ENGR 188EW

Lecture 1: 4/2/24

Prof. D. G. Browne

Gray box with black button: Protects from shooters

Case Study Approach (Most bad :/)

EC: Movie Review – The Inventor: Theramos

EC: Movie Review – Apollo 13, Tom Hanks

No final (per se)

National Electric Car Charging Network

- Compatibility, Unfeasible (Takes too long to charge), only 7% complete

Ex Topics: Mudslides, California Wildfires, Cow Manure

Teamwork:

- How many disciplines used in the original iPod?
- What do these. Two images have in common?
- What defines the size of the compact disc?

Engineering is a Team Sport

- Teams are Rewarded and Penalized
- Winning or Failing Depends on:
    - Taskwork skills
    - Teamwork skills

Top Executives Depend on Social Skills:

- Communication: 84%
- Organization: 75%
- Team Building: 72%
- Leadership: 68%
- Technological: 46%

Essentials

- Communication
- Leadership
- Emotional Intelligence

Communication Skills

- No Alpha Males >:(
- Participation

- Calculators vs intel

Tiger Teams: Damage Control Group, Used in emergency situations to provide solution to immediate problems

Wall Halton NASA

74 min, 19 sec → CD Length, Beethoven Symphony No 9

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Lecture 1_2: 4/4/24

Ch 1-2 Summary

Ch1

- Passive Responsibility: Review of past accidents
    - Case studies not always successful in achieving results
- Active Responsibility: Looking towards the future for failure modes
    - Aircraft Component Testing: Birds in jet engines
        - Place small turkeys, chickens in air gun into engine, shoot into engine, if engine still runs, engine is cleared
            - Does not account for large birds
                - Case: Both engines of LaGuardia flight killed by Canadian geese, although RAT motor deployed, plane landed in ocean
    - Crash Testing cars: Crash Test Dummy
    - Takes form in:
        - Environmental Impact Reports
            - SF models chemical spills
        - Risk Assessment
- Effectiveness: Achieving a goal
- Efficiency: Achievement vs Work inputted

Ch 2: The Codes

- Formalities don't follow ethical
- Corporate Codes

    - John Deere
        - Manufacturer of large farming, deemed very ethical
        - Leave and fly back if bribed
    - Johnson & Johnson
        - Code of Conduct prioritizes:
            - 1. Patients
            - 2. Employees
            - 3. Communities they work in
            - 4. Other shareholders
        - Cyanide Poisoning Incident: Recalled global sales of Tylenol in 15 minutes (Cost $150 million)
- Aspirational code: Expresses moral values of company
    - J&J, John Deere
- Advisory code: Foresees challenges professionals will face
    - John Deere: Don't take bribes
- Disciplinary Code: Outlines certain behaviors that engineers must meet
    - Mainly in state boards of engineers, Hippocratic Oath
    - Engineering Societies: Protects public health and safety
        - National Society of Professional Engineers
        - Royal Academy of Engineers
- Code of Ethics: American Bar Association (Private Organization)

UCLA E4 Carpets and Wall Partitions used to be toxic

- Solution:
    - Separation of engineering codes from corporate codes

        - Engineering codes only apply to engineers, corporate codes apply to everyone

How to figure out where to work? (Given ethical issues)

- Los Alamos, Livermore: Heavily involve in military weaponry
    - Bomb designers seemed to prioritize how small to make a bomb
    - Multiple independent Reentry Vehicles: Shaves off 1 intercontinental ballistic missiles, has 10 nuclear weapons in nosecone (shut down by international treaties, limit is 3 now :/)
    - Help on insular areas:
        - Assistance with cleaning plutonium contamination
        - Assistance with tracing back radioactive Kodak cardboard
        - Design safety standards

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Lecture 2_1: 4/9/24

Normative Ethics I

Deontology: Immanuel Kant

- Opposes religion, searches for reason
- We have a duty to other people and we should respect that

Virtue Ethics: Greeks, Romans, Thomas Aquinas

Utilitarianism: Jeremy Bentham, John Stewart Mill

- Define ethical conduct as greatest good amongst people
    - Doesn't address losers

