H. Nissenbaum, "Information Technology and Ethics" *Berkshire Encyclopedia of Human-Computer Interaction,* Great Barrington, MA, Berkshire Publishing Group, 2004, 235-239

Anderson, J. R., & Lebiere, C. (Eds.). (1998). *Atomic components of thought.* Hillsdale, NJ: Erlbaum.

Ballard, D. H., Hayhoe, M. M., Pook, P. K., & Rao, R. P. N. (1997). Deictic codes for the embodiment of cognition. *Behavioral and Brain Sciences, 20*(4), 723–742.

Benzeev, T. (1995). The nature and origin of rational errors in arithmetic thinking: Induction from examples and prior knowledge. *Cognitive Science, 19*(3), 341–376.

Berry, D. C. (1993). Slips and errors in learning complex tasks. In G. M. Davies & L. R. H. (Eds.), *Memory in everyday life. Advances in psychology* (pp. 137–159). Amsterdam: North-Holland/Elsevier.

Byrne, M. D. (2001). ACT-R/PM and menu selection: applying a cognitive architecture to HCI. *International Journal of Human-Computer Studies, 55*(1), 41–84.

Byrne, M. D., & Bovair, S. (1997). A working memory model of a common procedural error. *Cognitive Science, 21*(1), 31–61.

Card, S. K., Moran, T. P., & Newell, A. (1983). *The psychology of human-computer interaction.* Hillsdale, NJ: Erlbaum.

Elkerton, J., & Palmiter, S. L. (1991). Designing help using a GOMS model: An information retrieval evaluation. *Human Factors, 33*(2), 185–204.

Gray, W. D. (1995). VCR-as-paradigm: A study and taxonomy of errors in an interactive task. In K. Nordby, P. Helmersen, D. J. Gilmore, & S. A. Arnesen (Eds.), *Human-Computer Interaction—Interact'95* (pp. 265–270). New York: Chapman & Hall.

Gray, W. D. (2000). The nature and processing of errors in interactive behavior. *Cognitive Science, 24*(2), 205–248.

Gray, W. D., & Boehm-Davis, D. A. (2000). Milliseconds matter: An introduction to microstrategies and to their use in describing and predicting interactive behavior. *Journal of Experimental Psychology: Applied, 6*(4), 322–335.

Gray, W. D., & Fu, W.-t. (2001). Ignoring perfect knowledge in-the-world for imperfect knowledge in-the-head: Implications of rational analysis for interface design. *CHI Letters, 3*(1), 112–119.

Gray, W. D., & Fu, W.-t. (in press). Soft constraints in interactive behavior: The case of ignoring perfect knowledge in-the-world for imperfect knowledge in-the-head. *Cognitive Science.*

Gray, W. D., John, B. E., & Atwood, M. E. (1993). Project Ernestine: Validating a GOMS analysis for predicting and explaining real–world performance. *Human-Computer Interaction, 8*(3), 237–309.

Gray, W. D., Palanque, P., & Paternò, F. (1999). Introduction to the special issue on: interface issues and designs for safety-critical interactive systems. *ACM Transactions on Computer-Human Interaction, 6*(4), 309–310.

Heckhausen, H., & Beckmann, J. (1990). Intentional action and action slips. *Psychological Review, 97*(1), 36–48.

James, W. (1985). *Psychology: The briefer course.* Notre Dame, IN: University of Nortre Dame Press. (Original work published 1892.)

John, B. E. (1990). Extensions of GOMS analyses to expert performance requiring perception of dynamic visual and auditory information. In J. C. Chew & J. Whiteside (Eds.), *ACM CHI'90 Conference on Human Factors in Computing Systems* (pp. 107–115). New York: ACM Press.

John, B. E. (1996). TYPIST: A theory of performance in skilled typing. *Human-Computer Interaction, 11*(4), 321–355.

Kieras, D. E., & Meyer, D. E. (1997). An overview of the EPIC architecture for cognition and performance with application to human-computer interaction. *Human-Computer Interaction, 12*(4), 391–438.

Newell, A. (1992). Precis of unified theories of cognition. *Behavioral and Brain Sciences, 15*(3), 425–437.

