



**Ethics in
Electrical and Computer Engineering**

**Lecture #3: Moral Frameworks for
Engineering Ethics**

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Why a moral framework?

- Illuminates connections between engineering codes of ethics and everyday morality
- Helps make moral choices, resolve moral dilemmas
- **Utilitarianism:**
 - “Produce the most good for the most people, giving equal consideration to everyone affected”
 - What is “good”? Consider “acts” or “rules”?
 - From codes: “Engineers shall hold paramount the safety, health, and welfare of the public in the performance of their professional duties”? Related?
 - “Welfare” is a type of “utility” (so are safety, health)





- Engineering cost-benefit analysis:
 - The same as utilitarianism? No.
 - **Typical** cost-benefit analysis identifies good and bad consequences of actions/policies in terms of **dollars**
 - **Why are dollars the correct utility?** How to include costs of lives, injuries?
 - **Usually**, focus on profits to corporation
 - **Example:** Cost of safe designs vs. warranty vs. loss of lives/legal issues (e.g., Ford Pinto)



Rights Ethics, Duty Ethics

- Rights ethics: Human rights is the moral “bottom-line” (and human dignity and respect are fundamental)
 - Liberty rights: Rights to exercise one’s liberty that lead to duties of others not to interfere with one’s freedoms
 - Welfare rights: Rights to benefits needed for decent human life
- Codes? “Engineers shall hold paramount the safety, health, and welfare of the public in the performance of their professional duties.” (refers to each individual)
- Public has rights (life/no injuries from bad products, privacy, to get benefits through fair/honest exchange in a free market), *what are their duties in these respects?*
- Duty ethics: Right actions are those required by duties to respect the liberty or autonomy of individuals. Codes?



Virtue Ethics

- Virtue ethics emphasizes character (virtues/vices) more than rights and rules.
- Virtues: competence, honesty, courage, fairness, loyalty, and humility (vices opposites)
- **Relevance to codes? IEEE:**
 - “... be honest... in stating claims...”
 - “...improve our technical competence...”
 - “...treat fairly all persons...”



Virtues in engineering

- Public-spirited virtues:
 - Focus on good of clients (“client-focused”)
 - Focus on good of public
 - Generosity - going beyond minimum requirements in helping: “engineers who voluntarily give their time, talent, and money to their professional societies and local communities”



- Proficiency virtues:
 - Mastery/competence
 - Diligence (e.g., software engineering case study example)
 - Creativity (to keep up with technology)
- Teamwork virtues:
 - Working together effectively (not a loner)
 - Collegiality, cooperation, loyalty, respect for authority



NSPE, BER Case 96-4

- Engineer A is employed by a software company and is involved in the design of specialized software in connection with the operations of facilities affecting the public health and safety (i.e., nuclear, air quality control, water quality control). As the part of the design of a particular software system, Engineer A conducts extensive testing and although the tests demonstrate...



that the software is safe to use under existing standards, Engineer A is aware of new draft standards that are about to be released by a standard setting organization-standards which the newly designed software may not meet. Testing is extremely costly and the company's clients are eager to begin to move forward. The software company is eager to satisfy its clients, protect the software company's finances, and protect...



...existing jobs; but at the same time, the management of the software company wants to be sure that the software is safe to use. A series of tests proposed by Engineer A will likely result in a decision whether to move forward with the use of the software. The tests are costly and will delay the use of the software by at least six months, which will put the company at a competitive...



...disadvantage and cost the company a significant amount of money. Also, delaying implementation will mean the state public service commission utility rates will rise significantly during this time. The company requests Engineer A's recommendation concerning the need for additional software testing.



Analyze the case...

- **Utilitarianism**

- Hold paramount the safety, health, and welfare of the public – Do the testing for the new standards.
- This is the most good for the most people?
- Could do a cost-benefit analysis. Analyze what costs there will be to the company if there is a software failure vs. costs of the tests



Analyze the case, continued...

- Rights and duty ethics
 - Public has a right to exposure to safe systems, not to be injured, etc.
 - Engineer has a right to provide an opinion on such an important matter
 - Engineer has a duty to provide safe systems
 - Engineer has a duty to be loyal to company (try to avoid layoffs, etc)



Analyze the case, continued...

