Letters

Social Change and Social Science

In the letters bemoaning the paucity of research into contemporary affairs ("Research on social changes," 22 May, p. 951), the lack of money for research projects on social changes is proposed as an important factor retarding the growth of social science. On the contrary, it is a trivial factor. More to the point would be to argue that social scientists are frighteningly unaware of the goals of scientific inquiry. These letters—and Wolfle's editorial (6 Mar., p. 999)—imply that a science of social changes hangs on research into particular contemporary instances of social change, and for this, so their argument proceeds, money is needed.

I would ask if a genuine science of social change must await the coming to wisdom of research financiers. And I would answer, No! Social scientists who had, in S. S. Stevens's phrase, cultivated a love of invariance would appreciate that a good library and laboratory would provide a sure and inexpensive beginning. The whole staggering output of historical research represents a record of social changes, a treasure house of chronologically ordered, particular changes, that would make a geologist, for example (who must establish even the temporal sequences of his scanty materials), drool with envy. Surely a dedicated study of this empirical literature, with the sole aim of discovering invariant processes in any and all social changes, regardless of their particularity, might prove inexpensive and very fruitful. Once process-generalizations have emerged from such a broad survey, ingenuity and simplicity in verifying procedures could produce—and has produced (*1*)—experimental conditions in the laboratory incorporating the essential conditions, stated as tentative hypotheses, crucial to the emergence of social changes.

A social *science* would seek to establish verified process-generalizations concerning social change (of any and all varieties) as a *class* of events. To achieve this goal expensive field research on contemporary social changes is not a prerequisite. Indeed, the expense itself would not be justified, nor would the undertaking be expected to yield anything but more data to be thrown into the already oversize rag bag of unrelated findings in social "science," if the inquiry as I have outlined it has not previously been successfully undertaken. . . . Once this plateau is reached, and not before, social science must proceed to establish that the theory emerging from such inquiry is as valid in explaining contemporary social phenomena as it is "in handling the controlled variables of the laboratory experiment" (*2*), "that the generality of any finding [in the laboratory], the validity of any theory in social science, must finally be tested on the basis of its adequacy for [explaining] events of every day life, when human beings carry on the business of living" (*3*). Social science would proceed to research on contemporary social changes in the light of such theory, with a view to substantiating or discarding it. Perhaps then it would be worth such exorbitant claims (see *4*).

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References

1. See M. Sherif and C. Sherif, *An Outline of Social Psychology* (Harper and Row, New York, 1956, rev. ed.), chaps. 8 and 9. These chapters report a few of M. Sherif's epoch-making experiments in social psychology.
2. M. Sherif and H. Cantril, *Psychol. Rev.* **52**, 297 (1945).
3. M. Sherif, *An Outline of Social Psychology* (Harper, New York, 1948), p. 84.
4. See further: B. L. Koslin, *Preliminary Experiments on the Process of Norm and Attitude Change During Collective Behavior*, unpublished Ph.D. thesis, Univ. of Oklahoma, 1963; A. Pollis and B. L. Koslin, *Am. J. Econ. Sociol.* **21**, No. 2 (Apr. 1962); F. J. Teggart, *Theory and Processes of History* (Univ. of California Press, Berkeley, 1960).

Ground Water: Definition

Definition of terms that purport to describe the water cycle has been one of the factors which preserve an aura of the unknown in hydrologic science. Harold E. Thomas and Luna B. Leopold, in their article "Ground water in North America" (6 Mar., p. 1001), first treat ground water as water stored within the zone of saturation under the land surface, and later as "all the water beneath the land surface." I respectfully submit that this ambiguous definition will not do. Although it may seem at first trivial to quibble over terms, this is an old and deep-rooted misunderstanding among specialists studying different portions of the hydrologic cycle. O. E. Meinzer is generally credited with settling the place of ground water in hydrology (*U.S. Geol. Surv. Water Supply Paper No. 494*, 1923). He was clear in defining ground water as specifically the water contained within the zone of saturation. Meinzer went on to describe the zone of aeration above the saturation zone as the "no man's land of hydrology." As recently as the April 1964 issue of *Ground Water*, O. M. Hackett, in an editorial, again referred to the zone of aeration as "no man's land."

What is not generally recognized is that the zone of aeration, which can be a hundred or more feet deep in upland areas, is a huge reservoir for subsurface water. Year in and year out, these layers of porous, unsaturated materials receive water and slowly transmit it downward to springs, ground water, streams, and even wells. Many studies in soil physics, agriculture, forestry, and hydrology have shown that Meinzer's early concept that water in the zone of aeration can be removed only by plant or soil evaporation is clearly in need of revision. But still the idea lingers that only water within the zone of saturation is a resource worth accounting for, and huge volumes of porous materials above the water table continue to be the no man's land of hydrology.

Thomas and Leopold write,

> We have been discussing ground water more or less as if it were distinct from the rest of the hydrologic cycle. Such segregation has been common among hydrologists as well as the general public, and is reflected. . . . in the division of responsibility among government agencies. . . .

I wonder if it is not the other way around, that division of responsibility

itself has led to compartmentalization of hydrology into ground water, surface water, and no man's land.

