best ones, if several were of equal value). Such a computer would be a "perfect chess player." No other player, human or mechanical, could exceed its skill. In a recent article on this subject the authors found it expedient to limit the computer's review to the consequences of a relatively small number of steps in advance. The result, as I recall, was a respectably effective mechanical chess player which could defeat most human contestants. This is clearly a practical compromise which falls short of attainable efficiency. The efficiency of the compromise could be expressed in relation to that of the "perfect chess player."

Similarly, according to the deterministic postulate it would be possible, in principle, to construct a "perfect decision maker" if we could include in its programming all the relevant data and their interrelations. Following its advice, we would be in a position to make infallibly the best choice of action concerning every decision which confronts us. (An element of futility enters here because in such a deterministic world our choices would always be predetermined, but this would have to be accepted as an unavoidable cognitive dissonance.) The lesser efficiency of any practically attainable decision-making device or process would be measured in relation to that of the "perfect decision maker" and would, I fear, be very low indeed.

On the other hand, the postulate of freedom could lead to a different standard of decision-making efficiency. An appropriate analogy might be the construction and programming of a computer to play a game against a contestant who had the privilege of changing the rules at any move, provided each new rule were (i) clearly specified and remained permanently in effect for the duration of the game; (ii) not inconsistent with previous rules; and (iii) open-ended, that is, did not by its consequences terminate the rule-making privilege. It might be impossible to construct a "perfect player" for such a game, since the possible number of moves is no longer necessarily finite. A very effective player could possibly be devised by providing for the anticipation of a suitable number of moves. Perhaps there would be an optimum number of anticipated moves that would define a "most efficient player." I offer no answer to this problem. I offer the problem as an example of one which is suggested by consideration of the postulate of freedom, which can be specified with sufficient definition to invite intelligent attack, and which would appear to lead, if soluble, to interesting and important results.

CHARLES B. WOOSTER
State University College,
New Paltz, New York

Some of Boring's examples of cognitive dissonance may be reclassified as *real* and *virtual.* The virtual beliefs or attitudes are subject to experiment and are therefore trivial in an inspection of the human journey: these include the geocentric system of Ptolemy versus the heliocentric system of Copernicus and mysticism versus accurate observation. His real incompatibilities include, for example, "Accept tutelage from the wise *but* maintain your own independence" and the antithesis between freedom and determinism. Such dissonances have been harmonized by the principle of complementarity formulated by Niels Bohr (*1*).

Bohr pointed out frequently that if one probes for the wave-nature of light with equipment designed to study this property, one gets a wavelike answer; if the experiment is designed to test the corpuscular nature of light, one gets a particle-like answer. Further, "if we prove the corpuscular character of an experiment, then it is impossible at the same time to prove its wave character, and conversely" (*2*). By analogy, if one tests for determinism by holding a lighted match near an unsuspecting man's foot one gets a mechanistic response, but if one asks, "Will you see *Murder in the Cathedral* on Tuesday or Thursday or not at all?", one encounters uniqueness. In the words of Bohr, "In an objective description of our situation use of the word volition corresponds closely to that of words like hope and responsibility, which are equally indispensable to human communication," and "any apparent disharmony can be removed only by an appropriate widening of the conceptual framework."

One does not live in spite of the dissonances of the real type but, rather, in keeping with them. Paradoxically, these dissonances are intensive manifestations or attributes of every personality. To contradict Boring, freedom is not a preference for ignorance, but rather an acceptance of ignorance.

A. D. MCLAREN
University of California, Berkeley

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1. N. Bohr, *Atomic Physics and Human Knowledge* (Wiley, New York, 1958).
2. M. Born, *Atomic Physics* (Hafner, New York, 1962), p. 103.

The Cultures on the Campus

Lafore's discussion of the "cultures" on each campus (21 Aug., p. 790) is most disturbing, not because I question the authenticity of his observations but rather because I suspect he is quite right. On every campus there are many men trained in the sciences who are not scientists but capable technicians, and there are a like number trained in nonscientific disciplines who should be classified as the equivalents of technicians.

The average person from one so-called culture cannot communicate with the average person from the other. But it is hard for me to believe that the outstanding people in one would have difficulty communicating with members either of their own or of the other culture. In fact, I believe that among such outstanding people there is only one culture, encompassing the entire field of knowledge.

Historians often characterize the culture of a particular time and place in terms of its best elements. Shouldn't we apply this same perspective to our colleges and universities?

HAROLD E. YOUNG
School of Forestry,
University of Maine, Orono

Laurence Lafore's article "One Campus, Two Cultures" is delightful and persuasive. I have, however, a minor point of argument. I think that scientists have a "sense of unity" not merely because they remember the "day when the several sciences were in fact one," but because each has been trained in the use of scientific method, the tool essential to all the specialties in science.

Once having learned and used the principles of scientific method, a person ought to think differently from someone who has never encountered them. I think that most scientists at least intuitively understand that this tool is the most valuable possession they have. Perhaps that is the main reason why, to use Lafore's words, scientists "insist that a knowledge of science is indispensable to the good life."

JANET JEPPSON
985 Fifth Avenue, New York 10021