

## Beyond the Dark Side

Exploitation, however, even between ants, may be in danger of backfiring when it is carried to the extreme of certain specialized, slave-hunting species who know nothing but how to raid other ants' nest, from which they steal and bring back pupae to raise as cooks, butlers and serving maids, without whom they would starve since they have literally (without realizing it) let themselves become the parasites of their own slaves.

—*The Seven Mysteries of Life: An Exploration in Science and Philosophy*,  
by G. Murchie

As control professionals, we can be justifiably proud of the accomplishments of our field. Throughout engineering and science, control ideas and technology have contributed to important advances. Automation and smart systems are widespread, and virtually every branch of engineering has discovered the benefits and power of control.

Despite these accomplishments, “control” as an idea does not have a uniformly rosy reputation. Phrases such as “control freak,” “mind control,” and “crowd control” often have negative connotations. Further contributing to this negative image are experiments, dating from the 1960s and currently attracting media attention, that involve electronics implanted in the brains of animals. The exploitation of animals, as food, laborers, warriors, and medical subjects, is common and widely, though not uniformly, accepted in many modern societies. Although recent control-of-animal experiments lack the cruelty of many other “animal applications,” I personally find the use of electronics to manipulate the actions of an animal to be objectionable.

Yet the negative aspects of control go beyond any particular misuse of technology. Consider standard terminology such as “servo-mechanism,” where “servo” literally means “slave.” In effect, we treat a controlled system as a slave, and the paradigm of control is to impose the will of the controller on the freedom of the controlled. In the context of social systems, control often suggests coercion, that is, control by force. In modern societies, coercion is limited by legal protections that have slowly advanced and now protect, to varying degrees, minorities, women, children, animals, workers, the handicapped, and other

groups. Such protections were often won through immense effort and suffering. But these concerns don't extend to electromechanical systems, which involve only inanimate objects.

While I won't argue that robotic welders deserve equal pay and protection from discrimination, I maintain that “control” of a machine or any process is an inherently flawed concept. Just as a step command is an unnatural expectation for most processes, a working control system must reflect the limitations and needs of the controlled process, which must be properly treated and maintained, regardless of moral principles. In practice, technicians and engineers often become the servants of the system.

For example, some spacecraft need to be “babysat” around the clock, while teams of technicians must perform hours of maintenance on sophisticated fighter aircraft after every flight. Economic viability depends as much on the cost of maintenance as on the performance benefits of control. In effect, control is a cooperative arrangement in which the controller and the controlled work together to satisfy and respect individual needs.



*A young girl from Burma (Myanmar) drives the cow in the foreground all day to run the gristmill. (Reprinted with the permission of Derek Lee and The Journal of the International Institute of the University of Michigan, where the photo and caption were first published.)*



JASON BERNSTEIN

Editor-in-Chief Dennis Bernstein finds a reminder of the University of Michigan during his travels through Navajo Land in August 2004.

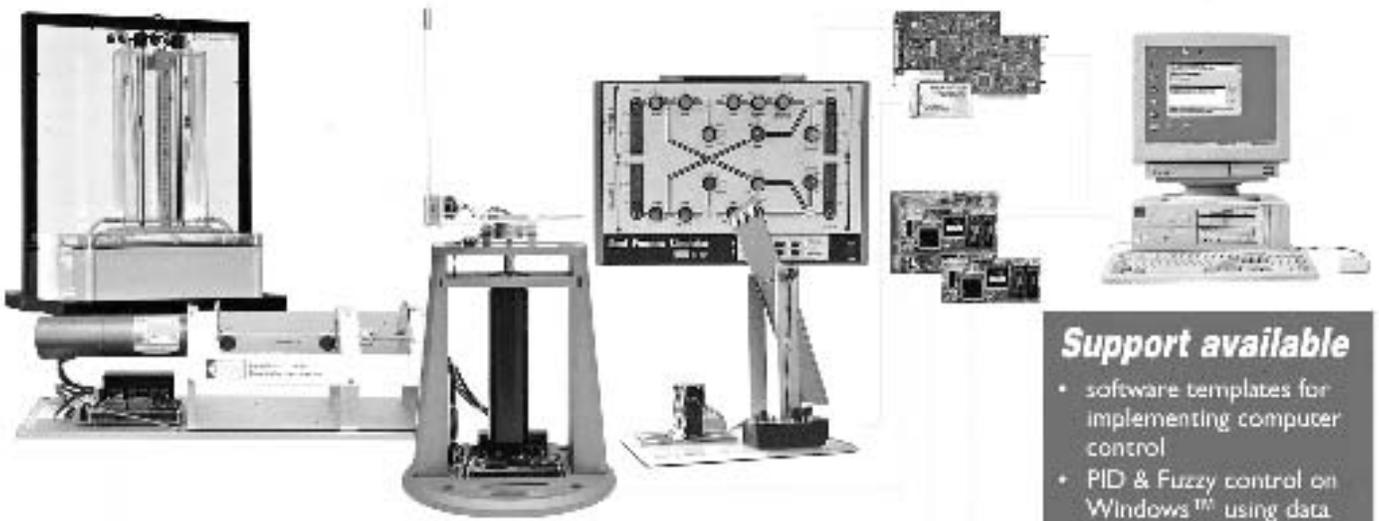
Control as a one-sided, asymmetric proposition is shortsighted. Instead, we need a paradigm that accounts for the limitations and needs of all the interacting subsystems, including the humans who

service the hardware and software. We can already see such a paradigm arising as systems ranging from robots to uninhabited aircraft divide and share tasks to maximize productivity.

How can our Society recognize and embrace this view? We can begin by shedding our traditional name to reflect a new vision of what it means for control to be successful. To this end, I propose that we routinely replace “control system” with the more enlightened phrase “cooperative system” to reflect a kind of benign supervision in place of dictatorial fiat. With this terminology, we recognize the reality of what it means to “control” a system—that the controlled system and the controller must form a symbiotic and synergistic partnership—and we distance ourselves from those “applications” that put our technology and ideas in a negative light. Welcome to the new IEEE CSS.

**Dennis S. Bernstein**  
 Editor-in-Chief  
 IEEE Control Systems Magazine

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