Engineering Ethics ENGR-183EW Notes

Yash Lala

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The quizzes are very very specific. He even goes into individual case studies. Take dense notes...

Lecture 1

Objectives:

1. We should be able to deal with critical problems in world today.
2. Should be able to build our personal ethical framework.
3. Provide historical context as to how ethics and tech affect each other.

Gershon Weltman (Professor):

Founded Perceptronics company. Got a DVD player from Japan, contracted with DARPA to make small tank aiming DVD videogame-style thing. Used to train tank gunners. Tried to make a tank battle game, but the tech wasn't there yet (DOOM style FPS wasn't big yet).

Course Assignments: - 2 essays - 2 exams - 5 textbook quizzes - 1 presentation

Grading: - If we submit course feedback, he adds +1% to our grade. - Need *lot* of work on writing. TAs are saying some non obvious stuff.

Society's Two Cultures

Snow wrote an essay in 1959. Claimed that professionals fall into:

1. Humanistic background: literature, history, philosophy, art, etc.
2. Scientific background: science and tech education.

Problem: most leaders tend to come from humanistic backgrounds, but the problems to solve are *technical*. Nowadays, technology leads the world, and society reacts. Solution: more social awareness on behalf of the engineers.

Engineers:

- Use special languages. Math, spreadsheets, etc.
- See ourselves as creative, solution oriented, rational.
- Others see them as overly analytical, not bounded by ethics, putting problems over people, etc.

Engineering: **what can be done.**

Defining Ethics

1. Set of ideas and rules by which to live.
2. Systematic reflection on what is moral.

Existential ethics and philosophy: you are what you do. *Acts* are more important than words or even intent. Having ethics != being ethical.

Sometimes ethics is controlling factor behind a decision. But usually it's just a component in the overall decision. When it comes to you, just figure out what you stand for and what you do. The most important aspect is the fact that ethics are guides to our action.

Ethics: **what should be done.**

Ethics as an Engineer

Engineering ethics codes: imposed on us. Personal ethics code: from inside.

War on truth right now.

Step wise optimization. As long as each step gets us closer to our idea of the world as it "should be", then gradient descent will eventually get us there.

If you give people a problem and tell them it's a business decision vs an ethical decision, they behave differently. Goal of this course is to balance both.

Lecture 2

Descriptive Ethics: describes existing ethical systems. *Normative* Ethics: deals with determining the "right" actions.

Where do morals come from?

1. Biological basis? Primates seem to be wired with some instinct against "unfair" behavior. This implies (as per existential ethics) that you are what you do, but you have predisposition.
2. Natural? Nature's laws/universal truths?
3. Revelation: from god?
4. Philosophical: From theory and experience?
5. Social? Entirely cultural?

Ethical Progression throughout history

Ethical Rulesets

Egypt and Mesopotamia: Ethics and laws are prerogatives of the Pharaoh. Eg: Code of Hammurabi.

Biblical Period: Very similar to Hammurabi's code, but harshness is tempered to some extent (very limited). 2 set of laws: 1. Noahite laws (7 laws for Mankind, revealed to Adam and Noah) 2. Set of Decalogue laws (10 commandments). Appears with 613 other rules. Why wasn't there a commandment to avoid keeping slaves if the Jews just came out of slavery in Egypt?

Revealed Christian doctrine (~30 AD): defers to the Biblical laws, but overturns Hammurabic laws. Doctrine of forgiveness, etc.

All of these rules are summarized into the *Golden* and *Silver* rules. Present in almost every religion + ethical frameworks. 1. *Gold*: What you would want others to do to you, do so to then. 2. *Silver*: What is hateful to you, do not do to your neighbor.

Problem: how do you know what's hateful and desireable to others? If you assume homogeneity, the rule fails. You can try to emphasize principles over particulars, or just use empathy. *Platinum* rule: do as they would have you do to them.

How do you use empathy, practically? To empathize with a person, use psychology. If you want to empathize with a group, use sociology.

Moral Codes

Moralities have often been formalized into lists of traits to possess.

Chivalry: 1000 AD. Defend the church, follow its teachings. Make war on the nonbeliever. Jihad. Addition of new core historical principle: *never lie, keep your word*. Bushido existed at about the same time. 7 virtues; justice, bravery, benevolence, politeness, veracity, honor, etc.

Magna Carta (1215): promise by English King John to obey laws. Shows that kings are bound to the same laws. Gives some rights to individuals as well.

Boy scouts. Return to Chivalry.

West Point: military academy. Don't lie, don't cheat, don't steal, don't tolerate those who do. Simple code => easy to remember. However, can't be complex.

Nowadays these codes get longer and longer. UCLA's code is 26 pages. Enormous.

TLDR: Morals are bedrock of a society. Also will look at Ethics and Laws.

Morals, Ethics, and Laws

Ethics are fed by morals. Inform the society's laws. Often dynamic (eg laws against child labor). Problems (gender discrimination, etc) can freely transition from ethical issues to legal issues as protections are added and removed. You need your own code to navigate.

Some people say that Silicon Valley benefited from free movement of ideas. Now, legislation has been passed by companies – federal crime against moving trade secrets from company to company. What will happen to Silicon Valley? Law came when people observed an existing process.

We see that ethics inform laws. What informs ethics?

- Religion: Religion can be a guide to ethics, but many prominent religious figures believe it's not necessary for an ethical foundation (eg: Thomas Jefferson, Dalai Lama, etc). America is becoming more secular rapidly, while remaining socially conscious.
- Science: As brain research gets more powerful, we may figure out what consciousness is and find a scientific basis for moral and ethical systems.
- Reason: Some people believe reason doesn't mesh with ethics, it's just about compassion. Others say that it's based on previous reasoning and algorithms. Others think it's a mix. Eg: should they have killed Harambe? Compassion argument, but the action was likely due to previous reasoning. The guard had thought about the relative value of a gorilla and a human, and reused this cached ethical decision.
- Intuition: Some believe that intuitive emotional reactions are a result of evolved instincts. These intuitions allow social cohesion; but now that we have brains, we choose to focus on different intuitions.
- Experience: Look at child labor. Rationally, it may be true. But through experience, we know that it "cannot stand" because of what it does to kids. So we forbid it. This is kinda stupid. Basically reason, but with benefit of hindsight. This is a subset of reason.
- Choice: A decision can only be ethical if it's chosen instead of an alternative. If there's no decision, there is no ethical quality.

Lecture 3

This lecture: intro, 5 key ethical philosophies, 2 case studies, alternative ethical frameworks, conclusion.

Ethical Philosophies are systems for dealing with various ethical decisions.

Philosophy 1: Rights Ethics

Humans have "rights". It's needed to respect these rights. 2 types:

1. Liberty rights. Individuals are the focus, we shouldn't interfere with them or their property.
2. Welfare rights. Communities are a focus. What does the individual owe them, what do they owe an individual?

Where do rights come from? Everybody disagrees. Some say god, some say nature, some say precedent, some say from *wrongs*; bad experiences + moral thinking. Why are they important? They restrict government, protect minorities.

Of course, rights are always in conflict. Courts usually are arbiters on how rights are legally enforced. Eg: majority of California voted for Proposition 14, which overturned Rumford fair housing act (illegal to have "no rent to jews, asians, blacks" style laws). The courts ruled it against the state constitution, so it passed to overwhelming distaste. In retrospect, great. But it's very hard to tell how to interpret these rights.

