THE GIS PROFESSIONAL ETHICS PROJECT: PRACTICAL ETHICS EDUCATION FOR GIS PROFESSIONALS

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Abstract

Teaching GIS involves teaching ethical and moral thinking as a distinct engagement with the use, applications, and responsibilities of GIS professionals. Over the past 20 years scholars (particularly those affiliated with the discipline of Geography) have contributed critiques of the instrumental nature of GIS as well as reflective case studies that seek to demonstrate how the technology can be used to promote social justice. During the same period a profession of GIS developed as governmental and private use of GIS burgeoned; a marker for the professionalization of GIS in the United States can be found in the observation that by mid-2009 over 4,500 individuals had earned certification as GIS professionals. Requirements for professional certification in the U.S. include practitioners' commitment to adhere with a formal Code of Ethics and Rules of Conduct. Meanwhile, U.S. higher education institutions have rushed to develop practice-oriented certificate and degree programs in response to the increasing demand for qualified GIS professionals in industry and government. Professional programs differ from academic degree programs in that most are designed to produce practitioners rather than scholars. In general, the rich literature in GIS and Society and Critical GIS is more useful to students and instructors in academic programs than those in professional programs. The objective of the National Science Foundation-funded GIS Professional Ethics Project (http://gisprofessionalethics.org) we describe in this chapter is to provide pedagogical practice and resources for American students and academics. The project combines the perspectives and experience of GIS educators and applied ethicists. The project has produced open educational resources (especially formal case studies with explicit linkages to the Code and Rules) to help professional GIS higher education programs prepare current and future practitioners to recognize and engage ethical problems.

Introduction

Engagements with "GIS Ethics"

Governments, militaries, commercial enterprises, and other interests have relied on maps and mapping for centuries and upon aerial surveillance technologies since World War I. Computerized geographic information systems, digital remote sensing, and satellite navigation systems are relatively recent developments. As these automated technologies matured and their applications became widespread in the late 1980s and early 1990s, scholars and practitioners began to express concerns about the ethical implications of their use. Brian Harley (1988) was in the vanguard of scholars who questioned the assumption that maps are impartial and value-neutral depictions. By 1991, he challenged map makers to consider whether there could be "an ethically informed cartography, and if so, what should be its agenda?" (Harley 1991, p. 13).

At the same time, Pickles (1991) highlighted the use of GIS as a surveillance technology, while Smith (1992) alleged that the makers and users of geospatial technologies were complicit in the killings associated with what he considered to be a morally questionable Gulf War. By 1995, a substantial literature focused on ethical and epistemological critiques of GIS and related technologies had appeared (e.g., Pickles, 1995), and a widening gulf of misunderstanding and mistrust had separated critical scholars from proponents and practitioners of GIS and related technologies (Schuurman, 2000).

Meanwhile, GIS began to show signs of coalescence as a distinct (if heterogeneous) profession. Among the earliest considerations of professional ethics in cartography and GIS was an "ethics roundtable" published in 1990 (McHaffie, Andrews, Dobson, & others 1990). Contributors identified implications of inaccurate maps and data, intellectual property issues, and conflicts of interest as important ethical issues. Soon thereafter, Monmonier (1991, 1996) pointed out ways in which maps can be used to mislead decision-makers and the public, and proposed design guidelines to foster ethical practice by cartographers. Speaking to the challenges for the nascent profession, by 1993, Craig had laid the groundwork for a GIS Code of Ethics (Craig, 1993). Onsrud (1995) recommended a survey of the moral reasoning of GIS professionals in response to a set of "ethical conflict scenarios" as a way to gauge the extent to which moral consensus about GIS practice exists. A code of conduct derived from "observation and analysis of current practice contexts and moral conditions," Onsrud (1995) wrote, should be "evaluated and honed by continuously reassessing (the Code's) conformance with theory" (p. 94).

