Div., San Diego, Calif. (G. S. Bahn, 16902 Bollinger Dr., Pacific Palisades, Calif.)

29–1. International Acad. of **Pathology**, 52nd, Cincinnati, Ohio. (F. K. Mostofi, Armed Forces Inst. of Pathology, Washington 25)

29–2. U.S. Natl. Committee, Intern. **Scientific Radio** Union, annual, Washington, D.C. (Miss J. Hannaum, Natl. Acad. of Sciences, 2101 Constitution Ave., NW, Washington 25)

29–3. Society of **Photographic Scientists and Engineers**, annual, Atlantic City, N.J. (D. L. Castellini, 98 Leland Terrace, New Shrewsbury, N.J.)

May

1–3. American Assoc. for **Contamination Control**, natl., Boston, Mass. (AACC, 6 Beacon St., Suite 626, Boston 8)

1–3. **Polymer** Science and Technology, conf., London, England. (J. N. Radcliffe, Plastics Inst., 6 Mandeville Pl., London, W.1)

1–4. American **Film Festival**, New York, N.Y. (Educational Film Library Assoc., 250 W. 57 St., New York 19)

2–3. **Human Factors in Electronics**, 4th annual symp., Washington, D.C. (F. Chernikoff, U.S. Naval Research Laboratory, Code 5124, Washington 25)

2–4. Kansas **Acad. of Science**, Lawrence. (G. A. Leisman, Dept. of Biology, Kansas State Teachers College, Emporia)

2–4. American **Philosophical** Assoc., Western Div., Columbus, Ohio. (L. E. Hahn, Washington Univ., St. Louis 30, Mo.)

2–4. Virginia **Acad. of Science**, Roanoke. (P. M. Patterson, Hollins College, Hollins College, Va.)

2–5. Council of Long Island **Technical Societies**, exposition of technology and industry, West Hempstead, N.Y. (CLITS, Route 110, Farmingdale, N.Y.)

3. **Astronomy and the Peaceful Uses of Space**, Evanston, Ill. (J. A. Hynek, Astronomy Dept., Northwestern Univ., Evanston)

3–4. Colorado-Wyoming **Acad. of Science**, Fort Collins, Colo. (R. G. Beidleman, Dept. of Zoology, Colorado College, Colorado Springs)

3–4. **Endocrinology**, 2nd intern. congr., London, England. (A. S. Mason, London Hospital, Whitechapel, London, E.1)

3–4. Minnesota **Acad. of Science**, St. Paul. (M. R. Boudrye, 1821 University Ave., St. Paul 4)

3–4. Nebraska **Acad. of Sciences**, Lincoln. (C. B. Schultz, 101 Morrill Hall, Univ. of Nebraska, Lincoln 8)

3–4. North Dakota **Acad. of Science**, Grand Forks. (B. G. Gustafson, University Station, Grand Forks)

3–5. **Protides of the Biological Fluids**, 11th colloquium, Bruges, Belgium. (H. Peeters, St. Jans Hospital, Bruges)

3–5. Wisconsin **Acad. of Sciences, Arts and Letters**, Milwaukee. (T. J. McLaughlin, Univ. of Wisconsin, Milwaukee 11)

5–7. **Biometric** Soc., eastern North American regional, Cambridge, Mass. (J. Cornfield, School of Public Health, Johns Hopkins Univ., Baltimore, Md.)

5–8. American Inst. of **Chemical Engineers**, Buffalo, N.Y. (F. J. Van Antwerpen, American Inst. of Chemical Engineers, 345 E. 47 St., New York, N.Y.)

Letters

Computers and Human Values

In "The man-computer relationship" [*Science* **138**, 873 (1962)] Johnson and Kobler explore an important but, I believe, derivative problem pertaining to the humane and effective use of computers. The basic problem is: What personal and societal values and operating styles will be rewarding and useful in a civilization whose problems and opportunities are defined by very large populations, enormous social complexity, and unprecedented rates of technological change, all existing on a scale such that *only* computers will be able to deal with the conceptual models, the data to be processed, and the real-time requirements for action and decisions.

It is very important to talk about preserving a place for individual preferences and purposes when policy decisions are made, but it may well be that our present ideas about the relations of the individual to society are the products of a rapidly vanishing, loosely coupled social environment in which a

wide range of individual variability could be tolerated and indeed encouraged. With growing interdependence of many social processes and the increasing saturation of various environments, whether they be the highway, the schoolroom, the front page, or the department store counter, effective social survival for the group as well as the individual may require different values altogether. Unpleasant as it may be to contemplate, what probably will come to be valued is that which the computer *can* cope with—that is, only certain kinds of solutions to social problems.

Whether or not this will be so remains to be seen. But it simply will not do to believe that, with proper precautions, we will be able to preserve our present system of operating values and priorities. In a world which has to deal with its problems on a statistical basis because the problems are statistical in nature, the intangibles of individual preference and purpose necessarily become different from what they have been.