Nooteboom, S. G. (1980). Speaking and unspeaking: Detection and correction of phonological and lexical errors in spontaneous speech. In V. A. Fromkin (Ed.), *Errors in linguistic performance: Slips of the tongue, ear, pen, and hand* (pp. 87–95). San Francisco: Academic Press.

Norman, D. A. (1981). Categorization of action slips. *Psychological Review, 88*(1), 1–15.

Ohlsson, S. (1996a). Learning from error and the design of task environments. *International Journal of Educational Research, 25*(5), 419–448.

Ohlsson, S. (1996b). Learning from performance errors. *Psychological Review, 103*(2), 241–262.

Olson, G. M., & Olson, J. S. (2003). Human-computer interaction: Psychological aspects of the human use of computing. *Annual Review of Psychology, 54*, 491–516.

Payne, S. J., & Squibb, H. R. (1990). Algebra mal-rules and cognitive accounts of error. *Cognitive Science, 14*(3), 445–481.

Rasmussen, J. (1987). The definition of human error and a taxonomy for technical system design. In J. Rasmussen, K. Duncan, & J. Leplat (Eds.), *New technology and human error* (pp. 23–30). New York: Wiley.

Reason, J. (1990). *Human error.* New York: Cambridge University Press.

Simon, H. A. (1956). Rational choice and the structure of the environment. *Psychological Review, 63*, 129–138.

Trafton, J. G., Altmann, E. M., Brock, D. P., & Mintz, F. E. (2003). Preparing to resume an interrupted task: Effects of prospective goal encoding and retrospective rehearsal. *International Journal of Human-Computer Studies, 58*(5), 583–603.

VanLehn, K. A. (1990). *Mind bugs: The origins of procedural misconceptions.* Cambridge, MA: MIT Press.

Vicente, K. J. (2002). Ecological interface design: Progress and challenges. *Human Factors, 44*(1), 62–78.

ETHICS

Philosophical interest in the ethical implications of the development and application of computer technology emerged during the 1980s, pioneered by, among others, Terrell Ward Bynum, Deborah Johnson, Walter Maner—usually credited with coining the phrase *computer ethics*—and James Moor. These philosophers and others laid the foundations for a field of study that, for a number of years, encompassed three central lines of inquiry: (1) ethical questions and challenges to social, moral, and political values raised by changes in society and individual lives, (2) the nature of computer ethics itself, and (3) ethical obligations of professional experts in computer and information technologies and engineering. More recently the field has broadened to include strands from neighboring disciplines.

Ethics, Values, and the Impacts of Computer and Information Technologies

Incorporating most of the work in the field, this line of inquiry focuses on the impacts of computing and information technologies that raise ethical questions as well as questions about moral, political, and social values in societies and in individuals' lives. Many of the issues that emerged early on, such as intellectual property, responsibility, crime, privacy, autonomy, free speech, and quality of life, have remained important and have evolved alongside developments in the technologies themselves. Philosophers engaged in the study of impacts have approached their subject from at least two perspectives. In one they have asked about the nature of moral obligations in light of particular changes, thus being concerned with right and wrong actions of people. In the other they have been concerned with the status of particular values in society and how these are affected by technology-induced changes.

In the case of intellectual property, philosophical interest focused on moral obligations owed to the creators and owners of software. Philosophers, like their colleagues in law, recognized key metaphysical (relating to a branch of philosophy that is concerned with the fundamental nature of reality and being) differences between computer software and traditional forms of intellectual property and sought to understand whether and in what ways these differences affect the extent and nature of property protection that software deserves. By the mid-1990s and into the present, as the Internet and World Wide Web developed and increased in popularity, most of the attention given to intellectual property has been focused on controversial questions concerning digital representations of a wide range of intellectual and cultural works (including text, images, music, and video), peer-to-peer file sharing, and even Web-linking (the use of Web hyperlinks to move from one web page to another). From the perspective of values, philosophers have questioned social and legal decisions that have shaped the relative strength and standing of intellectual property in the face of other values, such as freedom to share.

