Ethics and Technology

- **Engineers and computer scientists are <u>professional practitioners</u>.**

- **Although we often work for companies, non-profit institutions, or governmental units, we can also be independent agents and work for <u>clients</u>, like MD's or attorneys.**

- **Professions like ours have guidelines for interacting with clients, and these are called <u>professional ethics</u>.**

What are Ethics?

- **Ethics are general regarded as moral practices on which civilized societies base their laws and guidelines of behavior.**

- **They are usually based on moral codes (standards of behavior) of societies.**

- **They are part of a larger group of interaction rules which civilized peoples use to guide their relationship to others.**

- **Let us consider these rules in general.**

Interaction Rules

- **Society has rules of conduct that govern personal and organizational interactions.**
- **These include behavioral <u>guidelines</u>, legal implications, and moral (right/wrong) considerations, such as:**
  - Etiquette – Rules governing personal interaction; only penalty = embarrassment. Examples: Dressing, speaking well (face-to-face and over the telephone), proper table manners etc.
  - Legal issues – Societal mandates of behavior; "laws." Penalty for breaking laws = jail, etc. <u>Technical professionals need to know the laws pertaining to their profession</u>.

Rules (Continued)

- Morals – Accepted standards of <u>right and wrong in a society</u>. Typically "self-evident" standards of goodness (or evil) that <u>are not debatable</u> ("do not kill," "do not steal"), but <u>they still depend on the society</u>.
  - Some ancient civilizations believed in human sacrifice.
  - Some societies today believe in severe punishments for behavior that is considered acceptable in other societies.
  - Some "rights" may be controversial.
  - Engineers should of course seek to satisfy all societal moral standards.
- Finally, Ethics – Generally, <u>concepts or principles of right and wrong behavior</u>. <u>Most professional and engineering societies have a formal code of ethics</u>. Ref: NSPE code of ethics: <u>http://www.nspe.org/Ethics/CodeofEthics/index.html</u>

"Thumbnail" Definitions

- **Morals:** Societal or religious standards of right and wrong (can depend on society or religion).
- **Interaction rules in civilized societies:**
  - Etiquette – Guidelines for polite behavior. The only penalties for transgression are embarrassment or shunning.
  - Laws – Societal directives (demands) for correct behavior. Penalties can be severe and include imprisonment and death.
  - Ethical principals or codes – Organizational or religious guidelines for behavior generally dictated by moral considerations. Penalties may include organizational censure or ouster; where principles and laws overlap, legal penalties such as imprisonment may result.

Conflicts: Moral vs. Legal

- **Conflicts between moral standards and legal standards (laws) can occur because:**
  - **A law may not cover a specific situation (e.g., some <u>internet</u> violations).**
  - **Some moral standards cannot be successfully made into laws (e.g., <u>prohibition</u>).**
  - **Laws must be for everyone, no exceptions.**
  - **Laws must govern behavior, not attitude or thought.**
  - **Bad laws may be enacted by immoral governments (e.g. .Nazi regime).**

ECS 1200 Lecture 11 -- Ethics and Technology © N. B. Dodge 09/11

Settling Conflicts

- **Settling conflicts. Settling conflicts between ethical standards and laws can be difficult. Sometimes, more than one "look" at an issue (i.e., another viewpoint) may be needed to resolve a conflict:**
  - **Moral viewpoint** – sometimes a simple moral judgment can be made – e.g., speeding is bad due to potential for harm to others.
  - **Conceptual viewpoint** – given that speeding is bad, what is speeding? 55 mph? 70 mph? 30 mph?
  - **Application viewpoint** – going 40 mph in a 55 zone and having an accident may be breaking the law if it's rainy or icy.
  - **Factual issues** – "Speeding" may not be speeding if a radar gun is inaccurate.
  - **The point**: Ethical/legal conflicts can be difficult to resolve. Different viewpoints, moral values, additional information, may all be necessary to resolve them.

