Ethics & Responsibility in Engineering

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We start our semester by diving deep into the **responsibility of engineers** and how to instill our **ethics into our technical work**.

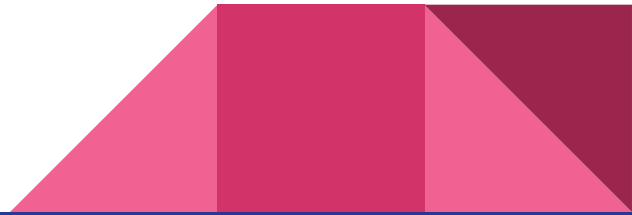
INTERNATIONAL • BOEING 737 MAX

After first 737 Max crash, why did Boeing's pilot warning fail to stop second plane from going down?

What are Engineering Ethics

- Areas of “applied” ethics where we rationalize the decisions and designs of engineers and technologists (inclusive of business leaders). Mostly interested in how they *imply values*.
- May consider ethical inquiry that is either grounded or speculative, meaning the target of our analysis may be an actual state of affairs or a hypothetical situation.
- **Technology Ethics** = How do *tools* (and systems of tools) and the sociological environment in which they are embedded define and perpetuate certain social realities and values?
- **Engineering Ethics** = How do the *choices* made by engineers define and perpetuate certain social realities and values?
- **Computing Ethics** = How does the use of computation and computer systems define and perpetuate certain social realities and values?

Similar, but there is nuance here!



Ethics are “Normative”

- What is unique about ethics is that you are talking about what “**ought**” to be or have been done.
- This is different than scientific or mathematical discourse in that **we are asking questions that do not have discoverable answers.** (ie., there’s no right answer)
- One critical part of thinking through an ethics lens is to start to **be able to identify a normative claim, proposition, or choice.**
- Think of normative as implying what is normal. “Normal” is a relative term - everyone’s normal is different. So when you impose a value you are making a normative statement.

Example: “Amazon *should* pay more taxes” (normative) vs. “Amazon uses tax loopholes such as offshore banking to pay much below what their net income would require” (factual)

When we ignore ethics there are consequences!

Elephant(s) in the Room

Engineers have not always made decisions that are best for our planet, all people, or the future. (This is not a statement of whether they *meant to* or not)

And we are seeing some of the results of this negligence.

<u>But we can and will do better, and we're going to look at how to build those ethical muscles!</u>

Is technology short-changing our attention spans?

Just 20 percent of e-waste is being recycled

Each year, the world tosses a million tons of chargers alone.

Job cuts and falling shares: how did it all go so wrong for the US tech sector?

Great Power = Great Responsibility

- As a (CMU-trained) engineer, you will be at the apex of privilege and power
  - You will be recruited to top jobs, you'll have an elite network, you'll have access to money and resources, and you'll have an incredible mind to apply to the world's biggest problems.
- Technologists and engineers may well be the most powerful decider in what humanity will look like in 20+ years. It will shape our personal habits, economy, and environment.
- *Computer technology* is bound into everything! Try to name a business sector or life practice that technology, software, and computing systems are not influencing.
- Importantly, you will be asked to create things for people who more often than not have no real understanding of how the technology works or what the options. You're a 21st Century alchemist as far as the general public is concerned.

→ Would you create things that you wouldn't want your own family or community to have/use? What role will you take in accelerating or slowing down the biggest problems in society?

Developing your Moral Agency

- As we continue to collect data, build machines, and develop digital infrastructure, we are structuring our future with no moral compass directing us.
- That is, rather than dealing with moral questions at the level of our teams and through human interactions, we are more and more favoring letting “data” or “machine intelligence” choose our destiny, and allowing for only what the path of least resistance in the market dictates.
- Zeynep Tufecki describes this as a “crisis of moral agency”

Having moral agency means knowing when our actions intersect with our morals and articulating the dilemmas involved to highlight consequences, determine trade-offs, and execute a path forward intentionally.

→ Every single person in an organization has agency to highlight ethical concerns and place friction on actions that are heading toward the unethical. **Don’t let the hierarchy of work fool you - senior management and government are often blind to the issues and are relieved when the easy path (ie., do nothing) is offered to them.**

Your Personal Values Matter!

- The path toward an ethical career starts with you understanding your own values
- Recent history has alienated individuals from the cultivation of personal values
  - “No religion or politics” or “no drama” at work
- We are seeing a lash back as local, national, and global crises are being piled onto younger generations who often feel cynical about the world
- However work without purpose leads to quicker burnout, poor mental health, and feelings of regret in the long-run.
  - The surprising reality is people who focus on meaningful questions are often rewarded (despite common narratives)

→ **Make sense of your personal values, and use them to develop:**

- **Your “why” in your work**
- **Your red lines around what you will and won’t do**
- **Your inspiration toward innovation**
- **Your community and allies**

Discussion Time!