Computer technology raised questions about attributing moral responsibility for harmful consequences of action as philosophers and others noted the increasing use of computer systems in control functions, sometimes replacing human controllers, sometimes mediating human action, sometimes automating complex sequences of tasks. Ethical concerns went hand in hand with technical concerns. Where computer scientists and engineers worried about correctness, reliability, safety and dependability, philosophers asked whether increasing reliance on computer-controlled automation is warranted and whether, secondarily, it leads to a diminishment of accountability for malfunctions, dangers, and harms due to computerization. Another intriguing line of questions was taken up by philosophers such as Kari Coleman, Arthur Kuflik, James Moor, and John Snapper. This line concerned responsibility and was spurred by actual and predicted advances in artificial intelligence. It asked whether aspects of human agency, such as life-and-death decisions, should ever be delegated to computers no matter what the relative competency levels. A twist in this line of questions is whether a time will come when humans will have moral obligations to intelligent machines.

An issue related to that of responsibility is the nature and severity of computer crime and the variety of harms wrought on others in the context of computer-mediated communications and transactions. Philosophers participated in early debates over whether actions such as gaining unauthorized access to computer systems and networks should be judged as crimes or whether such judgment should be reserved for cases where clear damage results, as in the cases of transmitting computer viruses and worms and posting obscene or threatening materials.

Privacy has been one of the most enduring issues in this category. Philosophers have focused attention on privacy as a social, political, and individual value threatened by developments and applications of computer and information technologies. Philosophers have participated in the chorus of voices, which also includes scholars of law, policy, and social science and privacy advocates, that has denounced many of these developments and applications as dangerously erosive of privacy. As with other issues, the

nature of the activities that raise concern shifts through time as a result of evolving technologies and their applications. The earliest applications to take the limelight were large government and corporate databases. Cries of "Big Brother" resulted in various legal constraints, including, most importantly, the U.S. Privacy Act of 1974. Through time dramatic reductions in the cost of hardware and improvements in the capacities to collect, store, communicate, retrieve, analyze, manipulate, aggregate, match, and mine data led to a proliferation in information gathering throughout most sectors of society and an amplification of early concerns. In parallel with these developments, we experienced an upsurge in identification and surveillance technologies, from video surveillance cameras to biometric (relating to the statistical analysis of biological observations and phenomena) identification to techniques (such as Web cookies) that monitor online activities. Each of these developments has attracted concern of a broad constituency of scholars, practitioners, and activists who have applied their areas of knowledge to particular dimensions of the developments. Philosophers, such as Judith DeCew, Jeroen van den Hoven, James Moor, Anton Vedder, and Helen Nissenbaum, have taken up particularly two challenges: (1) improving conceptual understanding of privacy and the right to privacy and (2) refining theoretical underpinnings and providing a systematic rationale for protecting the right to privacy.

Finally, a category of questions concerning "quality of life" asks, more generally, about the ways computer and information technologies have impinged on core human values. We could include in this category a variety of concerns, starting with the digital divide—the possibility that computer technology has increased the socioeconomic gap between those groups of people with power and wealth and historically disadvantaged socialeconomic, racial, and gender groups. Such questions concerning social justice within societies have been extended to the global sphere and the vastly different levels of access available in countries around the globe.

Another element in the category of "quality of life" concerns the impacts on relationships, such as those among friends, romantic partners, family members, and teachers and students, made by computers and digital networking technologies. Many researchers have pointed to the enormous positive potential of collaborating online and building community and accessing vast troves of information. However, some philosophers have asked whether the intrusion of digital technologies debases these spheres of life—replacing the actual with the virtual, replacing face-to-face communication with mediated communication, replacing family and intimate interactions with chat rooms and online games, and replacing human teachers and mentors with computerized instruction—and deprives them of their essentially human character and consequently deprives us of meaningful opportunities for emotional, spiritual, and social growth. The influence of Continental philosophers, including Edmund Husserl and Emmanuel Levinas, is more apparent here than in previously mentioned areas where Anglo-American, analytical thought tends to dominate.

