Information Technology and Society

Topic 7:
Risks, ethics, and evaluation of IT

1. Humans and IT
2. System and software failure
3. Ethics of IT professionals
4. Future prospects of IT

Reading:
Baase, Ch. 7-9;
Appendix A

Inquiry

- Is the reliability of software today at an advanced or primitive stage?
- In shaping our world, are we *enabled* by the ubiquity of computing and the connectivity of people?

Objectives

7a. Explain risks related to IT and ways to manage them

7b. Explain ethical responsibilities of IT professionals

1. Humans and IT

Computers vs. other technologies

- All technologies have benefits and risks
- We are dependent on all kinds of technology
- Unlike other technologies…
  - Computers make decisions
  - Software is often built from custom components
  - Pace of change with IT is rapid
- "Relying solely on results produced by computers is temptingly easy" (Baase)

IT and human relationships

- Do human interaction and community suffer because of computer use?
- Do computers invite addiction or divert people from worse addictions?
- "Perverse market dynamic" occurs in the fact that Wal-Marts are replacing downtowns
- Is e-commerce replacing human contact? Or is it just competition and choice that does this?
- Web 2.0 enables user–generated web content and greater human connectivity via Web

The digital divide

- *Definition:* lack of access to IT for some people
- Universal access is seen by some as a claim right
- Computer ownership by U.S. households: 1990, 22%; 2001, 63% (57% with Internet)
- *Global divide:* 1B of 5B persons worldwide had Internet, ca. 2007

IT and large-vs.-small enterprises

- J. Mander: Computers are bad for individuals and small businesses, good for large ones
- J. Naisbitt: telcom reduces size of business units
- Developing countries may benefit from IT earlier than from other new technologies

Risk: low-quality information

- Site operators must provide for correction of dangerous misinformation posted
- Digital image and video manipulation raise problem of possible deception – which kinds of manipulation are ethical?
- Does the ease of formatting and copying by computer, compared to difficulty of critical thinking, discourage critical thinking?
- Do we rely on the computer to do critical evaluation for us?

Computer modeling

- *Models*
  - *simplify* by abstracting from (removing) inessentials
  - are based on *assumptions*
- *Examples:*
  - Car-crash analysis software performs well
  - Climate change modeling
- *Two limitations of modeling:*
  - accuracy of data
  - knowledge of phenomena (e.g., clouds)

2. System and software failure

- Small errors can have huge impact , e.g., three lines in a 3M-line program disrupted phone in a region
- Failures are often caused by upgrade processes
- Failures of transportation-related systems without paper backup can cause huge travel disruptions
- A significant problem, as with Mars Orbiter: lack of error-detection procedures
- Software company stonewalling left students and educators on hook because of incorrect test-reporting software, used as sole criterion for decisions

E voting problems

- Congress authorized $3.8B for voting-system improvement, 2002
- Most voters cast other than paper ballots
- Many errors in E voting occurred, 2002-2006
- *Problems reported:*
  - Insecure encryption
  - Insufficient memory
  - Poor physical protection
  - Insufficient testing and training
  - Proprietary secret software
- Reasonable trustworthiness absent (S. Baase)

Wasted system development

- Houston airport: disastrous $193M baggage-handling system scrapped, 2005
- Hong Kong and Kuala Lumpur: massive failure of complete automation of airports (falsely) blamed on data-input errors
- Numerous other systems, costing hundreds of millions or billions of dollars, scrapped because of poor or changing requirements, poor management, bad expertise
- Of $1 trillion spent on IT projects annually worldwide, 5-15% are abandoned before or soon after delivery

Dangerous software errors

- Therac-25 radiation therapy machines gave massive overdoses to six patients, 1985-1987
- When given reports, manufacturer denied that the machine could have done this
- Clinics were overconfident in machine
- Operators ignored error messages
- Software errors were not expected
- Poor software development practices were followed

Assuring reliability

- System developers have professional responsibility to follow standard engineering practices
- Principles of good user interfaces
- Redundancy and self checking by systems
- Good testing practices
- Criminal and civil consequences for bad practices
- Warrantees
- Government regulation of safety aspects

Software engineering principles and steps

- Specification, including good user interface
- Design, including fault tolerance
- Coding
- Testing and maintenance, including independently of developers
- Redundancy where appropriate