Compliance with a GIS Code of Ethics (written primarily by Craig) is included among the requirements for certification as a "GIS Professional" (GISP) by the GIS Certification Institute (http://www.gisci.org), a program that began accepting applications in 2004. GISCI's Ethics Committee now seeks to compile a collection of authentic case studies to help GISPs develop moral reasoning skills (Craig, 2006). Meanwhile, following the lead

of more established fields like Computer Science, the University Consortium for Geographic Information Science (UCGIS) developed a *Geographic Information Science and Technology (GIS&T) Body of Knowledge* (DiBiase, DeMers, Johnson, Kemp, Luck, Plewe & Wentz 2006). Published by the AAG, the *GIS&T Body of Knowledge* highlights such ethical and legal issues as privacy, access, intellectual property, and others, among the 329 topics that comprise the GIS&T knowledge domain. "Ethical aspects" is included among the "core" units that UCGIS recommends as part of every geospatial certificate and degree program curriculum.

As GIS&T continues to cohere into a distinct field, emerging technologies introduce increasingly worrisome ethical challenges for academics and professionals, including such location-based services as "human tracking." Dobson and Fisher (2003) challenge society to "contemplate a new form of slavery characterized by location control" (p. 47), arguing that "…the countless benefits of [location-based services] are countered by social hazards unparalleled in human history" (p. 47). Clearly, there is an urgent need for practical ethics education that bridges the gap between academic engagment and professional practice in GIS&T.

Lessons Learned from Computer Ethics Education

The Association of Computing Machinery (in collaboration with the IEEE and other organizations) has issued a series of recommended curricula for undergraduate degree programs in Computer Science since 1968. From the outset, the recommendations included topics related to ethics and social issues. By 1994, however, observers concluded that the recommended curricula "fell short of providing sufficient detail and guidelines about how to implement [understanding of the social and ethical context of computing] within the curriculum" (Martin & Weltz 1999, p. 7). In response, NSF funded a project called ImpactCS to "define the core content and methodology for integrating social impact and ethics topics across the computer science curriculum" (Martin & Weltz 1999, p. 7). Following this effort, the *Computing Curricula 2001* (ACM/IEEE 2001) recommended "Social and Professional Issues" as one of fourteen knowledge areas, including the core unit "SP4 Social and Ethical Responsibilities."

To qualify for accreditation by ABET's Computing Accreditation Commission, undergraduate degree programs in computer science must demonstrate that there is "sufficient coverage of social and ethical implications of computing to give students an understanding of a broad range of issues in this area" (Computing Accreditation Commission 2004, p. 4). A 2005 survey of a quarter of the ABET-accredited computer science programs revealed that 55 percent of them meet this standard by teaching their own computer ethics course, 30 percent meet the standard by incorporating discussions of social and ethical implications of computing into other computer science courses, and only 15 percent of them outsource ethics to other academic departments, typically philosophy (Quinn, 2006a, b). In other words, addressing ethical issues "in house" is the

norm for accredited undergraduate computer science programs. We believe that the same should be true of in GIS&T education. As Davis (1990, p. 37) points out, "being concerned about the ethics of one's profession is a professional virtue. A professional [GIS&T] teacher can teach that virtue by example in a way a philosopher cannot."

Articles that describe, prescribe, and evaluate Computer Ethics education are plentiful. Many describe teaching strategies (e.g., Wahl 1999); face-to-face and computer mediated discussion (e.g., Sanders, 2005; Grodzinsky, Gehringer, King, & Tavani 2004), interactive tutorial and decision support software (e.g., Goldin, Ashley, & Pinkus 2001; Robbins, Wallace, and Puka 2004), and student evaluation methods including rubrics (Moskal, Miller, & King 2002) and peer review (e.g., Grodzinsky & others 2004). A common theme in the Computer Ethics education literature is the goal of giving the students the opportunity to transform themselves. As Martin and Holz put it: "Our belief is that ethics cannot be taught; rather what can be taught is a framework for evaluating ethical dilemmas and making decisions. In accepting the premise that technology is value-laden, we stress the need to teach a methodology of explicit ethical analysis in all decision-making related to technology" (Martin & Holz 2005, section 1.2).

GIS Professional Ethics Project

Unlike Computer Science, most of the academic disciplines that offer degree programs with specializations in GIS&T are not specifically accredited in the U.S--even though an estimated 50,000 students enroll in GIS classes yearly in U.S. higher education institutions. For this reason GIS&T curricula vary widely, and few require formal ethics training. Consequently, research publications on ethics education in the context of GIS&T are rare. Rarer still are case studies that illuminate the distinctive ethical problems that confront geospatial professionals. The GIS Professional Ethics project (http://gisprofessionalethics.org) promotes practical ethics training for current and aspiring GIS&T professionals by creating and sharing a collection of open educational resources – especially case studies – and evaluating their effectiveness within three graduate programs in the U.S. These materials are available for use in GIS professional education in the US and internationally. To launch the project and take the diversity of U.S. higher education into account, in 2007 the U.S. National Science Foundation sponsored design, development and evaluation of graduate GIS ethics seminars within Departments of Geography and Geosciences at the University of Minnesota, Oregon State University, and Penn State University.

