Beyond the Ballot Box:
Computer Science Education and Social Responsibility

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On 2 November 2004, millions of Americans went to the polls and cast their vote for the person they felt would best determine the future of America. Young people constituted a crucial part of the deciding vote and many organizations from MTV to the presidential campaigns made considerable efforts to increase the political awareness and involvement of this demographic category, typically characterized as the 18-24 year-old voter. This attentiveness to youth participation in national politics, albeit commendable, should not begin and end on Election Day. All citizens have a responsibility to remain informed of government actions and to express their approval or disapproval though public elections, communication with their elected representatives, or participation in any number of public forums or community organizations. However, readers of this magazine have a particular responsibility as educators of the future generation of computer and technologically literate citizens.

In the past ten years, information technologies have assumed a near ubiquitous role in our daily lives. In the process, they have created new legislative and judicial gray areas and opened new spaces for the "invisible hand" of the free market. Many of these political debates, legal decisions, and technological innovations will determine the range and character of our civil liberties (including such stalwarts as the right to free speech, privacy, and property), job opportunities, and the very design of future information and communications technologies. While some of these developments have made front-page news—consider the high profile war between the music industry and any one of the MP3 file sharing programs—other negotiations of equal or greater importance (e.g. whether to mandate wiretapping capabilities for Voice over IP) have escaped broader public notice. In this editorial, I present an argument in favor of bringing a deeper political awareness to computer science education and contend that computer scientists and computer science students are particularly well poised to assume roles beyond their cubicles, computer laboratories, and classrooms.

Know Your History

To understand the significance of current events, students must first be able to situate the present within the larger trajectories of the past. As a historian who teaches computer science students, my biases are clear, but it seems intuitive that to recognize change, be it political, technological, economic, or social, you need to know something about history. There are many different methods and rationales for incorporating history in the computer science curriculum; several of these viewpoints have already appeared in this magazine [1]. Within many computer science curricula, students encounter history either through the descriptions of early computing machines (e.g. Babbage's Analytic Engine, the Turing Machine, or the ENIAC) or through the legendary success

stories of computer entrepreneurs and their empires such as Bill Gates and Microsoft or Steve Jobs and Apple. Certainly, these examples endow students with valuable insight and knowledge, simultaneously linking their work to the achievements of the past and fueling dreams of becoming the next start-up whiz kid. However, I would like to encourage members of the SIGCSE community to consider other advantages for including history in the computer science curriculum that they may not have considered.

Example 1

While we all may know of the Bill Gates and Steve Jobs success stories, the reality of many recent computer science graduates may bear a closer resemblance to the cubicle life of Dilbert or even the cult-movie favorite *Office Space*. Instead of a fast track to riches and millions of dollars in stock options—the trail blazed by the 1990s dot-com boomers—they will face the uncertainty of a recovering economy, a job market that embraces flexible labor over job security, and an industry that expects more than the eight-hour work day while demanding mastery of the latest technological trends.

How can history possibly prepare students for this new labor market (without driving them from the field)? First, it can help them understand how corporations, start-ups, and managers engineer workplace cultures to uphold the identities, values, and practices that may appear "natural" to a new employee. Tom West's ability to create an environment of competition, self-sacrifice, and urgency within Data General, as told in the pages of the Pulitzer Prize winning book *The Soul of the New Machine*, might provide a valuable starting point, as might a more recently published text depicting life in the high-tech firms of the 1990s (such as Douglas Coupland's *Microserfs*). Moving further back in time, studies of the blue-suited conservatism that characterized the IBM family or the techniques of scientific management developed by Fredrick W. Taylor will help students understand how corporate culture has transformed over time as well as recognize the facets that have remained the same.

Teaching students to identify the mechanisms and strategies that underlie a particular working environment and drive the technological production process will raise their sensitivity toward these issues when they begin their first job and later will help them create their own productive cultures should they ascend to the ranks of management. It will also empower them to question the values naturalized by today's high-tech culture and market economy and realize that these assumptions are not set in stone. Just as history illuminates the changing face of industry, it also demonstrates the possibilities for resistance against abuse. Instead of accepting the direction of the labor market as inevitable and equating its hardships with the ethos of the computer science profession, computer science combined with history has the potential to provide students with the critical thinking skills to challenge these conditions and, possibly, improve the future of work.

