Information Technology and Society

Topic 6: Risks, control, and evaluation of IT

1. Human impact of IT
2. The need for human judgment
3. System and software failure
4. Future prospects of IT

1. Human impact of information technology

- Miracle or catastrophe?
- Neo-Luddites condemn computer technology that they say
  - Causes massive layoffs
  - Manufactures needs
  - Causes social inequality and disintegration
  - Destroys the environment
  - Helps big business and government most
- One issue: is nature or humanity the standard of moral value?

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

Computers 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 commerce? Or is it just competition and choice that does this?

The digital divide

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

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

2. The need for human judgment

- *Social media sites:* enable sharing information, opinion, entertainment
- *Democratic journalism:* news stories voted on by participants; e.g., *Digg*, *Newsline*
- *Blogs:* usually immediate, unedited reactions by non journalists
- *Wikipedia:* 1.7 million articles (‘07), 600 million words (vs. *Encyclopedia Britannica*, 40 million words), anonymous writers, any article editable by anyone

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

3. System and software failure

- Small errors can have huge impact , e.g., three lines in a 3-million-line program disrupted phone networks in several cities
- Failures are often caused by upgrades and 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
- “Relying solely on results produced by computers is temptingly easy”

E voting

- 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

4. Future prospects of IT

- Current predictions about IT have been difficult in the past
- 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?

References

S. Baase. *A Gift of Fire*, 3rd ed. Pearson Prentice Hall, 2008, Chs. 6-7.

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.