Moral Theories

- **In order to evaluate "proper" societal behavior, moral theories have been developed over the history of civilization.**

- **Some "moral algorithms" are discussed below, along with how each would arrive at the correct decision in a specific example:**
  - **A building inspector offered a $10K bribe to overlook bad construction not up to San Francisco building code for earthquakes.***

* Case study taken from Holtzapple & Reece, Concepts in Engineering, McGraw-Hill, © 2008

ECS 1200 Lecture 11 -- Ethics and Technology © N. B. Dodge 09/11

Moral Theories (Continued)

- **Ethical Egotism: Acting with enlightened self-interest.**
  - **Example: Self defense from a mugger.**
  - **In the bribery case, the inspector should not do it, as <u>he might get caught and go to prison</u>.**

- **Utilitarianism: A mathematician's dream. Maximize the "happiness objective function" *H*, and all is well.**
  - **$H = \Sigma$ (all happiness generated)– Σ (all harm resulting).**
  - **H should be <u>maximized</u> to solve the issue. Problem: Assumes (a) we understand <u>all</u> happiness sources, (b) we understand <u>all</u> harm sources, and (c) does not take into account that <u>individuals</u> may suffer harm.**
  - **In the bribe example, the building may collapse in an earthquake and kill many people. This overwhelms the $10,000 "happiness."**

Moral Theories (Continued)

- **Rights analysis – Basically the <u>Golden Rule</u>. That is, "treat others as you (and they) would like to be treated."**
  - **In the bribery case, clearly the "Golden Rule" approach forces the inspector to refuse the bribe.**
- **When the moral algorithms disagree, society makes <u>hard choices</u>. Examples:**
  - **Eminent domain: individual rights are violated so that societal rights are served.**
  - **Sickly man with healthy brother who has a tissue match. Suppose the brother does not like the sickly man and chooses to refuse the donation. Society says he is within his rights (which clearly violates utilitarianism).**
  - **Some advocates suggests that when theories diverge, use utilitarianism <u>unless individual rights are seriously violated</u>.**

© N. B. Dodge 09/11

Ethical Systems

- **Clearly, ethical systems are varied, and any number exist. following are two very old ethical systems which laid the groundwork for many of both our ethical codes and our legal systems.**
- **Note that the British legal system, on which much of US law is based, is said to trace its ethical base to the Christian moral code and the biblical Ten Commandments.**
- **Some claimants state that parts of our legal system may have also descended from Islamic Sharia Law, brought back to Europe by the Norman crusaders.**

The Code of Hammurabi

- **Established by King Hammurabi, Babylonia, ~ 1800 BC.**
- **Covers mainly 4 fields: economic provisions, family, crime and civil matters.**
- **The legal system is quite detailed, and even contains information on rates for services and trade. The criminal law is based upon equal retaliation, according to the eye-for-an-eye principle.**
- **Laws are quite humane; there are few tribal customs.**
- **For example, no blood feud or any private retribution or marriage by capture is allowed.**
- **Legal procedures guidelines are given. There are details about penalties for unjust accusations and perjury.**
- **All citizens in the Babylonian society were protected under the legal system, <u>even slaves</u>.**
- **No laws concerning religion were given.**

Examples: Code of Hammurabi

- If any one steal the minor son of another, he shall be put to death.

- If any one find runaway male or female slaves in the open country and bring them to their masters, the master of the slaves shall pay him two shekels of silver.

- If any one open his ditches to water his crop, but is careless, and the water flood the field of his neighbor, then he shall pay his neighbor corn for his loss.

- If a man wishes to separate from his wife who has borne him no children, he shall give her the amount of her purchase money and the dowry which she brought from her father's house, and let her go.

- If a man put out the eye of another man, his eye shall be put out.

- If a builder build a house for some one, and does not construct it properly, and the house which he built fall in and kill its owner, then that builder shall be put to death.

Ten Commandments

Early Hebrew Code (~ 1200 BC)

I   You shall have no other gods before Me.

II   You shall not make for yourself a carved image--any likeness of
   anything …

III   You shall not take the name of the LORD your God in vain.

IV   Remember the Sabbath day, to keep it holy.

V   Honor your father and your mother.

VI   You shall not murder.

VII   You shall not commit adultery.

VIII   You shall not steal.

IX   You shall not bear false witness against your neighbor.

X   You shall not covet … anything that is your neighbor's.

