

# to the editor

## Gravity and infinity

Perhaps I'm way off base, but I thought it was the velocity that required the rest mass of a photon to be zero, not the range (SN: 5/24, p. 512). Then in the relativity

equation,  $m = \frac{m_0}{\sqrt{1-v^2/c^2}}$ , the photon

itself may have a motion finite mass,  $m$ , via the indeterminate form

$m = \frac{0}{0} = \frac{0}{\sqrt{1-c^2/c^2}}$ . If the graviton has a

finite  $m_0$ , then  $v^2$  must be less than  $c^2$  and the graviton must be propagated at less than the speed of light, which seems most unlikely.

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*(Either criterion works equally well, depending on whether you start from special relativity or from Yukawa's interpretation of the uncertainty principle. The relationship between range and mass of intermediate particles is derived from the uncertainty principle and this allows them to be compared with one another. A graviton with mass would go slower than the speed of light, just as pions, the intermediate particle in strong interactions, are known to do. Ed.)*

## Clarification

The first paragraph of my letter (SN: 5/10, p. 445) may have served to obscure rather than illustrate my basic argument. A typographical transposition makes it sound as though Amitai Etzioni in his article on "basic human needs" is proposing that aggression is "an instinctive territorial imperative." The term is not Etzioni's but is associated with Robert Ardrey's book "The Territorial Imperative." Etzioni does not posit aggression as a basic human need in his article in the December 1968 AMERICAN SOCIOLOGICAL REVIEW.

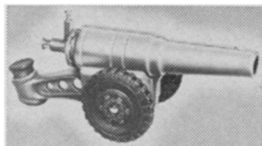
My reason for mentioning Etzioni, Ardrey and Parson's ideas in connection with my previous letter was that they all seem illustrative, in one way or another, of a relatively deterministic view of human conduct which leaves little room for human adaptiveness

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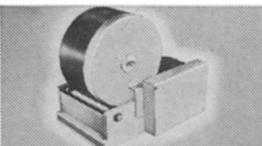
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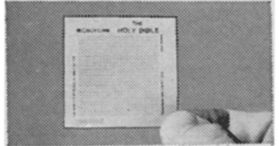
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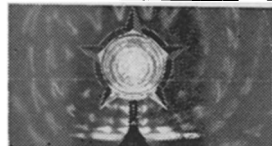


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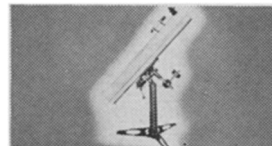
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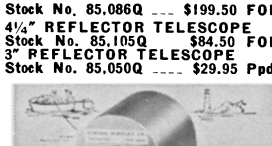
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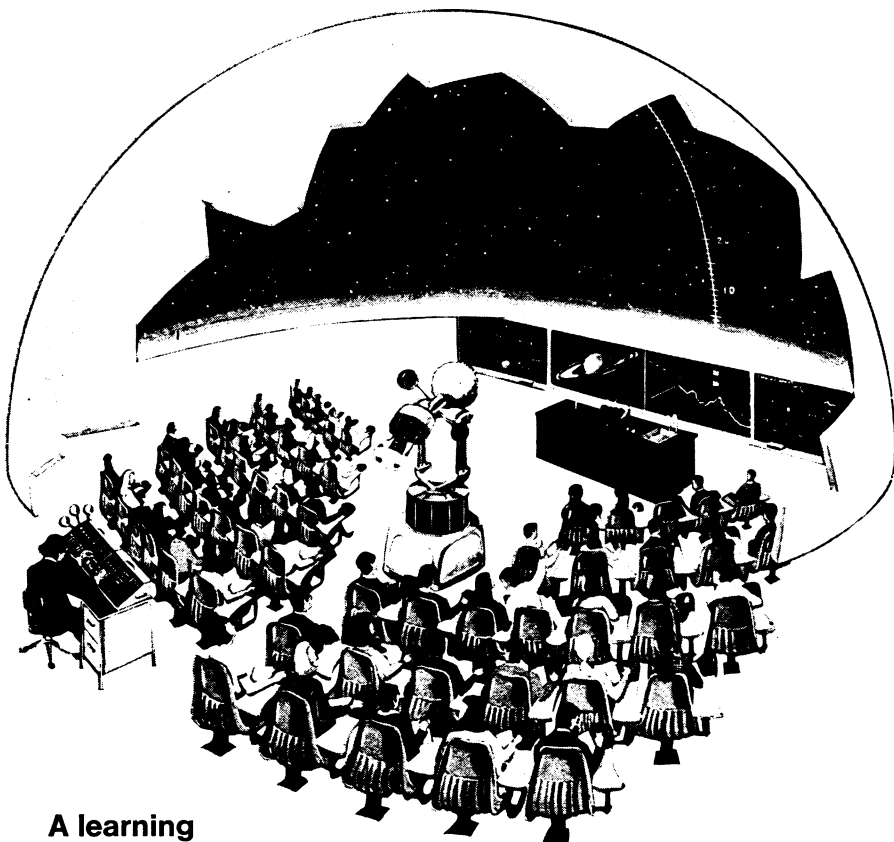
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(i.e., "intelligence") to overcome conditions imposed "naturally," whether by heredity, nature or society. Neither Parsons, Etzioni nor Ardrey, so far as I know, agrees with the idea that intelligence is determined primarily by heredity, which was the hypothesis of major concern. Each of their ideas is worthwhile, of course, just as is Jensen's hypothesis that heredity has a good deal to do with intelligence. But it seems clear that no one hypothesis about human behavior adequately encompasses the varied contexts of action men engage in.

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## Gigahertz and Googol

Mr. J. M. Reynolds' letter inquiring about the gigahertz (SN: 6/14, p. 568) reminded me of the googol. Invented by the American mathematician Edward Kasner, who died in 1955, the googol is equal to 1 with 100 zeros after it ( $1 \times 10^{100}$ ), or "ten to the tenth to the tenth."

Dr. Kasner reportedly coined the word to help his students handle huge numbers. Has it ever come into general use in the scientific community?

Walter Benjamin

Brooklyn, N.Y.

(Among scientists who habitually use large numbers, the general custom is that anything over a million is usually written in figures and spoken that way, e.g.,  $10^{40}$  pronounced "ten to the fortieth." In more than 10 years we cannot recall anyone saying or writing googol. Ed.)

## Viewing with alarm

Thank you for forwarding the June 28 issue of SCIENCE NEWS, with the very interesting article on disposal of CBW materials at sea. While I don't recall referring to the potential as "truly catastrophic" I suppose that in a literal sense this is true; the possibility certainly exists. The remainder of the material discussing Atlantic oceanography is very well put.

I believe that most oceanographers would join me in viewing with alarm the long-range use of the ocean as a promiscuous dumping ground.

T. K. Treadwell

U.S. Naval Oceanographic Office

Washington, D.C.

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