THE UNIVERSITY WISCONSIN MADISON

Engineering Ethics

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Engineering Ethics

Ethics
- Issues of right and wrong; morality
- Very broad, complex, and personal topic
- This not the time or the place; happy to discuss this off-line

Engineering Ethics
- Right and wrong *with respect to engineering practice*
- Consider effects of your professional decisions and actions
- Direct effects, e.g.
  - Safety and well-being of others
  - Legal/judicial consequences
- Indirect effects, e.g.
  - Profitability of your employer; stockholders' rights
  - Your financial security

Legal

Ethical

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Why Study Engineering Ethics? [M. Pritchard 1992]

1. **Stimulate the Moral Imagination**
   What if, role reversal, empathy
2. **Recognizing Ethical Situations**
   Know when to tread carefully and deliberately
3. **Developing Analytical Skills**
   Some tools to help you work through gray areas
4. **Eliciting a Sense of Responsibility**
   Don't pass the buck
5. **Tolerating Disagreement and Ambiguity**
   Reasonable people can differ; not everything is black and white

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Key Concepts: Factual/Conceptual/Ethical [ethics.tamu.edu]

Example scenario

Employee moves from Company A to Company B, but has signed a contract to not disclose *proprietary information*. At B, she finds a new way to apply a technique she learned of at company A. This will lead to a better, safer product for B, and will not affect A, since they are in a different line of business. Should she disclose the technique to B?

What issues are <u>factual</u>? Clear true and false
- Here: better, safer product
- Facts not always as easy to ascertain
- Nevertheless, once known, should be unambiguous
- Can usually be resolved by investigation or empirical research

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What issues are <u>conceptual</u>? A matter of definition
- What does *proprietary information* mean?
- What constitutes *use* of proprietary information?
- All parties must come to some agreement (consensus)
  - Lawyers/judges/courts often get involved

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What issues are <u>moral or ethical</u>? A matter of principles
- Which moral principles are *relevant?*
  - Here, *theft* of intellectual property
- If more than one *conflict*, does one outweigh the other(s)?
  - What if B's products are failing in life-threatening ways without this technique?
  - *Doing no harm* now conflicts with *theft*

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Moral/Ethical Principles

Vary widely across cultures, individuals

Something you ultimately have to decide for yourself
- Don't reinvent the wheel
- Careful about legal vs. ethical conflicts
  - You may think it's ethical, but employer must do what's legal

Possible starting points:
- Political: Bill of Rights, Constitution
- Religious: Ten Commandments, Golden Rule
- Judicial: Common Law traditions and precedent

Applying Moral/Ethical Rules [ethics.tamu.edu]

Analyze a continuum of analogous situations

Moral rule: "People should not steal (or commit theft)."

1. Breaking into a store and taking $3000 in merchandise.
2. "Borrowing" a friend's car and failing to return it.
3. Taking a bicycle that someone had forgotten to lock.
4. Developing a computer program on company time for your company, and then patenting a considerably improved version of the program under your own name.
5. Borrowing a book from a friend, keeping it by mistake for a long time and then failing to return it. (You discover the book after your friend has moved away, and you decide to keep it.)
6. Using some ideas you developed at Company A for a very different chemical process at Company B.
7. Using some management techniques at Company B that were developed at Company A.
8. Picking up a quarter that you saw someone drop on the street.
9. Failing to return a sheet of paper (or paper clip) you borrowed
10. Picking up a quarter that someone (you don't know who) has dropped on the street.

Example: IEEE Code of Ethics

IEEE: Institute of Electrical and Electronics Engineers
- Professional organization for EEs, CMPEs, CS professionals

Code of ethics established in Feb. 2006

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

1. to accept responsibility in making decisions consistent with the _safety, health and welfare_ of the public, and to disclose promptly factors that might _endanger_ the public or the environment;

2. to avoid real or perceived _conflicts of interest_ whenever possible, and to _disclose_ them to affected parties when they do exist

Example: IEEE Code of Ethics

3. to be _honest and realistic_ in stating claims or estimates based on available data;

4. to reject _bribery_ in all its forms;