 © N. B. Dodge 09/11

Differences

- **Code of Hammurabi:**
  - **No religious directives.**
  - **Laws spelled out (document was <u>both</u> ethical code and laws).**
  - **Punishments outlined.**
  - **Note <u>equal treatment</u> of citizens, <u>including slaves</u>.**
- **Ten Commandments:**
  - **Strong religious flavor.**
  - **Prohibitions tied to religious basis.**
  - **Punishments not spelled out (later Hebrew code would develop which did include punishments).**

The Ethical Technologist

- **Summary of behavioral standards from various ethical codes:**
  - Protect public safety, health, and welfare.
  - Only work in area of competence.
  - Be truthful and objective.
  - Be honorable, dignified.
  - Never stop learning.
  - Do "a day's work for a day's pay."
  - Contact proper authorities about illegal behavior.
  - Be involved in your community.
  - Protect the environment.
  - Do not accept bribes, gifts, or anything else that would interfere with your work standards or judgment.
  - Protect client or employer information (esp. federal gov't!).
  - Avoid any conflict of interest.

IEEE

IEEE CODE OF ETHICS

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;

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;

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.

UTD Code of Conduct (Short Form in Syllabi)

Student Conduct & Discipline: The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, *A to Z Guide*, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391).

A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

Academic Integrity: The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and/or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings.

Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.
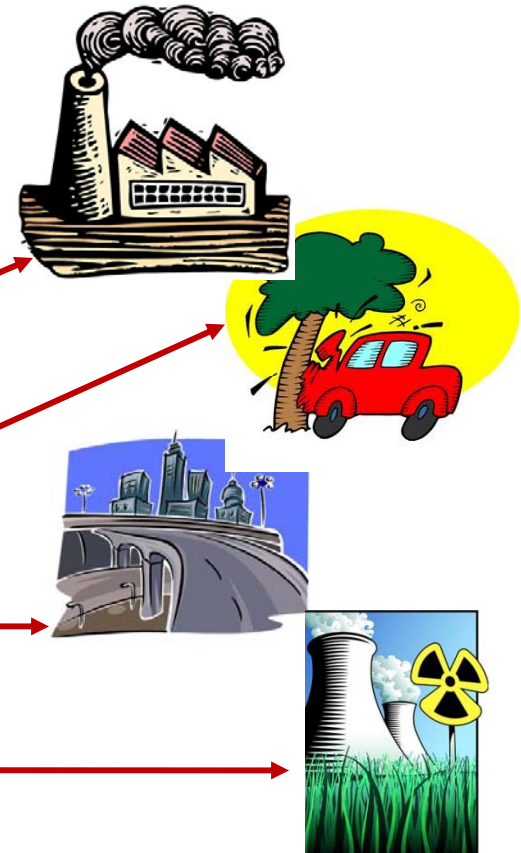
Other Topics

- **Conflict of interest – judgment compromised due to relations, loyalties, etc.**

- **Whistle blowing – informing management or authorities about serious harmful or illegal activities existing in a company or organization. There may be a major price for this noble activity. DOING THE RIGHT THING CAN BE COSTLY!**

- **Game theory – A tool for evaluating behavioral strategies that conform to the moral theory of ethical egoism.**

Resource Allocation

- **Society has limited resources to solve problems.**
- **Resource allocation issues = ethical conflicts. Examples:**
  - **Cost of removing carcinogens vs. benefit.**
  - **Cost of adding safety equipment to a car versus lives lost if not added.**
  - **Highway construction budget; spending must benefit the most drivers.**
  - **Nuclear power plant – not voluntary situation for those that live close, therefore much higher safety standards.**

Cases: Space Shuttle Disaster

- **Challenger shuttle used solid-fuel rockets, made by Morton-Thiokol.**
- **Rocket tubes made in pieces, assembled close to launch site.**
- **Tube pieces sealed together with rubber O-rings and putty.**
- **Day of launch was cold and windy (~ 35° F).**
- **Engineer warned that cold made seals fragile.**
- **Management and NASA <u>ignored warnings and launched</u>.**
- **During launch, <u>a seal failed, and the shuttle fuel tank exploded</u>.**

Seconds after challenger explosion.

