technological and economical advances puts battery research and development in a unique position. This fact should be recognized when programs dealing with future energy R & D are formulated. A large-scale effort, with a multidisciplinary approach (electrochemistry, solid-state physics and chemistry, surface chemistry) to the solution of the pertinent problems, should be seriously considered.

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Psychological Response to Tornadoes

Sims and Baumann (30 June 1972, p. 1386) attribute the remarkably high number of tornado deaths in the South to the psychology of the population. While human response to potential danger is always a factor in survival, Sims and Baumann do not prove that response is the controlling factor in the case of tornadoes.

The sizes of the samples that are compared, 33 people in the North and 24 in the South, are unacceptably small, and the populations, exclusively female with elementary education and unknown religion, are not representative of the regions. It can be argued that the "watch the sky" Alabama approach is more prudent than watching the news on television. Pertinent questions about available safe shelters, timely warnings, and response to actual tornado sightings were not asked. Also it has not been proven that tornado victims in Alabama died without seeking shelter. The conventional refuge place, the southwest corner of a building, has been shown *not to be* the best place to survive a tornado (*1*).

We disagree with the statement that "no easy generalization relating housing type to tornado casualties is possible." Mehta *et al.* (*2*) and Reynolds (*3*) have shown by means of damage surveys that tornado damage and deaths can be reduced markedly by tighter building codes that require the anchoring of houses to foundations and the use of mobile-home tie-downs. Fujita (*4*) did not find an inverse relation between damage and structural strength, but rather showed that these are local inhomogeneities in the tornadic wind field. The effect of open windows and impact of flying objects (perhaps from substandard houses) should also be considered.

The statement that "the most accurate measure of a tornado's ferocity is the length of its path" is an oversimplification. Fujita and Pearson (*5*) consider also the path width and severity of damage, and Reed (*6*) has shown that the average area destroyed per tornado reaches a peak in the South that is 2 to 4 times higher in Alabama than in Illinois.

The significance of Skagg's work (*7*) on the diurnal distribution of tornadoes appears to have been missed by the authors. In the South there is an earlier primary maximum (12 noon, local standard time) and a much flatter frequency distribution than elsewhere. Hence, there is a greater chance in the South of a nocturnal tornado striking an unaware population. Furthermore, the tornado death index as defined and used by Sims and Baumann is in fact not an index because it is expressed in units of square miles.

While the authors' statistics bear on all tornadoes, only 1.5 percent of them account for 85 percent of the deaths (*8*). Perhaps an analysis of the frequency of "intense" tornadoes would reveal a higher frequency for the South.

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9. We wish to acknowledge Griffith Morgan for his contribution to this letter (Illinois State Water Survey, Urbana).

Sims and Baumann attempt to explain ". . . the disproportionately higher frequency of tornado-caused deaths in the South" as a function of differences in psychological characteristics between Northerners and Southerners. The possibility that difference in construction of dwellings is an important causative factor was examined, but the authors concluded ". . . no easy generalization relating housing type to tornado casualties is possible." It should be noted that *above ground* differences in construction of dwellings were the only ones considered by Sims and Baumann.

In the more northerly portions of the United States, cellars (or basements) are common features of private and public structures. In addition to cellars which form integral parts of homes, nearby "root" or storm cellars can probably still be found in some rural areas of the North, although the ratio of storm cellars to people must be much less now than in earlier years. Underground sheltering areas of all kinds are much less common in the South.

In areas where cellars are abundant (the North), a tradition of "going to earth" when a tornado seems imminent has been long established. In my experience, it is understood by people without cellars that neighbors who have them will provide refuge if needed. If no study has been made of the relationship between availability of cellars and mortality from tornadoes, perhaps one should be made.

Sims and Baumaan make the point that watching the sky around one's home instead of listening to broadcasts emanating from distant points may be "psychologically anachronistic." However, one may actually be able to assay immediate danger somewhat better. It could be argued that the former approach better demonstrates "the sense of being autonomous" than "the sense of being directed by outside forces."

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Some of Sims and Baumann's conclusions presuppose that severe storm forecasting is equivalent for both the South and the Midwest. This is a very doubtful assumption. It is also questionable that communications are equivalent in the two regions.

It would, in particular, be unfortunate if use of "one's own senses" in lieu of "technology" would be considered a lack of sophistication. Even the best forecasts of severe storms, valid for hundreds of square miles, do not pinpoint tornadoes. Specific warnings usually have to be supplemented by actual sightings or radar observations when a tornado is either about to form or already in progress. Yet, as a professional meteorologist, I would not only personally rely on, but strongly advocate for others, the use of one's own senses. Sky aspect prior to the outbreak of severe storms or tornadoes is often so characteristic that from 20 to 60 minutes of warning time is locally available.