5. to _improve the understanding_ of technology, its appropriate application, and potential consequences;

6. to maintain and improve our _technical competence_ and to undertake technological tasks for others _only if qualified_ by training or experience, or after full disclosure of pertinent limitations;

7. to seek, accept, and offer _honest criticism_ of technical work, to acknowledge and _correct errors_, and to credit properly the _contributions of others_;

Example: IEEE Code of Ethics

8. to _treat fairly_ all persons regardless of such factors as race, religion, gender, disability, age, or national origin;

9. to _avoid injuring_ others, their property, reputation, or employment by false or malicious action;

10. to _assist_ colleagues and co-workers in their professional development and to _support_ them in following this code of ethics.

Some Useful Rules and Tools

Principle of informed consent
- Assume that people will act in their own best interest
- Ultimately an individual is responsible for his/her own welfare
- Ethical rule: Full disclosure to enable informed decisions

Golden rule
- Do unto others as you would have them do to you
- Pitfalls (don't rat out a bad engineer since you don't want to get ratted out)

The "New York Times" test
- Would you want to read about what you did on the front page?

Utilitarianism and Rights of Persons
- Analyze to find "best net outcome" or "least violation of rights"

Utilitarian and Rights of Persons Analyses

Procedure
- **Identify all those affected by an ethical decision**
- **Weight effects on all stakeholders for each outcome**
- **Consider sum of weights; choose the best outcome**

Problems
- **How do you weight intangibles?**
- **How do you weight effects on others vs. effects on you?**
- **What are relative values of different "rights"**
- **Can lead to bad conclusions**
- **Must be applied carefully and judiciously**

Nevertheless can be a useful tool for analysis
- **Can help you find a "third way" (alternative solution/outcome)**

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Example Scenario 1

You are developing a device driver for a USB webcam. While testing it you find that it crashes Windows unpredictably about once a week.
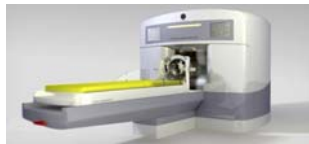
Should you release it? With what, if any warnings?

Who is affected and how?
- Company/shareholders: profitability, short- vs. long-term
- Customers: critical/urgent need vs. safety issues
- Third parties: how are your customers using these?
  - ATM security camera …
- You and your dependents: employment, income, liability

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Example 2: Therac-25

Radiation therapy machine in use from 1982-
- Software (computer) controlled, few hardware safety interlocks

Multiple design errors and safety mechanism failures
- One related to arithmetic overflow, which disabled safety interlock

Led to at least 6 radiation overdoses, 3 patients died

Conclusions
- Insufficient resources to develop software (1 engineer)
- Insufficient testing, inappropriate reuse of prev-gen control software
- Initial denial, slow reaction to reports of problems

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Example 3: Google Image Search

Tiananmen Square massacre in Beijing in 1987
Google image search (images.google.com)
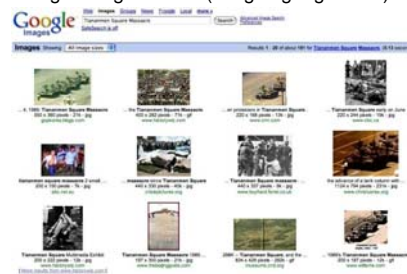
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Example 3: Google Image Search

Google image search (images.google.cn in 2006)

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Example 3: Google Image Search

Imagine you worked at Google and your manager ordered you to implement this feature (censorship).

What would you do?
1. Resign in protest?
2. Just do it?
3. Do it, but leak info to the press?
4. ???

Who is affected by your decision and how?

- Google & shareholders (profits)
- You & dependents (employment, income)
- Google users in China
  - Deprived of true history
  - Also could be deprived of any access to Google

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Engineering Ethics: Summary

Engineering Ethics
- Right and wrong *with respect to engineering practice*

Differentiating between Factual, Conceptual, and Moral

Moral Principles
- Help detect when something smells
- Guide ethical decision-making

Analysis of Conflicting Principles
- Identify those affected
- Consider direct and indirect effects of your professional decisions and actions

Bottom line: sometimes there are no easy answers

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