Challenger Disaster (2)

- **Questions:**
  - Should engineers have "blown the whistle?"
  - Were NASA and Morton-Thiokol managers to blame?
  - Were problems due to ethical lapses or "reasonable" budget constraints, or:
  - Were engineers at fault for an inferior design (regardless of cost constraints)?
  - Should an expensive escape system have been developed?
  - Space travel *is* dangerous – was this just "acceptable risk?"

Missouri City TV Antenna Collapse (1982)

- TV antenna in Missouri City, TX, built of pre-assembled sections using a "crawling" crane, set each section into place.
- Microwave "baskets" interfered with cable attachment points at top for last section.
- Engineers refused to remove baskets, due to potential for damage.
- Engineering company refused to approve a platform extension; also refused to approve drawings for an extension by another party. Installing company proceeded with installation.
- Bolts for extension based on weight, not **huge** torque due to extension projection. Extension failed, killing installation crew.

Final antenna ("basket") section of Missouri City antenna (section that dropped).

Missouri City Antenna Disaster (Continued)

- **Questions:**
  - **Was the original design faulty?**
  - **Was the construction company at fault for "engineering" a solution?**
  - **Should the engineering company have consulted?**
  - **Was there a greater fault? A lesser? Were any parties "innocent?"**
  - **Was this an ethical lapse? Bad judgment? Both?**

Kansas City Hyatt Walkway Collapse (1981)

- **Two walkways built across central Atrium of the Hyatt Regency.**
- **Design changed walkway suspension.**
- **Revised design put double stress on the upper bolts.**
- **Supervising engineer approved changes without reviewing carefully.**
- **A dance at the hotel attracted many party-goers onto the walkways.**
- **Weight caused top walkway to collapse. Casualties: 114 dead, 200+ injured.**
- **Two engineers lost professional license; found civilly guilty of negligence. Incredibly, they are still practicing engineering in other states!**
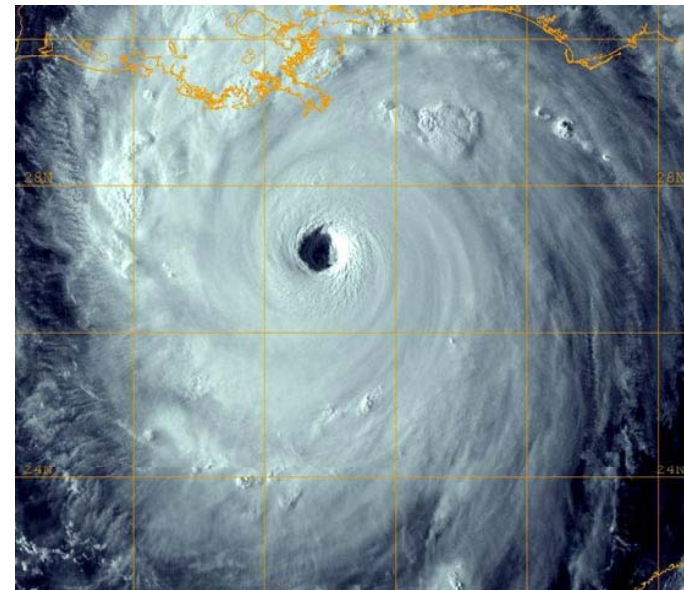

Aftermath of Hyatt walkway collapse.

Kansas City Hyatt (2)

- **Questions:**
  - **Was this an ethical lapse or simply incompetence?**
  - **Was the contractor who built the building at fault?**
  - **Should the engineers still be permitted to practice?**
  - **Should they be in jail?**
  - **What steps should be taken to prevent future disasters such as this?**
  - **What do you think of the ORIGINAL DESIGN?**

Hurricane Katrina

- **New Orleans history: 7 category 3 hurricanes (111+ mph), 8 cat. 4 hurricanes (131+ mph) and 2 cat. 5 hurricanes (155+ mph).**

- **Aug, 2005, Katrina (cat. 3 at landfall) hit Louisiana and Mississippi. Over 1800 died, $81 billion in property damage.**

- **Levees designed to protect the coast in Louisiana failed.**

- **In the aftermath, every political entity blamed every other entity.**

Actual photograph of Hurricane Katrina from space.