3. Ethics of IT professionals

- *Concerns*
  - Transparency, honesty
  - Privacy
  - Free expression
  - Intellectual property
  - Safety, security
- *Factor:* persons affected by IT work are often not customers of IT professional doing the work, and have no control
- Obligations include limiting risk to others

Professional ethics

Responsibilities may exist toward

- Customers and clients
- Coworkers, employees, employers
- Others affected by products and services

Examples in other fields

- Ethics of journalists
- Business ethics
- Science research

Ethical decision making in IT professions

Questions:

- Who is affected? What are their rights?
- What are risks or issues?
- What are benefits?
- What actions are possible?
- What are responsibilities of actors?
- What are ethically acceptable choices?

Ethics for software developers

- Costs and benefits to end users, including safety
- Decisions affect employer reputation and profits
- Whistle blowing may helping company and the public
- Some issues are worth going public or quitting over
- The issue is not always safety or quality versus profit
- To assess risk one must have sufficient expertise
- Disclosure of conflicts of interest is crucial
- Testing should be independent of product development
- Maintenance of systems requires same professionalism as initial development

Codes of ethics for IT professionals

- Central concern: the public good, including human rights and diversity of culture
- Honesty and fairness in communication about software and related topics
- Use client or employer property only as authorized
- High quality, reasonable cost and schedule
- Respect for privacy, intellectual property
- Disclose conflicts of interest
- Address software errors
- Lifelong learning
- Honor agreements and assigned responsibilities

Some guidelines

- Define objectives reasonably
- Involve users in design and testing
- Plan, estimate and schedule carefully
- Design for human users, validating input
- Validate components and default settings
- Speak honestly of risks and limitations
- Disclose possible conflicts of interest

Some ethical-choice scenarios

- A clinic for families with problems with violence wants its staffers to have laptops for home visits – issue is client privacy protection via security steps
- Designing an email system with targeted ads – issue is storage of customer data related to ads and responses to them
- Implementing a system design where demographic data is missing from input – ethical issue is related to following system specs

More scenarios

- Testing of a safety-critical central application under deadline pressures to ship – should delivery be delayed?
- Copyright violations by installing more copies than licensed
- Requests to sell confidential information
- Conflict of interest – stakeholders should be informed
- Kickbacks – recommendations are expected to be honest opinions, not paid for
- Expert system for judicial sentencing

4. Future prospects of IT

- Predicting accurately about IT has been difficult
- Technology "shapes the space of possibilities in which [people] can act: people are drawn to technologies that expand the spaces of their actions and relationships" (P. Denning)
- *Technological singularity:* the point at which machine intelligence reaches too far for us to see what is beyond
- Will we still be human when we can implant Internet interfaces in our brains?

Frontiers of computation

- *What is computation?*
  - Both human thinking and computer processing?
  - Is communication (interaction) part of computation?
- *Can a machine be intelligent?*
  - Think? Have emotions? Imagination?
  - Does a computer "understand" machine language?
  - Does it "know" the information it has access to?
  - Is chess-playing research intelligence?
  - Can computers create art?

Issues about artificial intelligence

- *Strong AI view:* an AI system may *be* intelligent
- *Refutation based on phenomenology* (study of experience): machines are said to lack the *experience* of thought
- *Argument based on intentionality*: machines are said not to be referencing actual things in the world
- *Comparisons:* artificial sweeteners, insemination; flowers
- Is computer simulation of a mental process an actual mental process?

Concepts

artificial intelligence
code of ethics
conflict of interests
digital divide
digital image and video
electronic voting
error detection
fault tolerance
input validation
interface principles
model
professional ethics
redundancy
risks
safety-critical application
software engineering
specification
system development
technological singularity
testing practices

References

ACM/IEEE. Software Engineering Code of Ethics.

ACM IT professionals' code of ethics.

S. Baase. *A Gift of Fire*, 3rd ed. Pearson Prentice Hall, 2008, Chs. 7-9.

M. Castells. *Rise of the Network Society*, 2nd ed. Blackwell, 2000.

R. Spinello and H. Tavani, ed. *Readings in CyberEthics*, 2nd ed. Jones and Bartlett, 2004, Ch. 3.