How Computer Systems Embody Values

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Trained as a philosopher, I am nevertheless increasingly drawn toward the science and engineering of information technology in my work on its ethical, social, and political dimensions. I trace this interest back to a research project on computer systems' bias with Batya Friedman ("Bias in Computer Systems," *ACM Trans. Information Systems*, July 1996, pp. 340-346). A compelling and mysterious idea emerged from this project: Computer and information systems can embody values. I found this idea so compelling that it has all but hijacked the path of my work since then, forcing me to grapple with devilishly complex technological details. Its mystery lies in seeing values as part of technology, a perspective not usually adopted by scholars and researchers who study the social, ethical, and political aspects of information technology.

ETHICS AND TECHNOLOGY

The story of how information technology has radically altered our lives and even our selves has been told many times, in many versions. The radical effects of the process have extended to institutions, social processes, relationships, power structures, work, play, education, and beyond. Although the changes have been varied, affecting the economy, the shape and functioning of organizations, artistic expression, and even conceptions of identity, some of us have focused on changes with an ethical dimension.

I've found it useful to organize this work into two categories according to the distinct ways values factor into it.

Focusing on social changes ...

In one category I place work in which values themselves are not the controversy's central subject. Thus, when researchers worry about computer systems replacing humans who act in positions of responsibility—prescribing drugs, making investment decisions, controlling aircraft, and so on—they do not call into question the value of responsibility itself. Rather, they worry that under the new arrangement, lines of accountability and responsibility will be disturbed and possibly erased. Where once we could hold someone responsible for failure and its consequences, now there is a vacuum. When researchers call attention to the digital divide, while committed to the *value* of justice, they *focus* on the possibility that information technology will cause even greater social injustice than we currently experience.

...versus focusing on values themselves

In the other category, however, technology's values form part of the controversy. In the case of intellectual property, for example, some researchers argue that because intellectual production has been so profoundly affected by information technology, it strikes at the heart of previously settled ideas and valuations of intellectual property. Privacy offers another case where information technology, as a result of the novel actions it enables—including the capture of trivial bits of data and the ability to aggregate, mine, and analyze them—forces us to reexamine our conceptions and theories regarding privacy and its normative theories.

In such cases, we cannot simply align the world with the values and principles we adhered to prior to the advent of technological challenges. Rather, we must grapple with the new demands that changes wrought by the presence and use of information technology have placed on values and moral principles.

Reversing direction

Common to both research categories is the direction of causation: Information technology changes the world, and some of these changes challenge previous commitments to values and principles. Yet the idea of values embodied in computer and information systems suggests motion in the opposite direction, from values to technology. Values affect the shape of technologies. Briefly, the values that systems and devices embody are not simply a function of their objective shapes. We must also study the complex interplay between the system or device, those who built it, what they had in mind, its conditions of use, and the natural, cultural, social, and political context in which it is embedded—for all these factors may feature in an account of the values embodied in it.

Accepting that systems may have moral or political properties has an immediate

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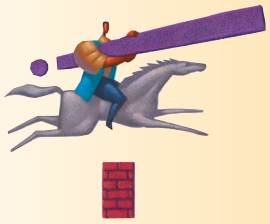

The author calls for engineering activism to intelligently guide the inevitable incorporation of values into computer systems and devices.

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practical consequence: Humanists and social scientists can no longer bracket technical details—leaving them to someone else—as they focus on the social effects of technology. Fastidious attention to the before-and-after picture, however richly painted, is not enough. Sometimes a fine-grained understanding of systems—even down to gritty details of architecture, algorithm, code, and possibly the underlying physical characteristics—plays an essential part in describing and explaining the social, ethical, and political dimensions of new information technologies.

WHEN VALUES AND TECHNOLOGY COLLIDE

Several recent dramas played out in the public arena demonstrate why we must maintain a tight link between values and design.

Take, for example, Intel's Pentium III processor chip with its embedded personal serial number. When the uproar over PSN arose, Intel took advocacy groups seriously enough to send executives to discuss a proposed compromise that would, hopefully, stop a threatened boycott. Intel asserted that it designed the PSN to guard against hardware theft and unauthorized copying of software. PSN would also facilitate user security by, for example, authenticating users' identities for e-commerce. Privacy advocates argued that PSN would also facilitate tracking of users' Web activities. Intel's compromise? A software patch that set the PIII's default mode to disable PSN disclosure.