- **Virtue ethics**
 - **Competence** – engineer's competence in coming up with a less expensive test
 - **Honesty** – engineer's honesty in whether meet new standards, old standards
 - **Courage** – engineer's courage to make a tough decision (like to do the expensive tests)
 - **Loyalty** – engineer's loyalty to the company to protect them from litigation by testing for new standards



Self-Realization Ethics and Self-Interest

- Ethical egoism: promote only your own self-interest (extreme view!)
- Predominant egoism: strongest desire for most people most of the time is self-seeking (“mixed motives,” reasonable!)
- **Engineers:**
 - Proficiency motives: Challenge self, serve public
 - Compensation motives: Make money for self/family, but helps community
 - Moral motives: Desire to do right (“give back”), integrity, feels good and positively impacts community
- **Engineering companies:**
 - Safety/profit motives! Company competence, education
 - Professional climate, compensation



Self-Realization Ethics and Personal Commitments

- Community-oriented version of self-realization ethics
- Pursue self-realization, but enrich community
- Personal commitments form the core of a person's character and motivate, guide, and give meaning to the work of engineers
 - Must all engineers have *outside* humanitarian, community, etc., commitments? No!
 - Could be directed only *within* the profession, company, or clients (professional behavior in the organization)
 - Outside commitments should not adversely affect your job responsibilities!



- Personal commitments - professional life
 - Create meaning: “enliven ones daily work and life”; “work is worthwhile”; “life is worth living”
 - Motivate professionalism throughout long careers (deep commitments persist; they are a part of you)
 - Religious beliefs often supportive
- Engineering:
 - Meaning can come from technical challenges, relationships with co-workers... other sources?
 - Engineering makes life better for others? Helps others?
 - Alleviates suffering?
 - Eliminates difficult, dangerous, or tedious toil?
 - Makes people healthier/happier?
 - Aesthetically or intellectually enriches people?



Aspirational Ethics

- Harris et al. approach
- Range of freedom in promoting “human welfare”
- “Good” engineers:
 - Have high “professional character” to make them the “best, or ideal, engineers”
 - Types:
 - Professional “pride”, top level competence, above and beyond
 - Social awareness/concern, social embeddedness of technology (e.g., involvement in alleviating poverty and other injustices)
 - Environmental conscientiousness: above and beyond codes of ethics, sustainable design, and usual expectations



Pro Bono Engineering Work?

- Should engineering professions do more to encourage engineers to apply skills in offering voluntary service to others? **Yes.**
- Pro bono (or reduced rate) work is encouraged in law, medicine. Sometimes/often in engineering. Would it raise the stature of the profession by making it a “direct contact” profession?
- Engineers do a lot of volunteer work now!
- What does engineering education do to support such professionalism? *The “service-learning” initiative is happening...*



ENGR 5050

Humanitarian Engineering

- Undergraduate, graduate; Spring semesters
- Topics:
 - Poverty and underdevelopment
 - Social justice (religious/secular views)
 - Development strategies (from aid to making profits off the poor)
 - Engineering for community development (collaborative and participatory design, extreme design constraints/appropriate technology, sustainable design, etc.)
- Feature: Collaboration with other countries on problems
<https://hecourse.engineering.osu.edu>
- **Humanitarian Engineering Minor** (15 hrs, HE course, 6 cr “human welfare”, 6 cr project)



Humanitarian Engineering Center

<https://osuhe.engineering.osu.edu>

- Student organizations: ECOS, EWB, ESW, SEO,...
- Courses in service-learning, capstone design, and project trips (e.g., Merrill, Dzwonczyk, Greene, Passino/Anderson)
- Service trips: Honduras, Guatemala, Colombia, Haiti, Ghana, Dominican Republic, etc.
- Large vibrant group at OSU, involving the whole range from Freshman to Seniors... for example,...
- **Questions? See me**



Engineers for Community Service (ECOS), <http://ecos.osu.edu/>

- OSU College of Engineering student organization
- Grew out of this class!
- Connected to self-realization ethics, aspirational ethics
- Service-learning approach
- ECOS Mission: Engineers for Community Service (ECOS) promotes life-long professionalism via educational experiences in the uses of engineering skills for local and international community service projects



ECOS

- Local Projects
 - Worthington Food Pantry
 - CSS Service Saturday software
 - Wheel chair ramp project
 - Open Shelter, projects for homeless
 - Derby car project
 - Westminster, computer classes at a retirement community
 - “Phone-a-Buckeye,” over the phone help in science and math for middle and high school students



ECOS

- International Projects
 - Montana de Luz and Choluteca, Honduras
 - Colombia (labs project, Bogotá and Pasto)





Attendance Question

- **Do you know of professional engineers that apply their talents in community service? Explain what they do, especially focusing on how it exploits their engineering skills, and how it benefits the community.**

Please: Put your name on the sheet of paper and turn it in...