If elementary education included a bit of sky watching and the use of slides and movies of clouds, as well as some instruction on the dangers of lightning, many unnecessary weather deaths could be eliminated.

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The article by Sims and Baumann on cultural attitudes and tornado deaths presents the argument that a higher proportion of Southerners are killed by tornadoes because of an implied set of typically Southern characteristics: "Fatalism, passivity and . . . lack of trust in and inattention to society's organized systems of warning. . . ." Millions of Southerners are apparently thus classified on the basis of 24 individuals from 4 counties in Alabama.

My thoughts go back to my childhood on a farm in Oklahoma. I wish Sims and Baumann could relive with me the experience of awakening at 2 a.m. to an incredible roar, running wildly for a storm cellar while parts of trees and clouds of dust swirl about your head, and finally sitting for part of the stormy night on a box in the damp cellar while fruit jars (and water moccasins) float about your feet. Fatalism? Passivity? Bunk!!

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Davies-Jones, Golden, and Schaefer state that we ". . . attribute the remarkably high number of tornado deaths in the South to the psychology of the population." We do no such thing. In-

deed, we carefully state that ". . . we are not, of course, arguing that the psychological dimension of internal-external locus of control is the sole, or even the primary, determinant of the tornado death rate. Almost certainly that phenomenon is a result of multivarious forces in combination, of which the sense of locus of control is but one." We then suggest that not only other *psychological* dimensions need exploration, but that ". . . traditionally considered factors, such as quality of housing and storm violence, need to be reexamined with more and better data." These statements were not ritualistic reservations; they were said because they were meant.

But if we insist upon being taken at our word, we pay these authors the same courtesy. Assuming the literature they cite is the "more and better data" needed to show that inferior housing and greater storm ferocity in the South are at work in determining the South's greater tornado death rate, we take it that they are *not* therefore arguing that this "proves" *them* to be the "controlling" factors, nor that this would disprove the *contributory* influence of the psychological factor we discuss. Our data remain, and as Davies-Jones, Golden, and Schaefer themselves avow: ". . . human response to potential danger is always a factor in survival."

We agree with Pine's main argument that there are more basements and root or storm cellars in the North (the implication being that fewer Southerners have an available refuge). But if so, isn't it important to ask why? Assuredly, climatic differences and corresponding differences in building costs would figure in determining the relative infrequency of basements as integral parts of homes in the South. But can such reasoning also account for fewer storm cellars? Were the once commonly found "cyclone" cellars in the rural North there because its farmers lived in a colder climate, were richer, or because they thought it would be a good idea to have a safe place to go to in case of a tornado?

Landsberg's letter rightly stresses both the diffusiveness of tornado forecasts and the usefulness of one's own senses in judging the local imminence of the danger. But we were not advocating the nonuse of one's ears and eyes, we were calling attention to the Southerners' seeming neglect of the benefits to be derived from their technological extension—the communications media. The danger in exclusive reliance on one's own senses seems supported by Landsberg's argument that there is a need for proper education.

We fail to see the logic of Pedersen's argument. Are we to generalize to millions of Southerners both his parents' forethought in having a storm cellar and the good sense to use it? The point is that our Alabamians showed no inclination to join him in his uncomfortable but safe hole in the ground.

The considerable amount of mail we have personally received regarding this article comes in three kinds—complimentary, helpful (citing more references, suggesting other relevant variables, and so forth), and outraged. It is the strength of the anger expressed in these last which strengthens our conviction that the basic argument made in the article needs to be made again and again: the quality of man's interaction with nature is, in part, determined by forces within himself of which he is unaware. The fact that many find this thesis to be infuriating, repugnant, or humiliating is not new. In a lecture delivered in 1917, Freud, attempting to explain the antipathy to psychoanalysis, reviewed three blows to man's self-love: the realization that our earth was not the center of the universe, the realization that man was descended from the animal world, and finally, ". . . the third and most bitter blow from present-day psychological research which is endeavouring to prove to the 'ego' of each one of us that he is not even master in his own house" (*1*).

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A Doctorate Earned

William D. Metz, in "Physics at a turning point?—Interview with Freeman Dyson" (Research News, 16 Mar., p. 1114) reports that "Freeman Dyson never earned a doctorate, but rose very rapidly. . . ." The "never" clause is misleading, and the "but" should be "and."