approach a point, though sustaining a balance in this instance is difficult and rare.

▶ Laws explained how balance is restored by moving the upper body in the direction of the fall to create a reaction force of the floor against the feet in the opposite direction. While it is implied, something could have been said directly about the role of inertia in providing an impetus for the force. A tightrope walker using a balance bar is an illustration of this inertia. Conceptually, a dancer's head, arms and torso can be substituted for the balance bar in the above example.

Undoubtedly, Laws addressed some of these points in his book *The Physics of Dance*, which I eagerly look forward to reading.

MONTE MAKOUS
Bryn Mawr Ballet
4/85 *Bryn Mawr, Pennsylvania*

KENNETH LAWS REPLIES: The thoughtful letter from Monte Makous indicates that he exemplifies that unusual combination of physical insight and sensitivity to dance. I am pleased to respond to the five points in his letter:

▶ Does balance require good "placement" of the body? Balance is a condition involving only the location of the center of mass relative to the area of support. This condition can be met whether or not the body is "well placed," a circumstance that involves only the orientation of the different body parts relative to each other. Thus, although a dancer may find balance easier if the body is well placed, the two conditions are physically separable.

▶ This alternative technique for achieving a "floating" illusion is excellent. The mind of the observer may indeed translate an unchanging body configuration into an illusion of "floating."

▶ The discrepancy in rotation periods for the *arabesque* turn was inadvertent.

▶ Makous points out that one must deal with an *area* of support rather than an idealized *point* of support. That is true, of course, and is taken into account in my book *The Physics of Dance*. The point made in the article, however, is that manipulating the body so as to exert an appropriate horizontal force against the floor is the action that must be taken to regain balance. Idealizing to a point of support not only suffices for this analysis, but also approximates the situation of balance *en pointe*, which is not as uncommon as is implied in Makous's letter.

▶ Rotational inertia is, of course, the reason the technique for regaining balance works. The analogy of the tightrope walker with a long pole is accurate and remarkably apt. One is led to intriguing analyses of other dance movements, some of which involve the same principles a cat uses in flipping over when dropped from an inverted position.

A final note: It has become clear to me that many people—not just dancers and scientists—have an inherent interest in understanding how the human body moves. This presents us with an intriguing opportunity to communicate our physics interests to others, accepting that our field is characterized as much by the approach to nature as by the subject matter. The rewards of such communication are great!

KENNETH LAWS
Dickinson College
9/85 *Carlisle, Pennsylvania*

Neutron scattering

The cover story, "Special issue on neutron scattering," in your January 1985 issue (page 25) is mistitled. It should be "slow-neutron scattering," or better yet, "neutron scattering in condensed-matter physics."

The term neutron scattering includes studies of fast-neutron scattering, which are not covered at all in your special issue, but which are of very considerable interest, as already pointed out in recent issues of PHYSICS TODAY (March 1984, page 136; April 1984, page 13).

LAWRENCE CRANBERG
4/85 *Austin, Texas*

Third atomic bomb?

The transcript for the NBC program "Meet the Press" on Sunday, 27 January 1985, with Senator Barry Goldwater (R-Ariz.) as the guest and Marvin Kalb and Roger Mudd as correspondents, reads in part as follows:

> Sen. Goldwater: Well, we've used two atom bombs.
> Kalb: Right.
> Sen. Goldwater: We've used another one, I forget the name of it, I think we've used one of them in Vietnam where it theoretically just cleared a large, big circle out of everything.

Several people who viewed the program recall that Goldwater used the word "three" in referring to the two nuclear detonations in Japan plus the one in Vietnam. In any event, whether the transcript is verbatim or not, Goldwater has made a public statement claiming that the United States detonated a nuclear weapon in Vietnam. Such a detonation cannot go uninvestigated in light of the public pronounce-

ments against nuclear weapons that the United States Government has made, not to mention the treaties the United States has signed. Assuming that the detonation took place after the signing of the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, it would clearly have been a violation.

I am undertaking a study of the possibility that a nuclear detonation could have taken place without immediate detection and of the means that could be utilized at this late date to determine if such a detonation took place in Vietnam. Anyone with any information to share on this subject can write me at: 23939 Rooster Hill Road, Nevada City, California 95959.

Erich Hutzler

4/85 *Nevada City, California*

Complexity and understanding

The review of J. F. Traub, G. W. Wasilkowski and H. Wozniakowski's book *Information, Uncertainty, Complexity* by John Bartholdi III and Joseph Ford (June, page 75) was exceptionally interesting. It did not, however, explicitly mention what seems to me a very promising aspect of algorithmic information theory for physics. This is the possibility that this theory may offer real help with the problem of distinguishing phenomenology from understanding in fundamental physics. The steadily increasing complexity of physical theory has made this distinction more and more difficult. While logical positivists, if they still exist, would say that there is no difference, a good case can be made that there is, and that although phenomenology can lead to understanding, there is a distinction between them. One possible basis for such a distinction is that the ratio of the information content of the assumptions to that of the results would be expected to be higher in a phenomenological theory than in a deep theory.

In an early paper on algorithmic information theory, R. J. Solomonoff suggested[1] a model of a scientific theory that could be useful in this connection. In this model the theory becomes one tape of a Turing machine, with the initial conditions of an experiment being a second tape and the calculated results a third. Using this model one could compare different theories giving the same results and thereby find the shortest algorithm and—to the extent that such tapes represent a reduction to a common formalism—the simplest. An obvious first step would be to try this approach on historical physics, where we believe we can clearly tell phenomenology from understanding.

Algorithmic information theory can offer some help in minimizing the length of an algorithm having given logical capabilities. There is no useful general solution to this problem—and quite possibly there can't be—but minimum algorithm lengths are known for a number of problems and the minimum algorithms themselves for some of these. At the least, AIT gives an answer to the strongest objection to using simplicity as a measure of merit in theories: that simplicity is too dependent on the formalism in which the theory is cast. Here all formalisms are reduced to a common language: the Turing tape. Perhaps simplicity is not a proper criterion; truth obviously has a higher priority. There is some reassurance, however, in Albert Einstein's view[2] that "we are seeking the simplest possible system of thought that will bind together the observed facts."

This of course may not be the right approach to the problem of understanding. As an experimentalist I am content to leave that judgment, and the hard work, to the theorists. However, I do want to add a sententious but possibly useful warning, that fundamental physicists should take the problem of understanding more seriously. Not only is it important in physics itself—understanding is more reliable and fruitful than phenomenology—but it is perhaps even more important for the role it plays in explaining our views of nature to the society in which we live. We have an ineluctable obligation to justify ourselves and our roles in this way to those who pay for fundamental physics.

References

1. R. J. Solomonoff, Inf. Control **7**, 1 and 224 (1964).
2. A. Einstein, *The World As I See It*, Covici-Friede, New York (1934), p. 138.

Roy Ringo

Argonne National Laboratory

7/85 *Argonne, Illinois*

Word-processed manuscripts

A recent letter in PHYSICS TODAY (April 1985, page 15) mentions typographic defects in manuscripts submitted for publication. I call attention to two types that are also at fault, that is, those for the Arabic numerals 1 and 4, which should be Gothic (sans serif). Perhaps serifs were attached to these two characters to conform with the practice of putting serifs at the base of all Roman letters with vertical stems, but 1 and 4 are Arabic characters, not Roman.

On a typewriter or printer the serif

continued on page 96