Universal Human Rights: post WWII.

Philosophy 2: Duty (Deontological) Ethics

Deals less with rights and more about what we should do. *Actions* determine ethical content, and *Required Duties* are actions that reflect ethical principles. With every right, comes a duty.

Eg: 10 commandments, codes of chivalry, professional codes, etc.

Philosophy 3: Virtue Ethics

Deals with feelings and psychological states that lead to actions (not the actions themselves, that's duty ethics). These *virtues* are guides to conduct, and help inform action. These internal psychological states are paramount.

Eg: religious precepts, boy scout oath, etc.

Plato had a fixed list of "cardinal virtues" that are required. Aristotle focused on the "golden mean"; it's possible to have too little and too much of a virtue (a person with too much courage becomes a liability, etc). Life is about finding the middle ground.

Categorical imperative: "What if everybody did it?".

Philosophy 4: Utilitarianism (Consequentialism)

Focus is not on the actions, but on the consequences. Balance the benefits and the cost; do the most happiness for the most people.

Cautions: Inequal distribution of happiness. It's very hard to figure out what consequences are in advance, and things are unforseen. Some actions seem intuitively very wrong, regardless of consequences (see: any war crimes).

Philosophy 5: Pragmatism

Consider the context of a problem. Be flexible. Ethics are a framework for thought, but that's it. Focus on principles, be wary of generalizing specific cases.

Cautions: Everybody disagrees on what principles to be steered by. Really, this isn't a distinct philosophy, it's just a modifier on the previous rulesets.

Alternative Ethical Frameworks

All of the above are just based on Judeo Christian tradition. The rest of the world exists.

Conclusion: no matter what you do, you're almost certainly violating someone's ethical principles. On the other hand, by studying all of these, you can build your own personal framework.

Lecture 4

This lecture will focus on teamwork, leadership, etc. It's dedicated to his late colleague, worked on the Apollo Lunar Module. He wanted to emphasize the number of teams involved; project was teams of teams.

Engineering is social. It externally addresses a society's needs, and implements everything in teams. Like a team sport; compete for contracts, resources, in marketplace, etc. Some teams win, some lose. Winning has great rewards – but losing isn't disastrous by any means.

Components of victory: 1. Taskwork: Technical capability 2. Teamwork: Methods of working together, and social factors

Executives need social skills. So do managers.

Desert survival game. People are given a list of items, should rank them in importance of survival, etc. Score is given based on how well team members agree on the rankings. College students do worse than top executives, but also do worse than junior high school students – maybe because they're used to staying put and waiting for someone to get them (which is the smart strategy here). All women do better than all men, but mixed groups only do about as well as all men. Women's contributions weren't making it into the mixed groups.

How about individuals vs teams? If your score is better than your teams, that's *not* a point of pride. It's one of shame, because you couldn't convey this to the team and lead effectively.

Engineers need these 3 skills, top top (voted by successful people):

1. Communication Skills
2. Leadership
3. Emotional Intelligence

We'll also go into some extra skills at the end.

Communication Skills

Several aspects of this skill.

1. Exchanging information.
    - Presenting in front of an audience.
    - Listening: paying attention, focusing, asking the right questions, clarifying, summarizing, etc. Don't step on people's sentences, stay slow and let silence sit. This is the hard part for us, train it. Train via *active listening*:
        1. Really listen. Goal should be for you to understand, whether you agree or not.
        2. *Do not interrupt* with your own thoughts. Keep your focus on the speaker, don't say or even think "that happened to me too".
        3. Show signs that you're listening. Nod or something.
        4. Summarize what they said, ask if your summary was correct. Don't do this one all the time (not in casual conversations).
        5. End by asking if you understood them right. Again, this isn't for every casual conversation; just focus on the first 3 rules at all times.
2. Being Supportive.
    - Assume other opinions are useful. They always are. Point out these positive aspects, create opportunities for others to speak, etc.
    - Be open, friendly, and empathetic. Don't be controlling, don't criticize, don't use negative body language.
3. Differing in opinion.
    - Support your opinion. Don't retreat or avoid conversation; but argue constructively.
    - Involve other people. Give everybody an equal chance, don't let a few dominate.

Leadership

If you're a team leader, you need to have 3 goals.

- Help others to make contributions.
- Help others realize their own potential.
- Help others achive satisfaction from their work. Make sure they enjoy what they're doing; if they don't, they'll just move on.

Lot of philosphies as to what a leader should do. Several believe they should be subservient to the team, like a Scrum Master. Others believe their job is to execute informal covenants, provide motivation (empathy), etc. Others think a leader should *define reality*; help us come to a consensus, and to appraise a situation.

Emotional Intelligence

- Self Awareness: Recognize your own emotions, etc – but most importantly, recognize *how you affect others*. This is PARAMOUNT! But hard to acquire. If you're aggravating, nobody cares if you're a genius.
- Self Regulation: Have control over your actions.
- Motivation: Impart meaning to people beyond money or status.
- Empathy: Understand what makes other people tick.
- Socialization: Manage relationships, build rapports, etc.

Goleman model: without self awareness, you cannot have self control or empathy. And you need control *and* empathy to socialize with others.

Your emotions will count heavily. If you radiate Falcon Energy, then it spreads more than COVID.

Extra Skills

- Be oriented around a team.
- Be adaptable.
- Be motivated.
- Trust people effectively. Doesn't mean naivete; just trust that people will go according to their own natures (trust they'll do the wrong thing, and accept it when needed).
- Diversity improves creativity. Many studies show this. Some strong some weak forces people to plan for weakness and plan for failure. Navy SEALs boosted.

Diversity

Have to be aware of issues:

- *Competency Proving*: Women / less represented minorities have to repeatedly prove they are technically qualified.
- *Failure to Differentiate*: Members of minority groups are
  1. Assumed to be representative of the group.
  2. Mistaken for other people in that group.
- *Sexual Innuendo*: Teammate's requests for technical assistance or collaboration are taken as romantic advances or suggestions to go on a date.
- *Micro Aggressions*: Remarks that are assumed to be confident but are actually based on stereotypes. Eg: "you're different from the other Xes". "As a X, what do you think about it?".

Team Methodologies

Approaches for solving a problem. Think of desert exercise:

1. First, decide on objectives and goals.
2. Then figure out major issues, conflicts to stop us from reaching goal.
3. Figure out options to work around conflicts.
4. Figure out what resources you have to pull off these options.

Lecture 5

We'll be talking about engineering projects with ethical challenges. Will go through some case studies, and try to find a "bright line" between ethical and unethical projects.

Projects

- Project := Technical activity with specific objectives. Has to be bounded, in terms of money, scope, etc. Staffed with dedicated personnel.
- Customer := Person who pays
- User := Person who actually uses the product
- System Engineering := process of making systems. Learn to define requirements, work, expand project scope, verify the result, etc.

Case Study: Ford Pinto

Classic case study. 1970s Pinto was one of the first compact cars, it had its gas can in the rear. It would get pushed forward onto some protruding bolts, which usually caught fire. Could have put a sheet in front of the protruding bolts, to prevent them from piercing the gas tank.

Ford was in the process of pushing back on safety standards at the time. They did some cost analysis (fix was $11 per car), and figured out that it would be cheaper to eat the lawsuits from the wrongful deaths than to fix the defect.