Metaethics of Computer and Information Technology

Many philosophers leading the inquiry of ethics and information technology have raised questions about the nature of the inquiry itself, asking whether anything is unique, or uniquely interesting, about the moral and political issues raised by information technology. The continuum of responses is fairly clear, from a view that nothing is philosophically unique about the issues to the view that settings and capacities generated by computer and information technologies are so novel and so distinctive that they demand new theoretical approaches to ethics. The more conservative approaches assume that we can reduce the problems in computer ethics (for example, any of those mentioned earlier) to the more familiar terms of ethics and applied ethics, generally. From there the problems are accessible to standard ethical theories. For example, although transmitting computer viruses is a novel phenomenon, after we cast it as simply a new form of harming others' property, it can be treated in those familiar terms. Other philosophers, such as Luciano Floridi, have suggested that because these technologies create new forms of agency or new loci of value

itself, new ethical theories are required to resolve problems. James Moor, in an essay entitled "What Is Computer Ethics?," offers something in between. Computer ethics deserves attention because it raises not only policy questions that are new (such as "Should we allow computer programs to be privately owned?") but also novel conceptual questions about the very nature of a computer program, whether more like an idea, a process, or a piece of writing. These conceptual puzzles, particularly acute in the case of privacy, explain why we continue to struggle to resolve so many of the controversial questions that privacy raises.

Computer Ethics as Professional Ethics

Some contributors to the field of computer ethics have seen its greatest potential as a guide for computer scientists, engineers, and other experts in the technologies of computing and information, thus placing it in the general area of professional ethics. Early proponents of this idea, Donald Gotterbarn and Keith Miller, added their voices to those of socially concerned computer scientists and engineers who—starting with Norbert Wiener and Joseph Weizenbaum, followed by Terry Winograd, Peter Neumann, and Alan Borning—exhorted their colleagues to participate actively in steering social deliberation, decision, and investment toward socially, politically, and morally positive ends and also to warn of dangers and possible misuse of the powerful technologies of computation and information. In this area, as in other areas of professional ethics, such as legal and medical ethics, key questions included the duties accruing to computer scientists and engineers as a consequence of their specialized knowledge and training. In the area of system reliability, for example, computer engineers such as Nancy Leveson have focused enormous energies to articulate the duty to produce, above all, safe systems, particularly in life-critical areas.

Responding to calls for greater focus on professional duties, at least two major professional organizations—the Association for Computing Machinery and the Institute of Electrical Engineering and Electronics—have developed codes of professional ethics. Two issues remain controversial. One issue deals with the nature and limits of professional codes. The philosopher Michael Davis has provided a thoughtful account of the role of codes of conduct in encouraging ethical professional practice, in contrast to John Ladd, who has challenged the very possibility that professional codes of conduct can rightly be thought of as codes of ethics. The other issue, specific to the professions within computer technologies, asks whether they are sufficiently similar to traditional professions of law and medicine to warrant the label of "professions."

Porous Borders

Although the philosophical community pursuing inquiry into ethical implications of information technology remains relatively small, its intellectual borders are fluid. Since the decades of its emergence, it has been enriched by developments in the literatures and methods of neighboring fields. In turn, many of the works produced within those fields have been influenced by the work of ethicists. A few examples, where cross-disciplinary flow has been particularly active, bear mentioning. One example is information law, which emerged into prominence roughly a decade after philosophical issues of privacy, intellectual property, free speech, and governance spurred many of its core works by legal scholars such as Lawrence Lessig, Yochai Benkler, James Boyle, Pamela Samuelson, Jerry Kang, and Niva Elkin-Koren. As a result of these works, philosophical studies have paid greater attention to issues of public values, the direct effects of policy on values, and the meaning for society of key court rulings.

A second prominent influence has come from the areas of philosophy and social study of science and technology where theoretical writings and empirical studies of scholars such as Langdon Winner, Albert Borgman, Bruno Latour, Wiebe Bijker, Andrew Feenberg, and Donald MacKenzie have inspired novel approaches to many of the substantive issues of ethics and information technology. Ideas such as the social shaping of technical systems and the values embodied in system design

have focused philosophical attention on design and development details of specific systems and devices, opening a line of work that views the design of systems and devices not as a given but rather as a dependent variable. Although influenced by such ideas, ethicists approach them with a different goal, not only seeking to describe but also to evaluate systems in terms of moral, political, and social values. Philosophers who have pursued these lines of inquiry include Deborah Johnson, Jeroen van den Hoven, and Philip Brey, who has interpreted many key works in social constructivism (an approach to the social and humanistic study of technology that cites social factors as the primary determinants of technical development) for philosophical audiences and developed a concept of disclosive ethics (a philosophical approach which holds that system design may "disclose" ethical implications).