Scientists and engineers must expand the set of criteria they would normally use to evaluate systems to incorporate social, ethical, and political criteria.

As I watched this story unfold, I wondered why Intel had decided to stamp its new processor with a digital serial number. Had it overlooked the privacy implications, merely hoped no one would notice, or made a considered judgment that the potential security benefits outweighed privacy concerns? Had there been deliberation behind closed doors after some project manager, designer, engineer, or marketing executive alerted company executives to the hazard? Was the decision a sign of carelessness, arrogance, or mere misjudgment? Was Intel out of touch with prevailing values, or did it assume that the company carried enough clout to shape them?

Cases like Intel's PSN are not unique: We have witnessed furor over cookies, consternation over PICS (Platform for Internet Content Selection), raging indignation on both sides of Napster, disappointment over security flaws in Java, and worry about data mining. We need accurate answers to the technical questions these issues raise. Does the software patch for the PIII work? Does Napster make its own copies of the music? How readily can PICS be adapted to individual users' mores? In what ways are we vulnerable to damaging applets? Does data mining generate privacy threats of a new order? In each of these cases, although questions address the system's technical character, they are rooted not in an interest in the technology alone but in a concern—and usually a dispute—over values. That the pursuit of questions about values at times leads necessarily and irrevocably into the entrails of information and computer systems lies at the heart of the idea that systems can embody values.

EXPANDING CRITERIA

But the lesson taught by Pentium III and a multitude of similar cases does not apply to technology-shy humanists and social scientists alone. Scientists and engineers can learn a different lesson from these events: They must expand the set of criteria they would normally use to evaluate systems to incorporate social, ethical, and political criteria. The failure to meet conventional technical criteria did not propel Pentium III, Napster, and data mining into the limelight—the controversial ways these technologies engaged social, ethical, and political values did that.

If these cases can motivate at least some participants in both the technical and nontechnical worlds, an ideal meeting ground would be to join forces to uncover crucial keys to systematic relationships between systems' features on the one hand and values on the other. In turn, this approach might reveal possibilities of incorporating a broader spectrum of perspectives into the design process itself.

The idea of systems embodying values—its practical aspects and challenges—presents disquieting implications for both groups. Usually, social scientists and humanists conceive theory as the

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highest achievement of their fields. General truths and prescriptions are important because they broadly encompass both time and place. Painstaking attention to cases, from the bottom up, one at a time—as the idea of embodying values in design implies—may seem retrograde. Forget achieving collegial adulation—how can we save the world this way?

Ignoring values risks surrendering the determination of this important dimension to chance or some other force.

Engineers, including many who read *Computer*, although accustomed to the idea of building from the bottom up, are burdened in a different way. They face an unfamiliar obligation to perceive not only the usual set of properties that the systems they build or design may embody, but those systems' moral properties as well: bias, anonymity, privacy, security, and so on. The challenge of building computer systems is transformed into a forum for activism—engineering activism. Not only is such activism a calling for which many may feel unfit, it is also a difficult one.

We may be tempted to conclude from our computing examples that only unusual cases—those that have earned media attention—warrant concern about the values they embody. This is not so. While not every conceivable device nor every aspect of design has significant value dimensions, moral properties are common. For any number of devices and systems we encounter at home, work, and play, we should ask questions about the values inherent in their design. Questions such as the following may apply:

- What values do they embody?
- Is their locus of control centralized or decentralized?
- Are their workings transparent or opaque?
- Do they support balanced terms of information exchange?
- Do they unfairly discriminate against specific sectors of potential users?
- Do they enhance or diminish the possibility of trust?

Engineering activism means posing these and similar questions and, where possible, doing something about them.

It may be difficult to address such questions, however, because factors in the real world—such as bosses, shareholders, regulations, competitors, and resource limits—can prove hostile to yet another layer of constraints. Yet tempting as it may be to ignore value properties, doing so will not make them go away. Systems and devices will embody values whether or not we intend or want them to. Ignoring values risks surrendering the determination of this important dimension to chance or some other force.

Facing the challenge that values in technology present need not be an all-or-nothing business. We can commit to engineering activism in many ways and to varying degrees. Advise others, especially those with less technical know-how, on the gritty workings of systems and devices that may be systematically related to values. Advocate on behalf of values by sharing the moral and political implications of technical features with those who have the power to shape our profession, including managers, co-workers, regulators, professional organizations, and standards-setting bodies. Act, make, build, or design the necessary changes, if doing so is within your power. ✷

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