They did a cost benefit analysis. They reduced it to a cost vs cost analysis; but neglected to account for PR, internal satisfaction, etc.

Case Study: Ford Rollovers

1991 Ford Explorer SUV was introduced (one of the first SUVs on market, off road vehicle, 4 wheel). Ford wants to migrate the SUV to the suburbs, because families like the "look" of an offroad car; but there's no need for the actual off road capabilities, so those are nixed. Cost is kept low, because it's a marketing gimmick for the suburbs. Ford knows the first one into this market will get a great profit, so they start work on this "Urban SUV".

They import a chassis from Mazda, and keep repurposing it for different cars. 1972 SUV up to the 1996 Explorer. But this chassis wasn't a fit for the new bodies. The Static Stability Factor (SST) was way too low. The Ford Explorer was very prone to rollover, even the test drivers didn't want to sit in it without pontoons.

Engineers respond, management answers: - Lower the engine, lower CG. "Nope. Too expensive". - Widen the Track. "Nope. Need new factory". - *Lower the Tire Pressure*: "OK." - Lower tires: "No, then we couldn't market it as an SUV".

Management sells the Explorer with a known defect. Thousands of deaths. A decade later (2002), Firestone (tire manufacturer) has problems with a batch of tires, softer than usual. Now, a single tire failure causes a terrifying rollover (million plus rollovers). Firestone and Ford point lawyers at each other. Weltman was hired to consult for this lawsuit.

Judges order arbitration, so they'll have less lawsuits to deal with. Ford pays a lowball offer for an arm amputee, so they go to court. Prosecution moves to tell the jury the history of the Bronco – ford offers to settle out of court for half a million.

Engineers fight back with stats showing the Pinto was in the middle of the pack explosion wise (true!), not worse than most other cars. This is technically true. But as engineers do, they neglected the social impact of their actions. Small numbers of stories, big big stories. They neglected their duty, and the PR story hit them hard.

"One man's death is a story, one million deaths is a statistic".

Moral: Never buy Ford.

Case Study: Boeing 737 MAX

In early 2019, consecutive 737 MAX crashes tip the public off to a problem. Amazing storm of incompetence:

- Design concept was bad. Vanilla 737 was low to the ground, because it had a staircase. Later generations make the 737 larger. Engine would scrape along the ground, so they move it forward on the wing. This can cause the plane to stall, so they used automatic sensors to detect a stall; when it was detected, the sensors would lie to the flight computer and force the plane nose down hard to prevent the stall.

- People trusted automation too much. The engineers trusted the sensors too much.
- Terrible pilot UX design. They didn't tell people about this sensor, they didn't document it, they added safety settings as an extra cost module. It wasn't even in the plane manual. Pilots had no idea, they were flipping through manuals as the plane crashed.
- Nobody was certified, Boeing certified people itself. They had no idea how the MCAS system was supposed to work. They actively discouraged pilots from training.
- Criminal Coverups. Emails: "I haven't been forgiven by God", "Christ", etc. Criminal coverups. Management vetoed safety fixes, because they had become a financial company instead of an engineering company. Profit over people. After the first crash, they stay quiet in the hopes that nobody will respond.

The Shining Line

Why did the public get back on? It was an "acceptable risk". That word will come up a lot. The public's conception of acceptable risk is fickle, people will say things and do another, complex. Stats is the best way here. Some risk is part of life, we accept auto deaths for the tradeoffs.

What, then, is the "shining line" between ethical engineering failures and deliberate failures?

Look to law as an example. Kinds of damages: - Real damages: eg "you cost them this much". - Punitive damages: used to *punish* the offender. Needs to be: 1. Malicious. Need prior knowledge or malice. 2. Fraudulent. Needs to be misrepresented to the public, suppress path. 3. Oppressive. Impose its power on consumers

Other failures are because shoddy engineering (eg Minnesota bridge collapse due to engineering design flaws, they didn't verify their blueprints. Basic engineering duty was neglected, so engineers at fault). At what point do multiple acts of incompetence become ethical failures?

Fukushima had these problems. They didn't set up the backup generator in a way that was out of reach of a tsunami; they didn't want to invest in historians to find the maximum height tsunamis in that area. The government started suppressing and misdirecting after the failure, and let people die of radiation poisoning.

Paradise narrowed the only road out of the town, even though they knew they were at high risk for fires. Sure enough, the town burns, tires melt in the traffic jam and elderly burn to death while trying to run.

Weltman makes the argument that these are all on the "shining line", which is now a grey zone of ambiguity. Need to handle on a case by case basis.

Lecture 6: History of Industrialization

Will be going more into history here.

TODO: Copy in the slides.

...LATE...

Greeks were great at precision engineering, such as with gears. But these were used more for academic study and demonstration (astrolabes, gnomons, artillery bows, etc).

Romans use this technology more practically. They use concrete and stone to make vast public works, use power transmission with gears to create screw drives for aqueducts. Used for civil engineering, home products, massive transportation networks, and warfare. Roman roads are still used today, because they were built to last centuries. We look up to the Romans because they demonstrated how a state could be organized. Everything was consistent, there was good public infrastructure and communication, they had standard laws, a set of courts for all citizens, and good security. Standard money. Social stratification.

Chinese technology (2000 BCE - 1000 CE) was far ahead of anything that existed at the time, especially in agriculture. They understood row cultivation, seed drilling, chain pumps, etc. They understood suspension bridges, and built gigastructures such as the Great Wall of China (took almost 1000 years to build). They had paper, blast furnaces, steel, movable type printing, gunpowder and rocketry, compasses, horse stirrups, etc.

After the Romans collapsed, Europe moved into the (badly named) Dark Ages (500-1450 CE). The Catholic Church survived the collapse of the rest of Rome, and became the main societal structure afterwards. Called the Dark Ages because the Church didn't push technology like the Romans did, and most of these technologies

become extinct. Evolution of technology continued as more inventions steeped in from Asia, used for more efficient farming, which allowed capital gain due to agricultural surpluses (all thanks to the heavy plow, which allowed people to plow large areas of land using horses), which allowed exploration and creating giant cathedrals. A culture of "big jumps" in technology.

Advances in armor technology and horse gear leads to the rise of knights. It takes an entire village to supply a knight, but knights made this up by acting like tanks (armor over numbers). Knights were only countered when the armor-piercing longbow was created. First used at the Battle of Agincourt, shred knights from a long distance. Power is now with those who have large numbers of common soldiers (cheap). Bowmen are countered by firearms later.

In the late Medieval period, many more advances in technology. Shift towards automatic water-wheel based power. Many smaller quality of life improvements, he in particular points out:

1. Glass Mirrors. Allow microscopes and most later scientific advancements.
2. Eye Glasses. Removed a barrier to entry in the workforce, and extended the useful life of most human beings (eyesight gets weaker as we age). Now, old folks can study books and be useful. Great equalizer.
3. Horizontal Looms. Used as the base technology for most future complications.
4. Canal Locks. Allowed mass item transport across all kinds of terrain.

Aztecs, Maya, and Inca had amazing levels of sophistication. Supremely powerful astronomy, mathematics, calendars, irrigation, writing, etc. European slavery and diseases killed more than 90%, so they're given less credit than they deserve. Didn't use the wheel for transportation and warfare, for some reason. Maybe because of the terrain?