Interest in design as a dependent variable has also led to collaborations among philosophers, computer scientists, and researchers and designers of human-computer interfaces who have been inspired by the complex interplay between computer systems and human values. These collaborations are important test beds of the idea that a rich evaluation of technology can benefit from simultaneous consideration of several dimensions: not only technical design, for example, but also, ideally, empirical effects on people and an understanding of the values involved. For example, Lucas Introna and Helen Nissenbaum studied a search-engine design from the point of view of social and political values. Their study tried to achieve an in-depth grasp of the workings of the search engine's system, which they evaluated in terms of fairness, equality of access to the Web, and distribution of political power within the new medium of the Web. Other researchers who reach across disciplines include Jean Camp and Lorrie Cranor, as well as Batya Friedman, Peter Kahn, and Alan Borning, who have developed value-sensitive design as a methodology for developing computer systems that take multiple factors into consideration.

Helen Nissenbaum

See also Law and HCI; Privacy; Value Sensitive Design

FURTHER READING

Adam, A. (2002). Cyberstalking and Internet pornography: Gender and the gaze. *Ethics and Information Technology, 2*(2), 133–142.

Brey, P. (1997). Philosophy of technology meets social constructivism. *Techne: Journal of the Society for Philosophy and Technology, 2*(3–4). Retrieved March 24, 2004, from http://scholar.lib.vt.edu/ejournals/SPT/v2n3n4/brey.html

Bynum, T. W. (2001). Computer ethics: Its birth and its future. *Ethics and Information Technology, 3*(2), 109–112.

Dreyfus, H. L. (1999). Anonymity versus commitment: The dangers of education on the Internet. *Ethics and Information Technology, 1*(1), 15–21.

Elkin-Koren, N. (1996). Cyberlaw and social change: A democratic approach to copyright law in cyberspace. *Cardozo Arts & Entertainment Law Journal, 14*(2), 215–end.

Floridi, L. (1999). Information ethics: On the philosophical foundations of computer ethics. *Ethics and Information Technology, 1*(1), 37–56.

Gotterbarn, D. (1995). Computer ethics: Responsibility regained. In D. G. Johnson & H. Nissenbaum (Eds.), *Computers, ethics, and social values* (pp. 18–24). Englewood Cliffs, NJ: Prentice Hall.

Grodzinsky, F. S. (1999). The practitioner from within: Revisiting the virtues. *Computers and Society, 29*(1), 9–15.

Introna, L. D. (2001). Virtuality and morality: On (not) being disturbed by the other. *Philosophy in the Contemporary World, 8*(1), 31–39.

Introna, L. D., & Nissenbaum, H. (2000). Shaping the Web: Why the politics of search engines matters. *The Information Society, 16*(3), 169–185.

Johnson, D. G. (2001). *Computer ethics* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Johnson, D. G. (2004). Computer ethics. In H. Nissenbaum & M. E. Price (Eds.), *Academy and the Internet* (pp. 143–167). New York: Peter Lang.

Moor, J. H. (1985). What is computer ethics? *Metaphilosophy, 16*(4), 266–275.

Nissenbaum, H. (2004). Privacy as contextual integrity. *Washington Law Review, 79*, 119–158.

Spinello, R. A., & Tavani, H. T. (Eds.). (2001). *Readings in cyberethics*. Sudbury, MA: Jones and Bartlett.

van den Hoven, J. (1994). Towards principles for designing political-administrative information systems. Van den Hoven, J. (1994). Towards principles for designing political-administrative information systems. *Information and Public Sector, 3*, 353–373.

ETHNOGRAPHY

Ethnography has several meanings. It means the study and recording of human culture; it can also mean the work produced as a result of that study—a picture of a people. Today, however, someone interested in human-computer interaction (HCI)