

American Association for the Advancement of Science

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Publisher: Richard S. Nicholson

Editor: Daniel E. Koshland, Jr.

Deputy Editor: Ellis Rubinstein

Managing Editor: Monica M. Bradford

Deputy Editors: Philip H. Abelson (*Engineering and Applied Sciences*); John I. Brauman (*Physical Sciences*); Thomas R. Cech (*Biological Sciences*)

EDITORIAL STAFF

Senior Editors: Eleanore Butz, Martha Coleman, Barbara Jasny, Katrina L. Kelner, Phillip D. Szurromi, David F. Voss
Associate Editors: R. Brooks Hanson, Pamela J. Hines, Kelly LaMarco, Linda J. Miller, L. Bryan Ray

Letters: Christine Gilbert, *editor*; Steven S. Lapham

Book Reviews: Katherine Livingston, *editor*; Teresa Fryberger

Contributing Editor: Lawrence I. Grossman

Chief Production Editor: Ellen E. Murphy

Editing Department: Lois Schmitt, *head*; Julianne Hunt

Copy Desk: Joi S. Granger, Margaret E. Gray, MaryBeth Shartle, Beverly Shields

Production Director: James Landry

Production Manager: Kathleen C. Fishback

Art Director: Yolanda M. Rook

Assistant Art Director: Julie Cherry

Graphics and Production: Holly Bishop, Catherine S. Siskos

Systems Analyst: William Carter

NEWS STAFF

Managing News Editor: Colin Norman

Deputy News Editors: John M. Benditt, Jean Marx

News and Comment/Research News: Ann Gibbons, David P. Hamilton, Constance Holden, Richard A. Kerr, Robert N. Langreth, Eliot Marshall, Joseph Palca, Leslie Roberts

European Correspondent: Jeremy Cherfas

West Coast Correspondent: Marcia Barinaga

Contributing Correspondents: Barry A. Cipra, Robert Crease, M. Mitchell Waldrop, Karen Wright

BUSINESS STAFF

Marketing Director: Beth Rosner

Circulation Director: Michael Spinella

Fulfillment Manager: Marlene Zendell

Business Staff Manager: Deborah Rivera-Wienhold

Classified Advertising Supervisor: Amie Charlene King

ADVERTISING REPRESENTATIVES

Director: Earl J. Scherago

Traffic Manager: Donna Rivera

Traffic Manager (Recruitment): Gwen Canter

Advertising Sales Manager: Richard L. Charles

Marketing Manager: Herbert L. Burklund

Employment Sales Manager: Edward C. Keller

Sales: New York, NY 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); Scotch Plains, NJ 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); Hoffman Estates, IL 60195: Jack Ryan, 525 W. Higgins Rd. (708-885-8675); San Jose, CA 95112: Bob Brindley, 310 S. 16th St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581); Damascus, MD 20872: Rick Sommer, 11318 Kings Valley Dr. (301-972-9270); U.K., Europe: Nick Jones, +44(0)64752918; Telex 42513; FAX (0647) 52053.

Information for contributors appears on pages 35–37 of the 4 January 1991 issue. Editorial correspondence, including requests for permission to reprint and reprint orders, should be sent to 1333 H Street, NW, Washington, DC 20005. Telephone: 202-326-6500. **Advertising correspondence** should be sent to Tenth Floor, 1515 Broadway, New York, NY 10036. Telephone 212-730-1050 or WU Telex 968082 SCHERAGO, or FAX 212-382-3725. **Subscription/Member Benefits Questions:** 202-326-6417. **Science:** 202-326-6500. **Other AAAS Programs:** 202-326-6400.

War and Science

As this issue of *Science* goes to press, the tragedy of war engulfs the world. War is almost inevitably a result of miscalculation on someone's part. Despite commentators who say, "They must know they are going to lose," in most wars each side thinks it is going to win or it would not go to war.

From preliminary accounts, one of the serious miscalculations in the present war is related to the efficiency of modern warfare technology. It is difficult to understand that tactical surprise can be achieved when a deadline announced months in advance finally comes to pass. That surprise may well have been due to an assumption on the part of Saddam Hussein that night bombing could not be very effective. The number of soldiers on each side in the gulf region appears to be approximately equal, which usually means an advantage to the group fighting on its own soil, but history records that technological superiority is more often the deciding factor. Valor and heroism are the focus of novels about wars, but history has shown that, from bows and arrows to laser-guided missiles, technology is decisive if it is very one-sided.

Thus, science's role in warfare is clear. To some that is a question of mistaken priorities; our money should go into plowshares, not swords. Because no world government with sovereignty has yet been established, armies are a necessity. Even within a country, the police must use weapons, or abandon the society to criminals who are willing to use them, and a nation unwilling to maintain an army must depend on the kindness of its neighbors. That was as true in the days of bows and arrows as it is in the days of laser-guided missiles.

This time around, science seems to have changed warfare in a second category, the capacity for precision attack on military targets. The present war has so far been distinctive in that one side has the mechanical capability and the political astuteness to pinpoint military targets and spare, insofar as possible, the civilian population. In World War II and Vietnam, massive bombings were necessary to destroy key targets, and civilians died in droves. "Humanizing war" is the ultimate oxymoron, but a campaign in which military installations are the target is not only more civilized but also provides a better chance of constructing peace out of the ashes of war.

Another obvious role of science in this conflict is the enormous increase in public information. Television has changed the nature of modern warfare. In the past, heroic deeds and glamorous reports often obscured pain, suffering, and death, but television cameras looking everywhere vividly bring to people the real horror of war. It is probably an excellent inhibiting factor that no democratic government can go to war today with the hope that it will suppress the suffering of that war from its population. Of course, television can also confuse people by suggesting that simplistic slogans such as "peace in our time" will really save lives, or that "national honor" will construct a peace. Nonetheless, in the long run the added information provides a basis for informed consent by the electorate.

Science enters into this war in another way, in that it has made oil essential to modern civilization. The standard of living of many nations depends on cheap oil. Less than 40 years ago 25 percent of the U.S. labor force was involved in agricultural work. Today, one-fifth of that labor force produces three times as much agricultural product. That amazing increase in productivity depends almost entirely on cheap oil. This is only one aspect of modern life that would be dramatically changed by the loss of oil or an increase in its price. It is indeed ironic that war, which brings out the worst and best aspects of human nature, can in this case focus on a problem that society should address, regardless of conflict. In about 100 years, the world will run out of cheap oil for transportation, greatly magnifying the temptation of nations to fight over this increasingly rare commodity. Therefore, a massive research effort must be launched to provide other sources of energy before the present one runs out. In fairness to our children, and our children's children, research should start immediately on the replacement of oil, with solar energy the most likely long-term alternative. Perhaps the urgency of doing this for the sake of coming generations, a form of altruism which is tough to sell politically, may be easier to sell as a means to avoid future wars. Certainly one of our immediate priorities should be to give our nation and the world the opportunity to overcome an addiction to oil.

Science did not create warfare, but its advances can remove some of war's barbarities, can improve communication to decrease the probability of unjust wars, and can diminish the incentives for territorial conquest. Research is not only morally better than warfare, it is also more economical.—DANIEL E. KOSHLAND, JR.

Science

War and Science

DANIEL E. KOSHLAND JR.

Science **251** (4993), 497.

DOI: 10.1126/science.251.4993.497

ARTICLE TOOLS

<http://science.sciencemag.org/content/251/4993/497.citation>

PERMISSIONS

<http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. 2017 © The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. The title *Science* is a registered trademark of AAAS.