Renaissance

Rebirth, from 1400s to 1600s. Rediscovery of Greek and Roman science, broader dissemination of knowledge to social classes via books (printing). Many great inventions. Mechanical Clocks were huge. After they turned into portable watches, enormous productivity, scientific, and navigational gains.

Renaissance Individual should be: versatile, a scientist, an artist, expressive, a communicator, etc.

Enlightenment

1500-1700, in Europe. Newfound separation between:

- God's *words* and God's *works*.
- The idea of societal progress.
- Observation vs Revelation. Laws are not a matter of opinion.
- The Rule of Reason.
- A split between empiricists and those who create a formal mathematical structure for the world.

Galileo's beef with the Church doesn't line up with the common story. The Church wasn't trying to suppress his discovery – they wanted to publish it *first*. Galileo disagreed and published anyways. we know what happened from there.

Three themes of the time period:

1. Idea and importance of Reason.
2. Idea and importance of Science ("Experimentation").
3. Idea of Progress; we can use knowledge to improve the human condition.

Industrial Revolution

1700-1900. Metallurgy improves, wrought iron becomes more important. Machine tools, such as lathes, screw cutters, etc.

Newcomen invents the low pressure steam engine, useful only for moving water out of stationary mines. People jump on the idea, and improve upon it to a degree that nobody remembers the original incarnation anymore. Engineers create rotary motion (before it was just reciprocating, like an oil well), and add high-pressure steam.

Eli Whitney proposes the "American System", where every tool should have interchangeable parts. He offers 10,000 parts, and says that you can build any into a rifle without the need of a craftsman. Whitney fails. But the US small arms industry listens to the idea, and introduces it to England, where it succeeds. Every other country tries to catch up.

Rosen argues that the rise of patents (creates Intellectual Property) allows the common man to become wealthy through innovation, while simultaneously allowing anyone to use the invention. Leads to a duty to respect patents, use inventions ethically, and to promote the knowledge (can't get a patent without publishing what it is you do). Patents build on other patents, leads to quick advancements, crowdsourced. Also leads to industrial monopolies, split between developed and nonindustrial countries, which leads to colonization.

We also achieve lighter-than-air flight, and harness electrical power with the battery. The Civil War causes this technology to advance quickly; we get the steam ship, telegraph, trans-Atlantic cables, continental railroads, Suez Canal, etc. Photographs, phonographs, and kinetoscopes (movies) allow for accurate historical recordings. Electric motors are invented, lead to electric carriages (before gasoline replaces them later).

Bicycles allow for fast transportation, and use new machining technologies. Led to affordable mobility, demand for creation of roads, and was a step on the path for women's suffrage (allowed to take off heavy clothes for bikes, and race with each other).

Radio appears later on.

Now there's an indication of progress between generations. Opinion is divided whether this will lead to utopias or dystopias, and whether technology should be promulgated or banned. Some resistance movements appear:

1. Luddism: Skilled workers fight against their job displacement by machines. They go out and destroy weaving machines. Led by fictitious "General Ludd", so now called "Luddites".
2. John Henryism: Not protesting against the loss of their jobs, more the loss of their personhood and self-worth by machines. Harkens back to the myth of John Henry, a steel driver. Races against the newly-introduced jackhammer, and wins at the cost of his life.
3. Restorationism: Against the loss of skilled craftsmanship. Valued textiles designed and woven by hand, and valued personalized designs.

Conclusion

By the end of the 1800s, we had most of the essential components of the modern world.

Lecture 7: Beginning of the Information Age

Will go over the machine age 1900-45, then the postwar world (1945-1999).

The Machine Age

Technology keeps evolving at a rapid pace.

Heavier than air flight happens. Many scientists claimed it was impossible.

Skyscraper: illustrates how combination of technologies create something new. Elevator, AC, typewriters, telephones, plate glass, steel bridges (building framework), etc. Steel allows you to create tall buildings without stupidly thick walls.

Automobiles start becoming more widespread. Electric and gas cars coexist for a while before gas taskes over. Henry Ford makes cars for the masses. Does so by standardizing, simplifying (no colors), and improvable. Creates assembly lines (new!), $5 per hour wage for all workers, etc. Mass production blows all other manufacturers out of the water. Treats humans as machines, prefers unskilled labors, etc. Introduced scientific management; you don't have to be skilled at building, can come in with only managerial skills ("separation of thinking from doing").

As Ford's wage stays high, middle class is created. Focus on individual instead of family and community. Sears Roebuck starts advertising the now-affordable goods (mass production). Blue collar white collar split, strong

unions. Frugal Americans become "aspirational consmers". Instead of fighting for change, they organize together, form unions, and start the buying spree for them, too.

World War 1 interrupts. Old tactics can't stand up to new tech, so people are mowed down.

Futurist movement arrives. "You're not dealing with the average century anymore..." etc. They believe technological change is here, it's improving our society, and these will "modernize" all of our activities. This will only be for the better. They love racing cars, speed, fearlessness, etc; ignore the classical Greek statues and introduce the speed. They glorify war, military, "freedom bringers", "the world's only hygiene", beginning of fascism.

Modernist design movement comes by. Less ornate. Architecture looks like a modern department store (huge, flat plates). Design also starts making its way into consumer objects. Cars start to be styled, etc; although these styles are always sold for a substantial premium. Theme of modernism is "streamlining". Cars are streamlined, buildings, etc. Distinctive buildings (Wilshire, Empire State, etc) are all built then.

Bauhaus philosophy was different. No decoration, form should only follow function. Introduce tubular steel into goods, we get the minimal steel chairs. Branch of the modernist movement.

Society starts to connect. Radio appears in 1920, almost universal by 1935. Broad variety of sports, news, and *opinion pieces*. Everybody sits and listens in the evening. Air transport appears at the same time, which allows movement at a national level as well (1930-40).

Great Depression shows up in 1929. Everybody's poor, tech continues to advance. Worlds Fair (New York) exhibit pushes for futurism, things changing, etc. The fair itself is the model of a futuristic city, etc. First TV broadcast. It's hard to imagine people being so optimistic about the future.

But WWII interrupts literally while the fair is going. America isn't prepared, but we have technical advances and mass production on our side (which others don't). A lot of investment in technology, such as computers, nukes, radar, etc.

Atomic scientists write Roosevelt in 1939 saying they can make a bomb. Roosevelt dies. Truman drops the bomb on Hiroshima and Nagasaki to force Japanese surrender. Enormous ethical controversy. Truman didn't weigh the Japanese lives, his personal reasoning was more "I need to do whatever I can to avoid any more Americans dying". Started domination of non-atomic nations by the atomic ones, Cold War, etc.

Lessons of WWII: Technology isn't always a plus (thoroughly kills Futurism). Mass production is key to war. Need worldwide cooperation to prevent planetary destruction.

The Postwar Age

US focuses on growth. Mass produced suburbs, produced highways, etc. Consumer products become huge. Streetcars disappear, as cars dominate. Ascribed to automobile industry, but was probably just because of "car culture" (people liked it). Television supplants radio.

Everything is connected on the national scale for the first time. Eg: Kathy Fiscus, small child, is trapped in a sewer pipe. News decides to follow the crisis, and broadcast it "24 hours a day until the situation is resolved". Christ. Beginning of the end. IBM appears, starts creating devices. Soviets send up Sputnik, which surprises us (didn't think the Russians could do it).