At the University of Minnesota, material developed in the project is included in two courses offered in the Professional Master's of GIS degree program (see article from McMaster et al in this volume). Taught each Autumn, students in GIS 8501 spend one week on an introduction to applied ethical approaches and the seven-step method. Small groups of students apply this method to a case from the gisprofessionalethics.org website.

In GEOG 5563, Advanced Geographic Information Science, a required course for students in the program, the seven-step method is revisited and students complete a take-home assignment using the method with a case from the gisprofessionalethics.org website. Approximately 24 students are introduced to ethical issues each year through these two classes. At Oregon State University, the online course GEO 567, Responsible GIS Practice, includes a review of ethical theories and processes of moral reasoning, extensive discussion of papers and case studies, and required interviews with practitioners and development of additional original case studies based on those interviews. Around 30 students take this course each year by way of offerings in the fall and winter terms. Penn State's implementation of the "case method" within its Online Master of Geographic Information Systems (MGIS) program (http://gis.e-education.psu.edu) is a well-known GIS&T program. The Penn State MGIS program attracts working adults who are only able to participate part-time and at a distance via the instructor-led online classes. Formal training in responsible scholarship and professional practice is mandated for all Penn State graduate students. MGIS students fulfill this mandate either by completing an online workshop or a two-credit online class called "Professionalism in GIS&T. Both were developed as part of the GIS Professional Ethics project. Around 12 students will complete the Penn State's courses each year.

Teaching Practical Ethics by the Case Method

In the context of professional ethics, case studies are realistic workplace scenarios that challenge students to analyze ethical problems rationally and to identify reasoned solutions (see example in Table 2 below). Helping students develop stronger moral reasoning skills is an overarching goal of ethics education (Dark and Winstead 2005). The "case method" is a common pedagogical technique for strengthening the moral reasoning skills of students in business, medicine, law, engineering, and computer and information science (Davis 1999, Keefer and Ashley 2001, Quinn 2006c). Professional ethicists recommend that students be provided with frameworks to guide their case analyses. Penn State students are required to analyze cases using Davis' (1999) "seven-step guide to ethical decision making" (outlined in Table 1 below) or similar models suggested by Keefer and Ashley (2001) and others.

Step 1. State problem. For example, “there's something about this decision that makes me uncomfortable” or “do I have a conflict of interest?”
Step 2. Check facts. Many problems disappear upon closer examination of situation, while others change radically.
Step 3: Identify relevant factors. For example, persons involved, laws, professional code, other practical constraints.
Step 4: Develop list of options. Be imaginative, try to avoid “dilemma”; not “yes” or “no” but whom to go to, what to say.
Step 5: Test options. Use such tests as the following: *Harm test:* does this option do less harm than alternatives? *Publicity test:* would I want my choice of this option published in the newspaper? *Defensibility test:* could I defend choice of option before Congressional committee or committee of peers? *Reversibility test:* would I still think choice of this option good if I were adversely affected by it? *Colleague test:* what do my colleagues say when I describe my problem and suggest this option as my solution? *Professional test:* what might my profession's governing body or ethics committee say about this option? *Organization test:* what does the company's ethics officer or legal counsel say about this?
Step 6: Make a choice based on steps 1-5.
Step 7: Review steps 1-6. What could you do to make it less likely that you would have to make such a decision again? Are there any precautions can you take as individual (announce your policy on question, change job, etc.)? Is there any way to have more support next time? Is there any way to change the organization (for example, suggest policy change at next departmental meeting)?

Table 1: Davis’ (1999) Seven-step guide to ethical decision making.