Katrina (2)

- **Accusations:**
  - *Levee maintenance money was used for other purposes.*
  - *Levee work was substandard.*
  - *Environmentalists blamed for thwarting work to strengthen levees (marsh preservation).*
  - *Construction of levees halted wetland preservation and prevented wetland renewal, a natural buffer to the storm.*
  - *Water pumps to help drain flood water had no backup power.*
  - *Lack of disaster preparation.*
  - *Levees not maintained for years.*
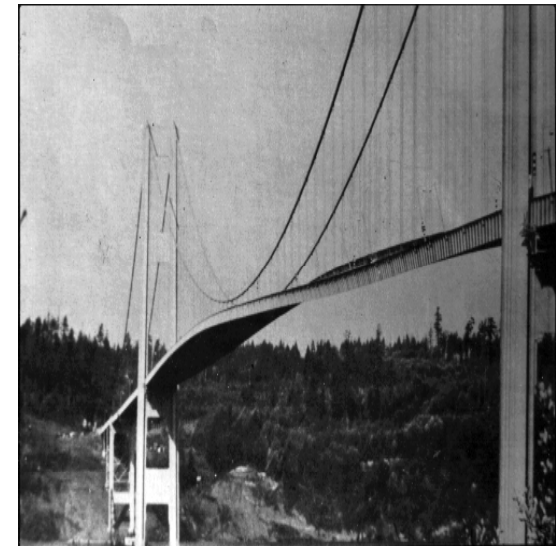 - *The levee design was faulty.*

A National Guard patrols the streets outside the Superdome in New Orleans, post-Katrina.

Katrina (3)

- **The American Society of Civil Engineers conducted a study for the US Senate (led by our Dr. Daniel). They determined that there were a number of failure causes and modes. Questions:**
  - Should an engineer or two be on the New Orleans Levee Board?
  - How should we balance environmentalism with needs for flood control?
  - Should additional wetlands be built, and at what price?
  - Should a cat. 3 hurricane levee system have been built for a coast that has seen ten cat. 4-5 hurricanes in the last 150 years?
  - Would a double-wall levee be too expensive? It would be more than the $14 billion+ to rebuild and strengthen the current system.
  - Should federal taxes be used to build such a new levee?
  - Given possible global warning, can LA <u>or</u> the US afford to build big enough levees?
  - Should New Orleans be abandoned?

Tacoma Narrows Disaster

- **Bridge built across Tacoma Narrows, spanning strait of Puget Sound between city of Tacoma Washington and Kitsap Peninsula.**
- **Opened to traffic on July 1, 1940.**
- **Third longest suspension bridge in the world in terms of main span length.**
- **Construction began in September 1938.**
- **From the time the deck was built, it began to move vertically in windy conditions.**
- **Given name "Galloping Gertie."**
- **Behavior continued after bridge opened to public.**
- **Measures to stop the motion were ineffective.**
- **Finally collapsed under 40-mile-per-hour winds the morning of November 7, 1940.**

"Gertie" in full motion – an excellent example of resonance.

Tacoma Narrows Bridge

- ## Questions:
  - **Was this an ethical lapse?**
  - **Was it bad engineering?**
  - **Was this just "bad luck" due to a new, untried engineering approach?**
  - **Should the construction company share in the blame?**
  - **Should careless or incompetent engineering be considered unethical?**

Summary

- **Technologists, as professionals, <u>are expected to behave in an ethical manner</u>:**
  - **Ethics, like law, morals, and etiquette, are among the interaction rules of society.**
  - **Interaction rules are made to guide behavior and eliminate conflict, but all conflict cannot be eliminated.**
  - **When conflicts occur, they must be identified. Sometimes the conflict can be settled using factual information.**
  - **Moral conflicts depend on background and upbringing.**
  - **To settle moral issues, various moral theories may be applied (with more or less success), including ethical egoism, utilitarianism, or rights analysis. Sometimes such approaches converge; sometimes they diverge.**
  - **<u>Resource allocation</u> means that we cannot make society risk-free, even if the moral imperative is clear. Decisions must often be made that balance risk and safety.**

ECS 1200 Lecture 11 -- Ethics and Technology   © N. B. Dodge 09/11