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We subscribe to Hewlett's concern for ambiguous definitions, but apparently he has misinterpreted or misread parts of our article. He says that we "first treat ground water as water stored within the zone of saturation under the land surface, and later as 'all the water beneath the land surface.' " We did not define ground water later as "all the water beneath the land surface." Our statement reads, "Ground water, or more broadly all the water beneath the land surface, is distinctive in hydrology . . ." We believe that the words "or more broadly" fully qualify the statement to indicate that "all the water beneath the land surface" includes other subsurface water in addition to ground water.

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Esthetic Values and Power Lines

The general sentiments expressed by Harold E. Thomas of Woodside, California, on conservation and on the attractiveness of the local scene (Letters, 10 Apr., p. 135) are completely in accordance with mine. In the continuing competition between preservation of natural resources and esthetic values on one hand, and purely economic motives on the other, we must be willing to discount the short-range economic arguments more and more. This remark applies to private agencies, to local communities, and to agencies of the federal government.

Unfortunately, these sentiments do not support in any way the conclusions of Thomas and the city of Woodside in relation to the dispute concerning the power lines to the Stanford Linear Accelerator Center which the AEC has contracted for with the Pacific Gas and Electric Company. As evidenced by Thomas's letter and the recent article in *Science* about the Stanford Linear Accelerator Center (News and Comment, 27 Mar., p. 419), this matter seems to have become of more than local interest. The proposal made by the PG&E to the city of Woodside and the San Mateo County Planning Commission—which was accepted by the County Planning Commission (not "denied," as Thomas wrote) but refused by the Woodside Town Council and now the San Mateo Board of Supervisors—was to construct a line about 4 miles long supported on painted steel poles of average height 70 feet (not "towers," as stated by Thomas). The middle sketch in Fig. 1 shows the type of pole to be used. Of the 34 installations in the line, five would be in the city of Woodside and eight in San Mateo County; most of the installations would be single poles but some would consist of three. Since the line would carry 220 kilovolts, it would cost about $400,000 a mile to put it underground with current practices. Woodside presently contains 1700 poles of the more conventional wooden type ranging in height from 45 to 75 feet and carrying pole transformers and other equipment, as shown in the right-hand sketch in Fig. 1: 1400 of these were inherited by the city when it incorporated; the city constructed 25 more while contesting the AEC-contracted lines. The local power lines could be put underground at a cost of $30,000 a mile or so, since they carry much lower voltage. It is against this background that the AEC found it difficult to justify the high cost of putting the 220-kv circuits underground, although it supported undergrounding all SLAC secondary (less than 12-kv) circuits, in conformance to Stanford (but not Woodside) practice. . . .

The crucial issue before the public is therefore not whether the federal government is coming into the city spoiling a carefully guarded natural resource, but whether the federal government can be forced by local jurisdictions to adopt standards which are more stringent and costly than those applied to local users. Since the proposed pole line is actually a great improvement on local practices of transmitting very-high-voltage power by means of the tower structures commonly used (Fig. 1, left-hand sketch), and since the need for power for SLAC is urgent, we believe that the pole described should be an entirely acceptable solution.

As a long-range problem the encroachment of overhead public utilities on the landscape is becoming serious. It might therefore be proper for the federal government to engage in a joint effort with the utilities to improve the engineering of underground installation with a view to reducing the cost. . . It is clearly impossible for the federal government to adopt practices by which the cost of transmission

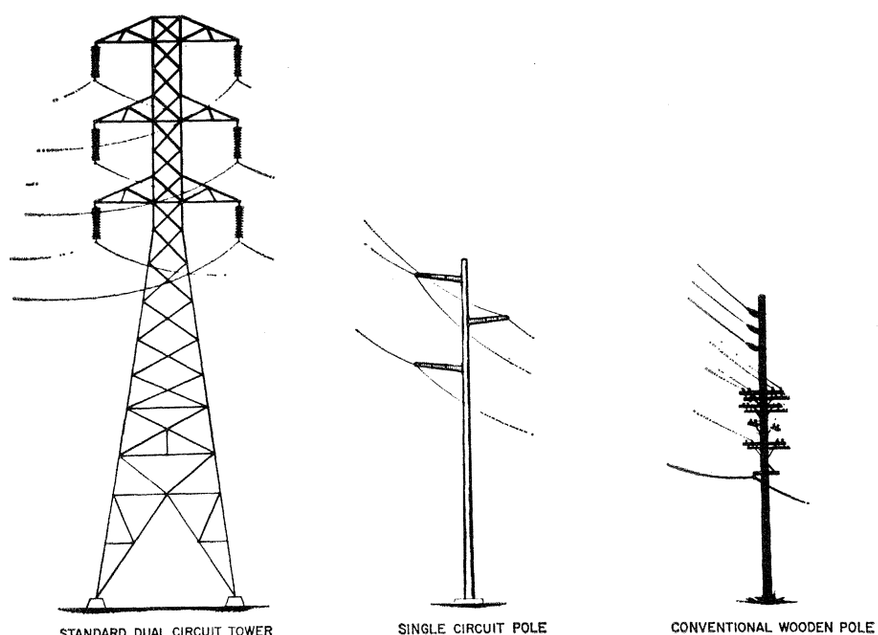

Fig. 1. Types of power poles involved in the current discussions on supplying power to the Stanford Linear Accelerator Center. (Left) Standard tower used by utilities for overhead transmission of 220-kilovolt power; (center) single-circuit pole proposed by the Pacific Gas and Electric Company to supply power at 220 kilovolts to the Stanford Linear Accelerator Center; (right) conventional wooden pole common in California communities for carrying lower-voltage circuits.