Example Case Study

Case Study: Mapping Muslim Neighborhoods

A GIS Professional employed as director of the Center for Risk and Economic Analysis of Terrorism Events at the University of Southern California receives an inquiry from an officer of the Los Angeles Police Department (LAPD). The officer, Commander Michael P. Downing, seeks the laboratory's assistance in a "community mapping" project whose purpose is to "lay out the geographic locations of the many different Muslim population groups around Los Angeles," and to "take a deeper look at their history, demographics, language, culture, ethnic breakdown, socio-economic status, and social interactions." The community mapping project is to be one component of a counter-terrorism initiative that aims to "identify communities, within the larger Muslim community, which may be susceptible to violent ideologically-based extremism..." (Downing 2007, p. 7). The director invites Downing to send the laboratory a Request for Proposal (RFP).

Soon after the telephone contact, Commander Downing is invited to Washington DC to explain the LAPD plan to the U.S. Senate Committee on Homeland Security and Governmental Affairs. Committee chairperson Sen. Joseph Lieberman cites it, among other similar projects, as an example of effective local-level counter-terrorism strategy.

News of the Senate Hearing and the LAPD plan is reported by the major media outlets including the New York Times, KNBC Los Angeles, and National Public Radio. Within days, representatives of three local Muslim groups along with the American Civil Liberties Union sent a letter to Commander Downing expressing "grave concerns about efforts by the Los Angeles Police Department ("LAPD") to map Muslim communities in the Los Angeles area as part of its counter-terrorism program." The signatories argued that the community mapping project

> ...seems to be premised on the faulty notion that Muslims are more likely to commit violent acts than people of other faiths. Singling out individuals for investigation, surveillance, and data-gathering based on their religion constitutes religious profiling that is just as unlawful, ill-advised, and deeply offensive as racial profiling" (Natarajan et al 2007, p. 1).

Meanwhile, the LAPD's RFP arrives at the Center. The well-funded project will involve considerable GIS work and will provide support for both student interns and professional staff. However, the director worries about the unfavorable publicity and possible legal action that might attend the project given the allegations of racial profiling. How should the director respond to the RFP?

Table 2: Example Case study produced as part of the GIS Professional Ethics project.

Example Case Analysis

Table 3 below contains an edited version of a Penn State student's analysis of the example case study following Davis' (1999) seven-step guide.

Step 1: State Problem.

There are a number of potential ethical issues with this case, among them: Would work provided in response to the LAPD's RFP align with the mission of the Center for Risk and Economic Analysis of Terrorism Events? Does the Center's mission conflict with the University's? Should possible legal action or negative publicity influence the director's decision to respond to the RFP? Will the Center alienate its sponsors if it declines to submit a proposal? Will responding to the RFP alienate the University, the public, and more specifically the Muslim community? Could this project be considered racial profiling?

Step 2: Check Facts.

Fact: The Center's mission is "improve our Nation's security through the development of advanced models and tools for the evaluation of the risks, costs and consequences of terrorism and to guide economically viable investments in homeland security."

Fact: University prides itself as "pluralistic, welcoming outstanding men and women of every race, creed and background" and "private, unfettered by political control, strongly committed to academic freedom."

Fact: The LAPD has specifically invited the Center director, a certified GIS Professional, to submit a proposal in response to the RFP.

Fact: The LAPD hopes to identify Muslim neighborhoods within the city's Muslim community that may "be susceptible to violent ideologically-based extremism." (Downing 2007, p.7).

Fact: Representatives from three local Muslim groups and the ACLU object to the mapping project, claiming racial profiling (Natarajan et al, 2007).

Fact: LAPD portrays the mapping project as a "Community Engagement Plan" and specifically rejects charges of profiling.

Fact: "Racial profiling," according to one definition, "occurs whenever police routinely use race as a factor that, along with an accumulation of other factors, causes an officer to react with suspicion and take action" (Cleary, 2000). A dictionary definition is "the act or process of extrapolating information about a person based on known traits or tendencies."

Who might be able to offer guidance to the director for further direction? The University's legal counsel, ethics officer or a conflicts of interest board, and the University's own IRB can provide guidance. Professional societies may offer additional suggestions.

Step 3: Identify relevant factors.

Do the mission statements of the Center and the University conflict? An organization concerned with terrorism assessment seems an awkward fit within a university that prides itself in pluralism and independence from government influence, notwithstanding its commitment to academic freedom. The missions may in fact conflict, though on the surface they appear to be simply driven by separate objectives.