Bauhaus evolves into glass towers we see today. Automobile industry becomes "exuberant". Cars are *enormous*, practically tanks.

Kitchen "electrifies". Makes work much easier, effort to try and get women out of workforce and "managing the household appliances". This fails, because it's stupid. Many women stay in workforce.

The Jetsons (1950) imagines the future. Their vision is myopic (women stay at home, etc). But generally optimistic again.

Civil Rights movement begins, marches and riots start appearing. March on Washington scares Congress, and movement starts to spread to Women's rights as well. Truman ends segregation. Society reacts by assassinating those leaders. Warfare in the streets (Watts Riots of LA). "Free Speech Movement", anti Vietnam movements

start. Ohio national guard shoots students at Kent State University, others shoot black students in the south. Riots ensue, old guard steps down.

Powerful books: - "Silent Spring", Rachel Carson. Criticizes chemical pollutants, beginning of activism. - Ralph Nader pushes for safer automobiles instead of giant tanks that kill the user. Beginning of consumer activism. - Medium is the Message: TV, etc will create the "global village". - Selling of the President: Politics is now about selling the candidate to the people. Well dressed, shaved, young, makeup, hairstyle on television. TV liked Kennedy, radio liked Nixon.

We start falling behind in manufacturing, etc to Japan. Why? We did mass production, Japan did "lean production". Automate with machines, ask the customers what they want, just-in-time inventory, statistical quality control, bridge between labor and management, etc. They actually test the materials, invest in tools; so the world follows the reliable Japanese cars. Manufacturing moves to other countries, which starts killing the middle class.

Computers become desktop computers in the 1975s. Macintosh pioneers GUIs, mice, etc. Data moves faster. People get "shocked".

Cold War ends.

Post-Modernism begins. Buildings start to have decorative elements, express themselves, all this again.

Century Summary

Problems stay the same. War continues, no end to wealth inequality. - Anti-Scientism shows up (explicitly anti Enlightenment) - People become too overprotective (prevent scientific advances, cloning, etc). - Emphasize bad news. - Declinism: "We peaked, we're going downhill". - Opinion pieces now matter more than actual facts. - Dystopias everywhere.

But individual life is safer.

Lecture 8: Ethics of Population and Resources

Lecture outline: - World population goes up, resource pressure goes up. - The facts about what could happen. - What do we do ethically?

World Population: Resource Problem Overview

Cognitive revolution 70K years ago. Suddenly, we figure out how to dominate other species, population starts growing.

3 major growth periods:

1. Tool Making: up to 5000 BC. Better hunter-gathering.
2. Agricultural: up to 1700 AD. Apply tools for farming, sanitation, etc. However, conditions don't improve, because population grows proportionally (no pass production). *Malthusian Trap.*
3. Industrial Era: onwards. Widespread product availability, great medicine. Post-Malthusian trap.

Remember, average lifespan hasn't changed. We have decreased childhood death rates, though.

Fertility rate is also falling; we need 2.1 for the population to remain stable, but is dropping rapidly. The US depends on immigration for population growth.

Worldwide resource consumption per capita is very high, increasing, and increasing faster than the population.

Water: We're using most of the accessible water. Need to exploit water from new areas, capture more flood runoff, or find other sources (desalination, etc). We are mainly targeting flood runoff (most of the water is lost to the ocean when it rains). Processing is a problem; 1 billion people don't have safe drinking water today.

Land: Available land will soon be inadequate with current agricultural yields. We need to double or quadruple the yields in the next few years. Need genetic manipulation to go further, or try vertical farming.

Energy: Sources are more diverse; nonrenewable "fossil fuels" (nincluding uranium) and "renewable"s. Energy consumption has skyrocketed, due to cheap energy from fossil fuels. It will continue to grow, regardless of economic growth and consumption (needed for farming and industrial power). Interestingly, oil prices barely affect this. Gas is getting cheaper over time. We have a lot of coal; but it's very polluting and very expensive.

Nuclear may be making a comeback.

More weird technologies (gasoline from carbon capture) may emerge.

New energy technologies tend to evolve as previous energy solutions are deprecated. Complex interplay of different technologies.

World Population: Utilitarian Analysis

We start disproportionately (richest 20% of countries have 85% of income). Generally, this impact comes from population, affluence, and technologies (PAT). US has small population, great affluence and solid tech. Japan has low technology and lower affluence, but great tech.

World's income as a whole is increasing, and is becoming more egalitarian (globally).

Affluent countries burn *enormous* energy per capita. Order of magnitude of difference for USA vs other countries. One steak is 12400 liters of water; so water consumption is also enormous in the USA. Agriculture uses 70% of total water. Cattle take a third of the available land, and generate enormous greenhouse gases. Solution: lifestyle reductions in the USA. Get rid of their beef cravings, produce synthetic meat in bioreactors, or Impossible burgers.

Cars use enormous energy. Need to switch to buses. Electric cars are advertised as a stopgap, but the overall resource consumption can be huge (power plants that generate electricity, lithium mining, etc). Electrical grid incurs huge losses. Need buses.

World Population: Inflection Point

Population growth is slowing, and declining. Resources are approaching limits, and expectations for technology are decreasing. Might persuade people that growth may no longer the norm; long-term thinking is successful. Sort of like a pause.

World Population: Ethics

Commons := Resource that is available for use by all.

We want *agreement* on ethical use of common resources. Broad preconception of people as being mostly bad. This is not a consensus. A reasonable conclusion given current data is that while there are problems with global commons, people should be able to work better to overcome them.

Earth's common grounds are in danger. Water is being polluted rapidly. Forests, atmospheres, and oceans are being rapidly depleted. Species are being depleted (although we worry about the animals that seem cool to us; don't worry as much about animals that we don't relate to, such as cockroaches).

New framework may be coming up. Biocentric, less focused on humans and more about the well-being of the entire ecosystem. Assigning rights to nature and species, and focusing on the / sustainability. We need global, secular ethics.

Hard to predict the future.

Lecture 9: Environmental Ethics

Lecture outline: - Give overviews of ethical takes on environment. - Go over some case studies.

Environmental Ethics: Ethical Philosphies

1. Rights Ethics: People have a right to safe and healthy environment.
2. Duty Ethics: Breaking that right, have a duty to fix it.
3. Virtue Ethics: World citizenship has new obligations.
4. Utilitarianism: Makes sense from a "most happiness to most people" perspective
5. Pragmatism: Negotiate solutions locally and worldwide. Compromises needed.

Major Environmental Problems

Smog.

Case Study: LA Smog

LA's geography traps fog. *Inversion layer* (barrier of warm air high in the sky) prevents particles from escaping over the mountain.

Lifestyle was new. Used to have more factories, used to incinerate waste regularly in suburban houses. Cars produce photochemical smog (interacts with sunlight to create weird chemicals).

How did we control?

- Recognized the problem; couldn't take deep breath without coughing.
- Regulate car emissions; require catalytic converter, change gasoline formula.
- Banned home incinerators.
- Big tire factories disappeared, we got many small businesses instead.

Regulation from federal and local government was useful.

