessels and five drilling barges, as well as some submarines including one with nuclear power. Further, many shore facilities will be needed for satellite tracking stations, buoy deployment and development, computer centers, and research laboratories.

The marine pollution problem is clearly international. The urgent requirement for international pollution studies does not need further emphasis; a consideration of the mechanics of monitoring the earth for a variety of inputs, taking a variety of paths from the continents to the oceans, is the point of entry into a joint quest. Here, innovations in our present techniques to handle a whole new era of research are called for.

We feel that an international laboratory, equipped on a scale commensurate to global problems, is necessary. First, large-scale problems do demand a concentration of effort involving effective and economic fleet operations, data handling, and communications within the facilities and with other meteorological, satellite, and data centers. Where synoptic studies are being carried out or where single, unexpected events occur which need subsequent observation and follow-up, as in the case of an oil-spill, a command center is essential.

Second, the laboratory, perhaps the largest one in the world because of its unique facilities, will attract the best minds in oceanography. We have already seen such a situation occurring in high energy nuclear physics, where CERN (European Council for Nuclear Research) became a gathering place for some of the world's most distinguished scientists.

Third, an international laboratory will allow scientists of smaller and developing countries to be partners in first order research instead of having to forgo this kind of experience be-

cause they do not represent large nations. At the present time it appears that the scientifically advanced countries are widening the gap in knowledge and abilities between themselves and the smaller nations of the world as a result of the high cost of conducting modern research.

Finally, the very existence of such a facility as an international laboratory will stimulate the formulation of higher levels of problems which cannot be considered with present resources. New dimensions to oceanographic research will be added with the wider availability of the best tools of the trade.

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Pyrotechnics

The editors of *Science* deserve praise for the clever and subtle cover of the Fourth of July issue. Bombs bursting in air and fireworks represented by droplets of the spray of the bombardier beetle! Man is a part of nature, sermons in stones, scientists as humorists.

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Intellectual Loneliness

Since reading various solutions for preventing the intellectual brain drain from underdeveloped countries and suggestions for improving the "intellectual loneliness" of educated and talented people in those areas (Singer, editorial, 7 June 1968, and Wolfle, editorial, 2 Aug. 1968), I have also found in my copies of *Science* (which arrive in irregular fashion) letters describing both the glut of doctoral graduates in developed countries such as Australia (Willix, 22 Nov. 1968) and the need for relevance in the training of Ph.D.'s who plan to work in underdeveloped countries (Ronkin, 3 Jan. 1969).

These editorials and letters all stress that future planning for technical manpower is essential, but it should not be done at the expense of creative and intellectual freedom. If the supply of Ph.D.'s exceeds the demand in many Western countries, there is a great need for them in developing countries, especially in higher education, industrial research, and government services. I suggest that those Western countries with a surplus of trained people establish overseas research and development divisions which would accept requests, for the services of certain specialists, from hardpressed and understaffed developing countries. This would appear to me to be more relevant than bringing foreign associates from underdeveloped countries temporarily to our Western institutions, as it would answer their immediate problems and use available facilities, instead of farming out the work to be done in a sterile, air-conditioned (and irrelevant) setting in a North American or European institute. The presence of scientists and engineers from the developed countries would also help relieve the "intellectual loneliness" of their less fortunate colleagues in these poorer nations.

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I am a Pakistani who received higher training in England and the United States and am now teaching in Canada. . . . Basically I agree with Ronkin's and Stone's (Letters, 6 June) proposals for certain supplementary training of foreign students. But I object to the idea of training a foreign student exclusively on the basis of the needs of his homeland, although these should be important considerations of the agencies which award fellowships. When a modified program for a particular student is requested, such a request should originate in the student's home institution or his homeland and should not be imposed upon him by the institution where he will be trained. Many universities rightfully impose a few necessary conditions on the foreign students from a developing country, such as proficiency in English, a number of extra courses as prerequisites, and so forth, but to go beyond that and offer them a compulsory modified program would appear to be a kind of selective training, depriving them of working in all other areas beyond the current needs of their homelands. Such a practice will obviously discourage development of future programs in their countries beyond those needs. . . .

As Stone pointed out, it is a fallacy that the developing countries should