Example 2

Many of the measures taken by the U.S. administration and Congress in the war against terror have provoked reactions of shock and awe from those who fear that our quest for national security will come at the price of our civil liberties. As I write this article, the Patriot Act has granted law enforcement officials the right to conduct secret "sneak and peak" searches of private homes without advance warning, the ability to monitor email and web-surfing activities of U.S. citizens with little justification, and "roving" wiretapping powers that do not include the range of safeguards built into prior wiretapping legislation.

The new range of conduct made possible by today's information technologies further blurs the line between civil rights and government rights. Students of these technologies should be paying attention to how lawyers, politicians, and engineers currently negotiate these boundaries on a day-to-day basis. However, a knee-jerk reaction that vilifies the government as an incarnation of Big Brother could prove as deleterious as ignoring government activities altogether. We should challenge our political system when it tries to infringe upon our constitutional rights, but not at the price of losing the protections our government has historically provided. History conveys the importance of government agencies in supporting high-risk, high-tech endeavors that could not have evolved under the aegis of the private sector. U.S. government legislation has also proved vital in protecting Americans in times of bankruptcy or unemployment and reigned in the private sector when it has threatened to grow too large or too powerful. Most attention today focuses on the dangers of government regulation (a cry heard from the private sector as well as from citizen's groups). A more productive discussion would encourage students to formulate their ideas of "liberty" and "security" in a manner that incorporates the government's ability to protect and serve rather than simply appealing to libertarian ideals and the undermining of Big Brother [2].

Example 3

History provides a foothold for students to think critically about the language and values that surround computer and information technologies, particularly words such as "open", "democratic", "community", and "freedom". History texts, such as Janet Abbate's book *Inventing the Internet*, have examined the etiology of the internet as an open space for information exchange developed by a small user base within the scientific community who had no reason to create mechanisms for identification, surveillance, or security. The values typically associated with the internet have historical origins. During the past ten years, the internet has begun a dramatic transformation from a democratic space to an increasingly capitalist space,

one that emphasizes global markets, the protection of private industry, and the exchange of information for profit. Rather than echo the language associated with the internet's past, students should understand that this language of the internet has a history and that this history is changing as the technology matures.

In short, history enables the study of change. Recent events have spurred a number of changes that people educated in computer science need to be thinking about, questioning, and becoming involved in the drafting of new solutions. Through history, students learn to situate their work within a larger context of information processing, communication, and human/machine interaction. Increasingly, however, the study of history by computer science and engineering students has taken on new importance, for it has the potential to create the next generation of concerned citizens who understand changes of the past and the role they can play in changing the future.

Designing Democracy

Suppose the internet does not naturally provide a space of freedom and democracy, as my third example suggests. Could an alternative design hard code these values into the technology? According to Lawrence Lessig, the answer is a resounding yes. The architecture and design of the internet, and that of other information technologies, can determine the substantive values that these technologies promote. In his excellent book, *Code and Other Laws of Cyberspace*, Lessig writes, "We can build, or architect, or code cyberspace to protect the values that we believe are fundamental, or we can build, architect, or code cyberspace to allow those values to disappear. There is no middle ground" [3]. The very structure of cyberspace, he claims, has the power to circumscribe the liberties and freedoms enjoyed by state, individual, and corporate actors with the same force as those exercised by legal, market, and normative means.

Lessig's argument, while insightful, operates in the realm of abstractions; government agencies and private sector enterprises serve as the shifting protagonists and antagonists of his narrative. However, reinterpreting Lessig's line of reasoning with a focus on the individual places computer scientists and engineers in a position of considerable importance. As a group, they possess the ability to understand, create, and modify the very architecture of the technologies that our society has come to depend upon. To put it another way, computer scientists and engineers will have the capacity to think about the world they want to live in and the skills to implement these values into the very packets, signatures, and algorithms that make up our digital universe.

Recent headlines supply numerous examples of how conflicting values of privacy, anonymity, property ownership, security, profit, and justice have played into the design of technologies such as MP3 players, web tracking software, digital telephony and television, encryption algorithms, and biometric security systems. Deciding between open source and proprietary software architectures, a choice that may seem trivial at first glance, may result in socio-economic changes that go far beyond the realm of the technical. Many countries, particularly those within the developing world, have equated the adoption of open source software with the right to self-determination and an escape from prior dependencies on foreign technologies and foreign governments [4]. In short, design choices can change power relations between the governed and their governments, as well as between governments and peoples of different nations. The examples presented here constitute but a small sampling of the technologies currently under development that will determine the future of individual privacy, state sovereignty, the freedom to move across borders, and the capability to share ideas and information with others. Significant decisions guiding the form and implementation of these technologies will be left in the hands of computationally-literate individuals acting through government, corporate, and professional organizations, people capable of understanding technological detail as well as the politics and power of design. The opportunities to implement economic, social, and political changes are not as far removed from the life of a computer science student as they may initially appear.