Case Study: Ozone Layer Hole

Large hole in the ozone layer, expanded to the entire continent by 1996. Let UV radiation onto the surface, incinerating life. Caused by chlorofluorocarbons (refrigerants and spray cans) which depleted atmospheric ozone.

After problem was recognized, regulated CFCs. Global meeting of countries, pushed for CFC regulation and ban, gradual movement of industry towards HFC (hydrofluorocarbons).

Turns out that HFCs are powerful greenhouse gases. Have to regulate those now, too. Also, the hole is growing again. We don't know why yet (unregulated CFC release?).

Case Study: Climate Change

Youth tend to lead in terms of desire to fix the problem.

We are dumping massive amounts of greenhouse gases into the atmosphere. These gases come mainly from industrial outputs, fossil fuels, energy production, automobiles, etc. Every month is the hottest month on record now.

Our problem is that we have political divisions based on basic facts.

We see effects. Ocean levels are rising, groundwater levels are rising, coasts are disappearing, weather events are becoming more severe, and resource conflicts are starting. Desertification of much of Africa, much of the Arctic is ice free, and animals are migrating towards cooler areas.

How solve? First, agree problem. Then, set targets. Then, attack problem. Need to somehow capture carbon from the atmosphere; vaccum the air, and make it scale up. Some recommend scrubbing the oceans.

As a method of last resort, geoengineering will be explored. Volcanic particles cool the atmosphere and decrease carbon. This will transform the Earth.

The Pope pushes against a culture of excess. Good luck pushing for that, LOL.

Case Study: Waste Management

Previously, we would just throw it out of the window. Later in Greece, it became a personal responsibility to get rid of it. Became civic duty in industrial society, and started to be covered by government.

Everything is polluted now, even suburban springs. Los Angeles rivers are usually full of plastic after rains.

This causes us problems. We are on top of the food chain, so all of these pollutants accumulate in us. It pollutes oceans, and creates large death zones in the ocean. Illegal wastewater depositing is huge. Sometimes, the counties cover it up even when the sewage treatment plants malfunction. Frogs around the world are being born with mutations due to pollutions, and generally wildlife is disappearing. Sometimes, algal blooms drain oceanic oxygen, killing fauna. Insects (bees!) are disappearing due to pesticide runoff and pollution.

There is regulation. But while bills pass, they never come through, because nobody wants to live nearby. Yucca mountain nuclear disposal still hasn't come through, ater 35 years. NIMBYism is taking off.

Recycling works well for certain kinds of products (batteries, etc). But it's not really feasible to sort through garbage. Sorting is incredibly dangerous, because waste can be toxic and dangerous; and at the end of the day, humans have to sort through it. Usually children in undeveloped countries.

It's inadequate; not efficient, and fundamentally perpetuates a dumb system (cradle to grave paradigm). Start designing products so their waste is also a product that can be used by another industry (eg: runoff used by other factories). Eg: Patagonia set up neutral factories, use the waste for mulch. Eg: Locally, onion factories figured out how to produce energy using their waste in bioreactors. Powered themselves based on their own output.

Lecture 10: Bioengineering Ethics

Lecture outline: some intro, then 3 case studies.

Bioengineering and Genetics

History: - Have bred species for desired characteristics since antiquity. - Theory of Evolution was first put forward by Darwin in 1859. - Gregor Mendel finishes his experiments in the 1870s. - By 1900s, knew they were in chromosomes, by 1950s we found DNA. - After 1950s, focused on manipulating DNA.

Recombinant DNA technology := Cut and paste DNA to create new organisms (eg: insulin bacteria). Don't generate new proteins yet.

Sequencing is getting cheaper. Now we're focusing on how the genes actually translate to the phenotype, and how the genes are regulated.

Genetic engineered plants for yield and pest resistance. We've tried engineering animals, cloning Dolly, etc. Want to move forward to treatment on humans, but this is more ethically fraught.

Case Study: GMO Crops

Most plants we use are GMO. Needed to improve resistance to insecticides (*not* insects always), improve yield, and sustain human population. Do the same for animals, but results can be terrifying. GMO chickens are too big for their legs, can't move, abominations. Cannot sustain themselves.

Nobody's found a correlation between GMOs and any sort of human ailment. They are also necessary for yields. Non GMO became a marketing label, and has become popular. May lead to popular sentiment against GMOs, even though no science against it.

Pros: obvious. Cons: possible uncontrolled spread of transgenic crops via cross pollination (superweeds). Moral issues are more complex. Corporations are setting the agendas here, and poorer populations are most likely to suffer bad effects.

Case Study: Nanotechnology and Biotechnology Hybridization

Nanotech strives to create new molecular mechanisms by manipulating atoms directly. Creates new forms of materials (buckyballs, nanotubes, etc).

Because nanoscopic devices can infiltrate biological systems, there are many medical applications. They may allow hybrid organisms (cyborgs, robot bees to pollinate crops, spy insects, heart transplants, new prosthetics, etc).

Socieconomic inequality is always a concern here. Who can afford these things? What if they are better than human components?

Case Study: Embryonic Bioengineering

The Church used to believe life started at 3 months. Now that doctrine has changed to at conception. This creates lot of controversy around the issue.

Can use mechanical cloning (split the blastocyst, it'll create multiple humans). Can use DNA cloning (transfer DNA to another cell, like Dolly the Sheep). Can use this technology for cell repair.

CRISPR-CAS9 techniques (developed Berkeley, another variety at MIT) allow us to cut and paste genes easily. Now inexpensive, commercialized, and freely available. Makes research infinitely easier (remember SIMR?). Allows crazy technologies (eg: we now have the power to drive mosquitoes extinct). Used in the development of the COVID vaccine; the vaccine contains mRNA for viral proteins. We create the viral proteins, and the immune response triggers.

Chinese company BGI is pushing people to engineer their children. Another lab there gave some children resistance to HIV. The US National Academy of Medicine (and the UK Royal Society) released a report saying that genetic engineering technology wasn't quite there yet, but it was also inevitable.

Lecture 11: Simulation and Gaming

Starting a 4-lecture section on computing ethics now. First, will follow a historical timeline. Then, some case studies.

Simulation and Gaming: History

- Antikythera mechanism discovered, dates about 70 BCE. Complicated device for measuring the movement of planetary bodies. Analog computer (position of quantity represents amount). Digital counting aids include abacus.
- 1600s and 1700s, two digital mechanical calculators were created by Pascal and Leibniz.
- Mid 1800s, Babbage thinks of Analytic Engine; changes its state based on results of prior calculations. Ada Lovelace (assistant) is the first computer programmer. Boolean logic became big.
- Hollerith's tabulating machine does counting based on punch cards. Used to finish the census incredibly quickly, and leads to the founding of IBM.
- Harvard Mark II produced immediately after the end of WW2.

Theoretical improvements (Boolean algebra, Shannon's information theory, Weiner's AI and philosophy of societal communication) helped provide the vision for the computer revolution.

Computation progressed. Electromechanical machines shrunk. IBM 704 (1950s, punched cards everywhere) bought vaccum tubes, but was large mainframe. Eventually, transistors shrunk. Memory also progressed. Magnetic core memory was very small, very expensive to produce.

- *Moore's Law* started in 1958. Estimated end was 2022, and that's about right.
- *Kurzweil's Law*: computational tech builds on its own progress. The time taken to accomplish a fixed technological objective gets exponentially shorter. He says there's no limit to absolute power.