Rights Ethics: John Locke

- Governments have a duty to serve people and not oppress them

Normative Ethics: Derived from societal norms

- Norms grow out of values, societal goals that lack specfics towards their accomplishments
- "Rules that describe what actions are required, permitted, or forbidden"

Tesla settles outside of court:

- US-101 Crash into cement barrier
- Tesla's lane tracking is based on road markings

Deontological Ethics

- Immanuel Kant

- Categorical Imperative comprised of:
    - Universality Principle
        - Decisions from an individual that if they want to do something, do they want the entire world to start doing it?
            - Blowing a stop sign
    - Reciprocity Principle
        - One should never use other people to achieve their own goals
- Theranos: Blood testing machine without veinous draw
    - Do you want all medical professionals to send out equipment which doesn't work?
    - Used people for own interest
    - Extra Credit: The Inventor out in Silicon Valley
- Problems: It is binary (you're either ethical or you're not)
    - Ex: Lying is wrong under Universality, thus Gestapo
- Prima Facie Ethics: Extension to Deontology, addresses circumstantial cases, Ross
    - Fidelity, Reparation, Gratitude, Non-injury, Beneficence, Self-improvement, Justice

Utilitarianism

- Jeremy Benthan, John Stewart Mill
- Greatest good for most people
    - Act utilitarismism: Judgement on consequences of utilitarian acts
        - St Francis Dam, collapsed on first filling

- Rule utilitarianism: Judgement on rules controlling utilitarian acts, not acts themselves
    - Dam was not expanded laterally
- Case Study: Los Angeles Water Supply
    - City of LA gained control of water rights used for increasing city's water supply through land purchases
        - Subsequent developments demonstrate city's long-term violation of utilitarian principles (although land purchases were legal)
            - Drill out ground water, killing farmers
            - Drain streams for more water, removing local water access in San Fernando valley
                - Manzibar apple orchards die due to lack of ground water
                - Owens Lake dries up, heavy metals blow in windstorms in Lost Pine
                - Mono Lake drained
- Problems: Good for engineers, can be bad for society, environment.
    - Who are the losers?
        - Boeing MAX: Dead in Ethiopia and Indonesia

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Lecture 2_2: 4/11/24

Normative Ethics II

Rights Ethics (not in textbook)

- Government has an obligation to protect its citizens
    - If government is going to protect us, where will we see that?
- Human rights are basic
    - Rights are fundamental human authority
- Types of Rights
    - Liberty Rights: Non-interference and property protection
    - Welfare Rights: Concern for others within moral community
        - Benefits under contracts, promises
    - Modern Rights: Privacy, education, safety, healthcare
- Examples:
    - Declaration of Independence
        - Jefferson hardcodes the rights to abolish bad government, taxation, and limits government
    - Bill of Rights

Where do Rights Come From?

- Outside Sources: God
- Inside Sources:
- Wrongs: Bad Morals + Experience

How Do Rights Differ from Morals or Preferences?

- Rights are related mainly to governments

- Rights extend morals into law
- Rights are elected “super preferences”

Why are Rights Important?

- Restricts the actions of government
- Protects minority opinions and safety
- Provides necessary values and guidance

Rights Ethics Today:

- Pros: Government systems protect population
- Cons: Failures in government inspection and intrusive surveillance programs that follow actions of citizens

Right Ethics Violations in Engineering:

- Flint, Michigan: Water Supply
    - City council appoints city administrator (due to severe debt), admin stops buying treated water to opt for Flint river, skips treatment process to save money which corroded old lead pipe infrastructure, resulted in heavily-contaminated lead water.
        - Every level of government refused to make any changes
            - Rights Violation
- Fukushima
    - 9.1 Earthquake, reactor shuts down as expected (due to power failure) but did not withstand a tsunami
        - Tokyo Power Company had political power over Nuclear Energy (and thus its policies)
            - No upgrades to cater to earthquakes to save money