We must face up to the much deeper and more overwhelming—indeed terrifying—problem of inventing values which somehow will make it satisfying to be a human being living in this new kind of society. They probably won't be values *we* will particularly enjoy, but unless we face this problem we may end up with a society which totally defeats and depresses the individual.

There are many ramifications to this issue. Some are discussed in the pamphlet *Cybernation: The Silent Conquest* (Fund for the Republic, New York), which, while attending more generally to the points elaborated by Johnson and Kobler, tries to place them in the broader context of the implications for democracy of the widespread use of automation and computers.

DONALD N. MICHAEL
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Michael may be right when he states that in our article we explored a "derivative" problem, but we are not so sure. We were not unaware of the broad context in which he places the problem of the humane and effective use of computers, as is evident from many of the references in our article. Yet we see the understanding of the more immediate man-computer relationship as fundamental, and as necessary to the understanding of the broader problem to which Michael refers. Our emphasis allows for specific and concrete research efforts, some of which are under way. Thus, we do not agree that our weakness lies in not facing directly the "basic problem," as stated and elaborated by Michael.

We see in Michael's letter a contradiction: he emphasizes the need for inventing "different values altogether," while, it seems to us, accepting the dominance of a technically determined value system. For him, "the problems are statistical in nature," and "*only* computers" will be able to deal with them. We cannot agree with his definition of the problems and methods of solution. The present dominance and high evaluation of scientific method, of objectivity and quantification, of technical reason, need not continue if it is not good for man. We agree with Stover [C. F. Stover, Los Angeles *Daily Journal* (26 July 1962)] that "the notion that the majesty and the mystery of the human experience . . . can be written into a computer affronts the dignity of man."

Michael offers little hope. He seems to be saying that we are lost, doomed; we say it is not necessarily so. With the scientific-technological revolution of our day has come the growth of a vigorous social science and a concern with society on the part of physical scientists. Specific as well as general problems of technology today almost always include man as part of a mixed system. Knowledgeable persons familiar with problems of cybernation and the social sciences must turn their attention to values and priorities. While it is both easy and unrealistic to pretend that our present system of operating values and priorities should be rigidly upheld, it seems equally easy and unrealistic to assume that we must forthwith adjust ourselves to a society in which values are prescribed by absolute technical dominance.

We are not ready for the pessimism and the extreme compromise Michael offers as our best hope. While his predictions may turn out to be correct, we find ourselves with a future-oriented hopefulness. We may have been fooling ourselves in our implicit insistence that such "human values" as love, brotherhood, freedom, and liberty must be retained because man must live with the potential of achieving dignity. While we may be called conservative in consequence of our belief in these

old values, we are not Luddites. The computers are here to stay, bringing great benefits and difficulties for man. Man has not yet proved that he is able to handle the complex problems of our world. And, as our article emphasizes, we are concerned with man's frailty. But man has strength and vigor. Our age has produced a "revolution of expectations" as well as a scientific-technological revolution. Knowledge has been gained of the influence of technology on the moral order, and of the power of social forces in determining directions in which men and societies move. In this context we, and others, are searching for means by which computers can best be used to supplement human capability without the destruction of those abilities and values which we see as critical for man. Is it not possible that man can learn, that he can make changes in the areas which must be changed, while not losing those values which must not be changed?

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Turtle Grass in the Deep Sea

A deep-sea photograph, recently reproduced in *Science* [**138**, 495 (1962)], shows two "leaves" lying on the floor of the Puerto Rico Trench. These "leaves" are almost certainly the blades of *Thalassia testudinum* König, the common turtle grass of the tropical western Atlantic. This photograph is of more than passing interest because the life of the deep sea is dependent on organic material from land or the shallow seas that border islands and continents. As *Thalassia* is abundant in warm shallow marine waters, it must play a part in supplying the fauna of the deep sea with food. While the blades in the photograph looked rather clean, more often the blades are covered with attached algae, Foraminifera, Bryozoa, and other small sessile organisms.

The amount of *Thalassia* torn loose from the meadows in normal times is low. However, stormy weather or a hurricane can break off many blades, or even uproot entire plants in some situations.

An attempt was made by Thomas and his associates in 1961 to calculate the amount of *Thalassia* torn from the bottom of a bay of known size by hurricane winds. This calculation was based on the average quantity of grass washed ashore from a known area (Biscayne Bay, Florida). However, there was no way to estimate the amount of grass carried out to sea by the storm.

Fortunately, some observations were made on the abundance of displaced plant material. Harvey R. Bullis, Jr., of the U.S. Fish and Wildlife Service, directed an exploratory fishing cruise along the western edge of the Bahama Bank approximately 6 to 8 weeks after hurricane Donna had passed over the area. Shrimp-trawl hauls made by the merchant vessel *Silver Bay* in 100 to 300 fathoms brought up large masses of rotting vegetation, much of which, according to Bullis, appeared to be *Thalassia*.

Inasmuch as the continental slope in tropical areas is often found to be teeming with life, it appears that *Thalassia* must be of some importance in maintaining these populations. In addition, it supplies a suitable habitat for