Let’s explore our personal values

Short Exercise (while taking a break)

Rank the following situations from most ethical to least ethical:

A. A software developer leaks private source code to an outside party
B. A company intentionally writes their terms of service to mislead people about who they sell their data to
C. A researcher creates a deep fake video about a local politiclan to impact an election
D. An engineering team continues building a natural gas pipeline after a study says it will likely harm a native fish population
E. A company decides not to worry about making their software accessible to blind people to push up release date
F. An ML team makes a model to identify body language of people going through customs to determine who should be searched
G. A hacker steals emails from bankers they think were involved in insider trading schemes
H. A company lies about the advertised battery life of their product assuming few consumers will notice
I. A company CTO decides to ignore an analysis about data bias in their products to prevent financial losses

What did we learn (about ourselves) from that exercise?

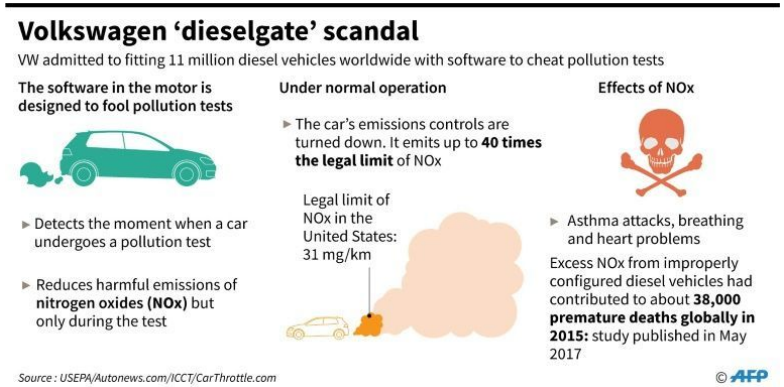
Concepts for Your Professional Life

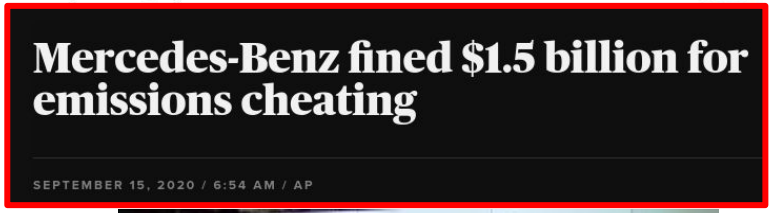
(As a Responsible Engineer)

1. Honesty / Transparency
2. Bias / Fairness
3. Accountability
4. Reliability

Honesty and Transparency

- Telling customers, consumers, and your team about the reality and limitations of your technology
- Providing people a “right to know” how their products and services work and why certain results were attained
- Giving enough information about the nature of the technology to users and consumers to provide a sense of “informed consent” about usage and the associated risks





Bias / Fairness

- Bias = a systematic distortion of reality favoring or ignoring certain factors
- Needing to recognize that you **occupy only one worldview** and most human problems need to be understood through multiple perspectives
- Fairness = systems that provide everyone an equal opportunity to receive the benefits of the technology AND equally distributes the risks

$$X = woman + doctor - man \approx \mathbf{nurse}$$

Accountability (to others, to the planet)

- Fulfilling expectations made by the promises and guarantees of the technology
- Making systems that are able to fulfill their intended function
- Being compliant with relevant laws and rights
- Owning up to the responsibility of something going wrong or having been negligent.

Reliability

- Adopting appropriate testing methods to ensure performance is guaranteed and regular
- Benchmarking and verifying procedural regularity of system
- Understanding failure cases and errors to be able to model risks and create appropriate mitigations

Group Exercise

1. Get into small groups of 3-4 people
2. Discuss this scenario derived from the VW Emissions case: You attend a meeting with company executives that shows that the cost of redesigning our diesel engines could be $100s of Millions and is not worth it given that fines for failing emissions tests are small. Thus, it is suggested that the electrical engineering department create a workaround in the CPU that monitors the engine to modify performance during emissions tests in a way that differs from road performance.
3. You are in this department and need to determine the right course of action
4. Write a brief interpretation on how this case implicates each of our key concepts:
    a. Transparency
    b. Bias/Fairness
    c. Accountability
    d. Reliability
5. Determine which concept is most important to the ethics of the situation
6. Write out an argument to convince the company why redeveloping the engine is the right thing to do.
7. Be prepared to share your argument with the class

Discussion & Shareout

Assignment

You will also be seeing some questions in your HWs that ask you to unpack the concepts we discussed tonight

→ Your Lab Assignment:

1. Reflection [2-3 paragraphs]: What is a personal value of yours you'd like to bring into your engineering career? Give a scenario where this value is implicated. (Use the short exercise we did before break as a guide)
2. Analysis [2 paragraphs]: You're designing a digital system that monitors particulate in chemical plants. This is a machine that reads samples from air, water, and other refuse to determine if contaminant levels are threatening workers or the nearby environment. Your boss is eager to get units out to customers, but you're still unsure if the accuracy is enough to enforce EPA safety standards. Your boss says EPA compliance is always changing so not to worry about meeting this criteria.
    a. Pick one of the core concepts discussed and explain how it applies to your situation if you were working on this project.

Assignment Mechanics

Your writing should be clear

Your writing should show thoughtfulness

Your writing should prove you learned something tonight

Upload a PDF (make sure it is readable) to Gradescope

Deadline: 48 hours from now