Case Study 1: Simulation

Simulations are useful. - Helps scientific predictions. - Helps industrial application. Drafting is no longer super important, because now we can visualize CAD via computer. - Entertainment progresses, because movies. - Training progresses; instruction via computer, eventually via simulation (eg: his tank thing).

Ethical issues: - Provide transparency. Tell the audience where the simulation comes from. - Deepfakes.

Video games commercialize simulation. Allow audience to take on roles. Ethical issues here too. - Can promote opposing life styles. - Can blur societal distinction (ethics vs non ethics, normal vs pathological). - Can learn and practice real world behaviors. Is this productive? No known correlation between video games and violence – what he's instead proposing is that games could be used to *train* for violence. Eg: Norwegian dude plans attack on youth camp, plans attack w/ games.

Courts usually avoid restricting video games, citing 1st Amendment.

Gamer communities can be much more violent, sexist, etc. Eg: Gamergate, advocates sexism and violence against women. One game claimed to be "serious games", historical, and simulated the slave trade. Wow. WTF?

ESRB rates games, at behest of parental organizations. But the idea of rating for ethics is not prominent in the gaming community. Game developers association doesn't make statements regarding violence, etc.

Question: Is playing a violent game unethical? Are developers enablers?

Lecture 12: AI and Robotics

Fascination with robotics in the Renaissance. People thought about AI (Mechanical Turn chess player, etc).

1958, AI Lab founded at MIT. First move towards this goal. They show perceptrons, etc. Later, Deep Blue shows brute force search can dominate. AlphaZero *learns* Chess and Go in a few hours.

NOTE: CHANGING NOTES STYLE. Don't bother taking notes on things that are obvious. We can just search the slides.

AI now moves towards intelligent automation. Replaces domain expertise with less skilled "attendants" to machines. What's left? Things that don't fit rules, innovation (for now), manual trades (for a while), face to face occupation (... but why)? Artificial Narrow Intelligence is incredibly powerful. Artificial general intelligence, less so.

Kurzweil proposes that we'll be dethroned by computers. They will have emotions, free will, spiritual experiences, etc. This is "The Singularity"; they will surpass in every way.

"her", movie. Movie where guy falls in love with an AI. Ex Machine, AI robot kills holders and moves on.

Some people preferred to talk to the "non judgemental" artificial therapist instead of a human one. Same thing happened at CSU, where "satisfying responses" are sufficient. People now trying to make AIs to detect and respond to emotions.

"Way of the Future Church"; religion that worships AIs.

Ethical problems: self driving cars, trolley problems, etc. ML models can be racist, sexist.

Cross cultural differences in trolley problem.

Need transparent AI.

AGI (artificial general intelligence) can be used to enable corrosion of democracy, AI-fuelled election interference, stock trading primarily AI, etc. Lack of agency freaks humans out.

"Human Centered AI". Analogous to cradle-to-cradle thing. They want AI to enhance human performance, support self sufficiency, facilitating participation, etc. Human users are at center of UX.

Lecture 13: Internet Connectivity

Lecture outline: background of internet, then go into specific cases regarding where it causes problems.

- Before Internet (BC): everything was broadcast.
- After Internet (AD): things can now be interactive.

History: - 1962: A psychologist has the idea of linking a large number of computers into a supercomputer. Helps design the ARPA network. - 1969: Enlisted help from company called BBN. Went to MIT, enlisted Kleinrock (graduate), who was working on packet switching networks. Kleinrock moved to UCLA, first node. BIRTHPLACE OF THE INTERNET. Turns out it's not very good for combined computing power, but is great for distributing information.

Societal Effects: - New services, email and browsers. - Makes enormous data storage banks feasible. - Increased entertainment value: interactive content now. - Social Networking: new ways to organize society. Spontaneous public organization (eg: Arab Spring) via social media. - New ways of publishing: democratizing information dissemination. - New Work models: asynchronous email based, Zoom. - Gig Economies start existing, makes connecting easier.

Ethical Issue 1: News and Publication

New York Times used to decide what would enter the public consciousness. Now, there is no standard for what comprises "news", and no checker for truth. Misinformation, no accountability. Conspiracy theories and groups of hate have appeared. Eg: flat earth. Platforms for conspiracies (eg: Parler), like Gamergate.

Tay, Microsoft bot, is fed racist training data. Companies usually respond against hate by tightening control on platforms. They're given a lot of leeway to do so, because they're not bound by the first amendment.

Ethical Issue 3: Weaponization

30% of social media content is bots. Russian troll factory (IRA) in St. Petersberg caused enormous upset with the 2016 election. Try to divide electorate.

DARPA starts INCAS to detect and monitor these spam bots in foreign countries. They automatically provide messages against weaponization.

Ethical Issue 4: Individual Behavior

People say it's easier to lie via text or remotely. Anonymity makes it easy for people to hate on others without repercussions; people do this for no discernable reason, when they would be afraid to in person.

Laws are not necessarily up to date.

- Megan Meir (US teen) fights with another teenager. The other teenager's mom catfishes Megan with a fake boy via MySpace, then dumps her and encourages her to kill herself. Megan commits suicide. Neighbors incensed, but this wasn't actually illegal at the time.
- Jamey Rodemeyer, gay teen, suicides due to internet.
- "Internet Dependency"; jury thinks one can control another remotely via text for the encouraging suicide case.

People fight back by doxing perpetrators. Called vigilantism. Not ethical.

Ethical Issue 5: Too Much Connectivity

Crowds of people standing in line that don't talk to each other. Conventional societal relationships suffer. Worry that people lose the ability to enjoy things in the moment.

This is on purpose. The media platforms use psychological tricks to keep people engaged with the app. AI based recommendation systems help these tricks scale up.

Is It Too Late?

Companies are enormous, but growing countercultural movement against social media and privacy breach. Roger McNamee says Facebook wouldn't change itself (precedent; seatbelts didn't catch on when they weren't mandatory. Regulation changed behavior). Society starting to catch on, especially when it comes to children.

Lecture 14: Databases and Surveillance

Talk about databases and privacy. 2 case studies about database use, and government surveillance.

Societal issues center on availability, privacy, security. What you want others to know? What you want others to not know? What do others already know? What are others doing with that info? What protection should we have?

Very relevant today.

- Search engines give you a lot of information given someone's name.
- Location sharing technology lets you track your friends as well.
- Internet circulates photos and videos.
- Government data is often public. Has always been; but now don't have to dig for it.

Alvin Toffler (*Future Shock*): "Information is going to be the determinant of power, influence, and security. Technologies associated with these will be the most important".

Ethical Case 1: Database Use and Abuse

Everyday action creates data, logged. Government collects it, businesses accumulate it, etc. Used for records, statistics, and strategic movement.

Can be shifted to the cloud. Cloud is someone else's computer, cloud provider has control.

Now can be traced by satellite, cell phones, cameras, drones, DNA, etc. Means of collecting data is bigger. Biggest difference now is "interconnection and distribution". Before, everybody collected their own data. Now they pool.

Categories of Abuse:

1. *Privacy*: Adding information to a database that other people would consider personal.
2. *Piracy*: Taking something from a database without permission.
3. *Preemption*: Inferring information from a database, and taking action preemptive strike style.

Protection: purpose is to authenticate yourself. Used to be something you had (card key), something you know (password), something you are (biometrics).