Is the project really profiling, and in what sense does mapping constitute profiling? Given the definitions cited above, the proposed project may at least be unethical, and at the worst, illegal and unconstitutional. The project would be particularly problematic if, unlike public Census surveys, it involves identification of individuals or small groups suspected of potential terrorist activities.

Is even the appearance of profiling more damaging to the University and the Center than the benefit of receiving the funding? If the funding primarily provides a short-term gain for what becomes a longer-term conflict with the media, public, and student body, the rationale for the Center's involvement is questionable.

Which of the GISCI Rules of Conduct pertain to this case? The GISCI Rules of Conduct represent a "set of objectives toward which [GISPs] must continually strive" (GISCI 2008). The Center director affirmed compliance in his application for GISP certification.

Under Section I. Obligations to Society
Rule 1: "...Some applications of GIS products and services may harm individuals (directly or indirectly) while advancing government policies that some citizens regard as morally questionable"
Rule 6, Rule 10: A GISP shall not accept an assignment that may be "in violation of GISCI Rules of Conduct" or "violate the law."

Under Section II. Obligations to Employers and Funders
Rule 6: A GISP will not assist a client who in conduct is "illegal' or "unethical."

Under Section IV. Obligations to Individuals in Society
Rule 3: "We shall allow people to know whether they are included in a database and to see the information listed about themselves. We shall encourage them to correct any inaccurate information about themselves..."
Rule 5: "If there is a potential for harm to the individual, spurious and questionable data about him or her will be validated, removed, or denoted."

How would RFP deliverables differ from publicly available Census data? Downing described some of the information the community mapping project was to collect, including data on Muslim population groups, detailing their "history, demographics, language, culture, ethnic breakdown, socio-economic status, and social interaction" (Downing 2007, p.7). Some but not all of these data are publicly available from the U.S. Census Bureau. It can be assumed that the community mapping project would go beyond simply aggregating existing public data sets.

Step 4: Develop list of options.

Option #1: Submit a proposal in response to the RFP.
Option #2: Don't submit a proposal.
Option #3: Request a modification to the existing RFP, or respond in a manner that removes any suggestion that profiling will occur.
Option #4: Spin off the Center from the University.

Step 5. Test options.
Option #1: Submit a proposal in response to the RFP.
Harm test: If awarded, the results of the project might alienate a community, cause irreparable harm to the University, and contribute to profiling.
Publicity test: Negative publicity is likely, though clients and sponsors will approve.
Defensibility test: The Center can defend applying from within it's own mission statement, but may struggle to do so within the confines of the University.
Reversibility test: If a member of the Muslim community, the director might have natural reservations about the focus and outcome of the project.
Colleague test: Center staff would likely support the decision. Other university colleagues might oppose it.
Professional test: There are numerous potential conflicts with the GISCI's Rules of Conduct.
Organization test: The University's ethics officer / legal counsel may have serious reservations.

Option #3: Request a modification to the existing RFP, or respond in a manner that removes any suggestion that profiling will occur.
Harm test: Causes LAPD to reconsider end-goals of RFP.
Publicity test: Public may not recognize the distinction, or care.
Defensibility test: Defensible but calls the Center's existence somewhat into question.
Reversibility test: University's concerns would likely be alleviated if the RFP itself were modified.
Colleague test: Colleagues would likely support and respect such a decision.
Professional test: Avoids potential conflicts with the GISCI's Rules of Conduct.
Organization test: This choice would probably be supported by legal counsel / ethics officer.

Option #4: Spin off the Center from the University.
Harm test: Could undermine the Center's viability and decrease revenue to University. Precedent could harm other University-based DHS Centers of Excellence.
Publicity test: Some may wonder why was the Center established in the University in the first place.
Defensibility test: Defensible but calls the Center's existence into question. Also questions DHS in providing the funding, and the University for pursuing the creation of the Center in the first place.
Reversibility test: DHS and University officials might be hesitant to back Center in the future.
Colleague test: Colleagues would likely question such a decision.
Professional test: Avoids potential conflicts with the GISCI's Rules of Conduct but might call into question the original intent and approval of the Center.
Organization test: This choice might be supported by legal counsel / ethics officer, if done correctly

Type to enter text**Step 6: Select choice based on steps 1-5**.

Option #3 - Request a modification to the existing RFP, or respond in a manner that removes any suggestion that profiling will occur.

Step 7: Review steps 1-6.