Getting the Word Out

Given that information technologies play a central role in many of these political debates, conversations about these issues often entail nitty-gritty aspects of a design and its limitations, information that can be difficult to explain to elected representatives or to the lay public. This is one of the central challenges facing organizations such as the Center for Democracy and Technology (CDT), a Washington D.C. based organization that works to "promote democratic values and constitutional liberties in the digital age" [5]. In a recent seminar given to the MIT community, CDT Associate Director Alan Davidson described the difficulties of presenting these technically laden arguments on Capital Hill, which often defy the simplicity of sound bites, and convincing Congressional staffers or the voting public of their importance.

It is here that the computer science community, especially the student body, stands to make the greatest contribution. If computer science students learn to pay attention to current political discussions, recognize the role of digital technologies within these debates, and see the possibilities for change, they have the unique opportunity to become the next generation of watchdogs, concerned citizens, and public communicators. A technical education will lay the foundation for students to assume these public roles, but an education in history and politics will possibly inspire them to contribute in ways that go beyond the cubicle, laboratory, or ballot box. These contributions are

vital for navigating the complexities of today's world and designing a future that preserves the values we cherish.

In conclusion, November's election has provided an impetus for increasing public awareness among young voters. Computer science educators now have an extraordinary opportunity to build upon this momentum by illustrating the many connections between current events and the work occurring within the field. This multifaceted and mutually shaping relationship not only has the power to guide the innovation of future technologies, but also alter the way we articulate our fundamental rights and freedoms. This has important implications. As history has repeatedly shown, the introduction of new technologies has affected the way we live and changed the range of options available for interacting with the world around us. Information technologies, in this sense, pose no exception. However, studies of the past also reveal that human agency, not technological determinism, has governed the path of history and laid the groundwork for our current challenges. This editorial has presented several examples of how computer scientists have the power to influence our political, social, and technological futures in settings that range from the workplace to the Congressional floor. It has also illustrated that the responsible design of computer and information technologies cannot take place without attention to considerations that have not been labeled "technical" in the traditional sense. Thus, it stands to reason: if the making of a computer technology cannot be divorced from its broader social contexts, neither then can the making of a computer scientist.

References

[1] See for example John A.N. Lee. "Where did history go?" *ACM SIGCSE Bulletin*, Vol 34, No 4, December 2002, 11-12. For those who want to learn more, the Computer Research Association is currently compiling a volume dedicated to the inclusion and teaching of history in the computer science curriculum, http://www.cra.org.

[2] Paulina Borsook's book, *Cyberselfish*, PublicAffairs, New York, 2000, provides a humorous, yet provocative, look at the ideological predominance of libertarianism within high-tech culture.

[3] Lawrence Lessig, *Code and Other Laws of Cyberspace*, Basic Books, New York, 1999, 6.

[4] For a further examination of free software in the developing world see Eden Miller, "Freedom in Code: The Birth of the Chilean Free Software Movement," *ReVista: Harvard Review of Latin America,* Spring 2004 (available online at http://drclas.fas.harvard.edu/publications/tcontents.php) and Anita Chan, "Coding Free Software, Coding Free States: Free Software Legislation and the Politics of Code in Peru," *Anthropological Quarterly*, forthcoming 2004.

[5] Center for Democracy and Technology, http://www.cdt.org. The CDT website is a wonderful resource for those who want to stay current on the latest digital technology issues being discussed on Capitol Hill.

Editor's Note

Eden Miller Medina has joined the faculty of the School of Informatics at Indiana University in 2004 and is completing her doctoral degree at MIT [Program in Science, Technology (STS), and Society, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E51, Cambridge, Massachusetts 02139, <eden@mit.edu>] in the History and Social Studies of Science and Technology. Her current research traces how computer technologies have created new forms of governance in Chile from the 1960s-1980s. She is developing the groundwork for her next project on the role of information technologies in the human rights discourse.

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