Do we hack back? No. Illegal, will likely have fallout, and may start an arms race. But when people try to change law, the wealthy (Hollywood, Google) step in.

Big Data: totality of information available about a person and their interests. Government agencies use this for surveillance. Really, all "communications" businesses like Facebook are actually in the data aggregation business.

Everybody's leaking data, everybody's collecting data. Everybody trades data, aggregate it. People worry we're creating a *voodoo doll*; image that you can use to manipulate the person, like fear tactics. Called "surveillance capitalism".

Ethical Case 2: Surveillance

Government used to only surveil for investigation of activity. Then, we started to surveil for "prevention" of future activity (McCarthy era), now we do constantly. 4th Amendment protects, prescient. However, it depends on "reasonable"; depends on our expectation of privacy, which changes.

Cannot legally enter house without a warrant. Can use visible surveillance if it's publically visible. Cannot use smell (drug dogs), infrared, or radar. Telephone activity and internet is questionable. Drones are scary. Voice assistants are new.

How define privacy? Not in Constitution, Brandeis described as "the right to be let alone". 2018, Sarah Igo realizes it can be monetized (private roads, private clubs), and has value. 12 years ago, Prof Kleinrock says that there's no privacy left. Government (deputy of intelligence) said it's a "system", no real right.

Used to be wire taps. Now SIGINT (military, encompasses recieving transmitting, telemetry, etc). DARPA tried a "Total Information Awareness" project, trying to tap into all communication in the US. Congress nixed it, but was more happy post-9/11. They listen to everything now, but not lot of communication between government agencies, eg: 9/11 FBI and CIA had the information together, but didn't communicate unless it was too late. There are positives; eg Boston Marathon bomber was caught very quickly.

Ethical issues. Infringes on 4th amendment, purposes are questionable, and human behavior changes when they're under watch.

Ethical analysis: - Rights Ethics: Need to preserve individual rights to be "secure in their persons", and society rights. Duty is to preserve both LOL. - Utilitarian: Europe is more proactive principles before technology arrives, GDPR. US is more reactive. - Pragmatism: Post 9/11, immediately US allows warrantless surveillance. Some rolled back in 2015, but we don't know what's going on in the background.

Edward Snowden shows us that most large corporations all cooperate with government agencies, they all spied together. First, people were OK with this. Then, opinion starting to switch. Apple locked phone encryption thing was an interesting conflict. China using surveillance en masse, social credit score. So does LAPD.

Preemption: data based surveillance. LAPD collects data, ends up just harassing minorities. Issue is trust; we do not trust the government or the LAPD, so giving them more power is not good.

Ethical Case 3: Right to Information

Do we have the right to other people's information? China has the great firewall, limits access to databases that CCP doesn't agree with. US companies mostly limit what the government tells them to do. Russian and Ukraine drama is also over false pretext.

Unknown over whether open or closed access will win. If information is power, does open access lead to more innovation?

Lecture 15: Military Engineering Ethics

Military Industrial Complex := "unwarranted influence of military on the government". See Pakistan, etc. Generally, the secretary of defense, etc are all civilians to prevent too much power combining.

- Department of Defense controls military.
- Department of Homeland Security formed post 9/11. Department of defense didn't really defend anything, it's illegal for them to take actions on American soil (entirely offensive for other countries). Homeland Security focuses mainly on R&D.

We spend about $700 billion per year. Budget keeps increasing. Greater amount of money (x7-10) of the rest of the top 8 combined. Most is spent on upkeep, contractors.

After war ended, the government asked defense industry to start consolidating. We end up with 5 main contractors (Lockheed, etc). Very large; all combined are smaller than Apple and Amazon though. These contractors take about 50% of the total DoD procurements.

Military does "multi-domain operations". Now "space" and "cyber" divisions; idea is that nations will constantly conflict, then subside briefly. These divisions stay ready.

Case Study 1: Ethical Analysis of Warfare

Military reaches back to first recorded history. Military imperatives drive technology, and technology drives war.

Law of War (LOW). Generally subscribed to, not always adhered to:

1. Military necessity
2. Avoid unnecessary suffering during war.

3. Distinction must be made between combatants and non-combatant civilians.
4. Proportionality: Loss of life and damage shoul be proportional to the necessity.

Military sets up "Rules of Engagement" that implement the laws of war on a case by case issue.

Now, asymmetric warfare. IEDs, etc. Explosives very strong.

Lecture 16: Ethical Decision Making

- Naturalistic Decision Making := Cycle. Model the real world, decide on a course of action based off model, use feedback to generate new model.
- Analytical Decision Making := Analyze the situation and model as well. Meta analysis, proceed to "decision analysis" (quantify).

Analytical Decision Making is not an intuitive process. Needs consciousness to analyze our decisions. Learnable skill.

2 types of decision analysis:

1. "Certain" outcomes: We know what'll happen if we take.
2. "Probabilistic" outcomes: Outcome is not deterministic.

How analyze decisions via Decision Analysis? Quantify benefits with "utility". *Multi-Attribute Utility Analysis (MAUA).*

- First, kill all options directy superseded by other better options.
- Move everything to the same units, via monetary equivalents. Least cost method. We can also convert to abstract utility values (range from 0 to 1). Utility represents value of each attribute level.
- After creating utility, we give each attribute a "weight" that sums to 1 (eg: 0.2 cost, 0.3 carbon emissions, 0.5 lifetime). Weight represents how much we value an attribute.
- Sensitivity tests: tweak the weights, figure out what the overall metric is sensitive to.

What if outcomes are probabilistic? Focus on a decision tree and causal model/influence diagram. Make sure to add negatives to decision trees. Expected value is useful.

Decision trees get too complicated with many branches. Instead use an *Influence Diagram* (sometimes called *Causal Model*). Condensed version of tree, map "very high" influence etc onto a quantitative scale.

OFC, these models are kinda dumb. Expected Value isn't the end-all (variance could be very relevant here, etc).

Prospect Theory:

1. Humans aren't rational decision makers.
2. Heuristics are very easily misled (like everything done before).
3. Emotions and Biases strongly influence results.

Eg: Loss Aversion, diminishing returns, etc.

Availability Heuristic := We put higher probabilities to more commonly discussed things, and less for things that are relatively unspoken or obscure.

Risk Space := people choose voluntary exposure to a familiar, chronic risk instead of involuntary exposure to new risks.

Case Study 1: Martha Stewart

Martha Stewart had an opportunity for inside trading. She takes this opportunity to look cool. SEC investigates her, Stewart lies to them, and she is convicted for obstruction of justice. From an ROI perspective, the expected value was negative. From an ethical perspective, it was unethical. So she shouldn't have done it.

Case Study 2: Gordan Caplan's Decision

Gordon Singer (legal guy) talks with "fixer" Rick Singer, arranges to have his daughter get 97% on the SAT. Rick Singer had been caught, and was an FBI informant. This was not smart.

Case Study 3: California State Decision

A $17.5 million fraud detection contract was terminated by the California Unemployment Agency. COVID hit. Now there's a lot of fraud, and no way to detect it.

Group Decision making is not smart. Use a framework, life will become better.

Decision Making is worse under stress. Can use Stress Resilience Training Systems (Perceptronics).

Lecture 17: Personal Ethical Framework

Final Lecture