The Center director should reflect on potential conflicts between the Center's mission and the University's. An ethics statement may help avoid future conflicts. The key issue is whether or not the project does indeed involve profiling. If I were the director I would not submit a proposal unless I was confident that the project would not infringe on the rights and privacy to U.S. citizens are entitled

Table 3: Analysis of example case study by graduate student in Penn State ethics seminar.

Conclusions

In the process of academic engagement with ethical issues arising from the increased use of GIS and corresponding professionalization of the field in the U.S., educators involved in professional GIS ethics education have recognized the importance of pragmatically engaging students with related ethical and moral issues. The GIS Professional Ethics project contributes an important foundation for teaching ethical and moral thinking as a distinct engagement with the use, applications, and responsibilities of GIS professionals. This paper reviews these developments and demonstrates a promising method that prepares students to analyze ethical problems rationally and to respond thoughtfully. As in allied fields the case method is a key pedagogical strategy for strengthening the moral reasoning abilities of current and aspiring GIS professionals. The GIS Professional Ethics project provides a collection of case studies online for educators who wish to incorporate ethics in geospatial education and training. Comments and additions to the collection are welcome.

Preparing these materials was an important outcome of the project. We also have some reflections on the lessons we have learned. First, there is the important observation that the integration of ethics in GIS&T programs must respond to circumstances for the programs and the context of the programs. Second, the applied ethics approach aims to prepare students for the value-based decisions their professional careers will involve. Instructors can draw on these experiences and discuss their ideas and experiences with others at the gisprofessionalethics.org website. Third, students are very open to the applied approach as it holds more direct relevance for students with a strong application interest than abstract engagements through ethical theories.

Indeed, this last point may be somewhat disconcerting for educators with strong grounding in theoretical ethics or theological studies. Indeed, it seems apt to conclude with the remark, signaled in the title of this chapter, that the focus of these courses and project was and is on practical ethics. There are still important needs for theoretical ethic engagements, above all, to help inform the evolving role of ethics and morals in GIS&T. That said, we feel the thousands of computer science programs adopting applied ethics alone speaks to the relevance it holds for many GIS&T programs.

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References

Association for Computing Machinery / IEEE Computing Society (2001). *Computing Curricula 2001* Retrieved 23 March 2005 from http://www.computer.org/education/cc2001/

Cleary, J. (2000). Racial Profiling Studies in Law Enforcement: Issues and Methodology". Minnesota House of Representatives, Research Department. Retrieved 3 March 2009 from http://www.house.leg.state.mn.us/hrd/pubs/raceprof.pdf

Computing Accreditation Commission (2004). *Criteria for Accrediting Computing Programs*. Accreditation Board for Engineering and Technology (ABET). Retrieved 23 March 2006 from http://www.abet.org

Craig, W. J. (1993). A GIS Code of Ethics: What can we learn from other organizations? J*ournal of the Urban and Regional Information Systems Association,* 5(2), 13-16. Retrieved 23 March 2005 from http://www.urisa.org/certification/craigeth.pdf

Craig, W. J. (2006). Ethics for GIS professionals (Panel discussion). Association of American Geographers Annual Meeting, Chicago IL.

Dark, M. J., & Winstead, J. (2005) Using educational theory and moral psychology to inform the teaching of ethics in computing. Information Security Curriculum Development Conference '05, September 23-24, Kennesaw, GA. Association of Computing Machinery.

Davis, M. (1990) Who can teach workplace ethics? *Teaching Philosophy,* 13(1), 321-38.

Davis, M. (1999) Ethics and the University. London: Routledge.

DiBiase, D., DeMers, M., Johnson, A.B., Kemp, K.K., Plewe, B.P., & Wentz, E.A., Eds. (2006). *The Geographic Information Science and Technology Body of Knowledge.* Washington, DC: AAG.

Dobson, J.E. & Fisher, P.F. (2003). Geoslavery. *IEEE Technology and Society Magazine,* Spring, 47-52.

Downing, Michael P. (2007). Statement before the Committee on Homeland Security and Governmental Affairs, United States Senate. Washington DC, October 30. Retrieved 12 June 2008 from http://hsgac.senate.gov/public/index.cfm?Fuseaction=Hearings.Detail&HearingID=483590e6-9f4e-4aa6-b595-8ca3791e4acb

GIS Certification Institute (2008). Rules of Conduct for Certified GIS Professionals (GISPs). http://www.gisci.org/Ethics_and_Conduct/rules_of_conduct.aspx Accessed July 6, 2009.

Goldin, I.M, Ashley, K.D., & Pinkus, R.L. (2001) Introducing PETE: Computer support for teaching ethics. *Proceedings of ICAIL-2001,* pp. 94-98. Association for Computing Machinery.

Grodzinsky, F., Gehringer, S., King, L.S., & Tavani, H. (2004). Panel: Responding to the challenges of teaching computer ethics. *SIGSCE '04 Proceedings,* pp. 280-281. Association for Computing Machinery.

Harley, J. B. (1988). Maps, Knowledge, and Power. In D. Cosgrove and S. Daniels, Eds., *The Iconography of Landscape,* pp. 277-312. Cambridge: Cambridge University Press.

Harley, J. B. (1991). Can there be a cartographic ethics? *Cartographic Perspectives,* 10, 9-16.

Keefer, M. & Ashley, K.D. (2001). Case-based approaches to professional ethics: A systematic comparison of students' and ethicists' moral reasoning. *Journal of Moral Education,* 30(4), 377-398.

McHaffie, P., Andrews, S., Dobson, M., & "Two anonymous employees of a federal mapping agency" (1990) Ethical problems in cartography: A roundtable commentary. *Cartographic Perspectives,* 7, 3-13.

Martin, C.D., & Holz, H.J. (2005). Non-apologetic computer ethics education: A strategy for integrating social impact and ethics into the computer science curriculum. Retrieved 5 July 2009 from http://www.southernct.edu/organizations/rccs/resources/teaching/teaching_mono/martin_holz/martin_holz_intro.html

Martin, C.D. & Weltz, E.Y. (1999). From awareness to action: Integrating Ethics and Social Responsibility into the computer science curriculum. *Computers and Society,* June, 6-14.

Monmonier, M.S. (1991). Ethics and map design: Six strategies for confronting the traditional one-map solution. *Cartographic Perspectives,* 10, 3-8.

Monmonier, M.S. (1996). *How to Lie with Maps*. Chicago: University of Chicago Press.

Moskal, B., Miller, K., & Smith King, L.A. (2002). Grading essays in computer ethics: Rubrics considered helpful. *Proceedings of SIGCSE'02,* February 27-March 3. Association for Computing Machinery.

Natarajan, Ranjana, and five others (2007) Letter to Commander Downing, LAPD. Retrieved 12 June 2008 from http://www.npr.org/templates/story/story.php?storyId=16162012

Onsrud, H.J. (1995). Identifying unethical conduct in the use of GIS. *Cartography and Geographic Information Systems,* 22(1), 90-97.

Pickles, J. (1991). Geography, GIS, and the surveillant society. *Papers and Proceedings of Applied Geography Conferences,* 14: 80-91.

Pickles, J., Ed. (1995). *Ground Truth: The Social Implications of Geographic Information Systems.* New York: Guilford.

Quinn, M.J. (2006a). *Ethics for the Information Age*. 2nd Ed. Pearson Addison-Wesley, Reading, MA.

Quinn, M.J. (2006b). On teaching ethics inside a computer science department. *Science and Engineering Ethics*, 12(2).

Quinn, M.J. (2006c). Case-based analysis: A practical tool for teaching computer ethics. *Proceedings of SIGCSE '06*, March 1-5, pp. 520-524.

Robbins, R.W., Wallace, W.A., & Puka, B. (2004). Supporting ethical problem solving: An exploratory investigation. *Proceedings of SIGMIS '04,* April 22-24, pp. 134-143.

Sanders, A.F. (2005). A discussion format for computer ethics. *Proceedings of SIGCSE '05,* pp.352-355. Association for Computing Machinery.

Schuurman, N. (2000). Trouble in the heartland: GIS and it critics in the 1990s. *Progress in Human Geography,* 24(4), 569-590.

Smith, N. (1992). History and philosophy of geography: real wars, theory wars. *Progress in Human Geography,* 16, 257-271.

Wahl, N. J. (1999). YAATCE – Yet another approach to teaching computer ethics. *Proceedings of SIGCE '99,* March, pp. 22-26. Association for Computing Machinery.