- BART
    - Originally run by bureaucrats, used an electric company that wanted no drivers, company could not have good electrics. 3 BART EE brought up concerns and got fired.
- Teton Dam Failure
    - Earth and Fill Dam in Eastern Idaho, warned that dam design had issues, it failed
- St Francis Dam Failure
    - Concrete Dam, no regard to safety standards, killed many migrant workers
- Parking Violation
    - Tracks all license plates
    - Should be used to track crimes

Virtue Ethics

- Virtue: A Desirable Trait
    - Wisdom → Courage → Temperance → Justice → Liberality
- Virtues are desirable as:
    - Motives, attitudes, and emotions
    - Guides to conduct
- Associated with societal classes
    - Boy Scout Oaths
    - Religious teachings

Citicorp

- Citicorp offers church to rebuild a church

    - Results in no structural beams every 25 feet
- Princeton student notes in thesis that chevrons installed were faulty
    - Original Plan: All connections were originally meant to be welded (where chevrons are each floor)
    - Construction Reality: Removes welding, replaces with bolts
        - Full weight of loads relied on chevrons, and thus the bolts
        - Trusses are not subject to safety regulations
        - In a hurricane within 16 years, the building will collapse
- Was Citicorp's Lemessurier Virtuous? (Kinda, but not really)
    - Design Phase:
        - Not Virtuous: Lemessurier failed to examine the structural effects of quartering winds even though he had the data, failed to communicate to associates that members were load-bearing
    - Realization Phase:
        - Called lawyer, insurance, and partner
        - Virtuous: Then called Citicorp and whistleblew himself
    - Correction Phase:
        - Lemessurier initiated emergency plan to fix welding, did not include Lemessurier and did not inform general public

Failures in Virtue Ethics:

- GM Ignition Model
    - Cut corners on the spring for ignition, resulting in car sometimes turning off sometimes (losing airbags), never issued a recall. Lawyers debated issue for 10 years

        - GM declared bankruptcy to avoid legal issues (That's the old GM, you cant charge our new GM)
- Ford Pinto & Explorer (Textbook is wrong)
    - To get marketing edge, strived to make Pinto under $2000, cutting corners on structural stability, developing a substandard car

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Lecture 3_1: 4/16/24

Ethical Case Studies I: The Space Shuttles

<u>Challenger</u>

Two side solid fuel rockets needed to get main ship into orbit

- Liquid Fuel Rocket: Checks plumbing in first 8 seconds
- Solid Fuel Rocket: You cannot stop a fuel rocket once started

Night Static Test: Tested Sideways, does not mimic effect of winds, gravity, or real conditions

Failures

- O-Rings: Gaskets which prevent oil from entering the gas chamber
    - Prevents hot gas blocked by zinc chromate putty “gunk” from exiting the chamber
    - O-Rings were never tested, rubber becomes brittle when cold
    - 9-Year Paper Trail of engineers arguing that O-Rings are “junk”
        - 1977: Design Phase, Leon Ray says Clevis is leaking, recommends shims for short-term fix
        - 1978: Internal document, relaxation of O-Ring Acceptance Standards
        - 1979: Looking for alternatives for rubber products
        - 1985: Morton Thiokol, management is aware of O-Ring erosion problem (15 launches, goop would fail and hot gases hit O-Rings and burn/erode)

        - 1986: Temperature of test site was not tested
            - Shore Hardness → Colder means harder
    - Added retention band to heat up the O-Ring

<u>Columbia</u>

- Thermal foam flakes off ship
- Ceramic tiles take dings
- Linda did not want to hear bad news

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Lecture 3_2: 4/18/24

The DC-10 Aircraft

The DC-10

- Innocent Engineering and Business Decisions Go Wrong → Small actions, Big Effect in Public Welfare
- McDonald Douglas → Management should have a Bottom-Up Design to allow for Whistleblowing
- Blue Envelope: Lowest Level Person in U.S. Department of Interior receives a blue envelope and addresses secretary of interior → Only the recipient is allowed to open it
- FAA defines how aircrafts should behave using regulations (which take in user feedback)

Douglas Aircrafts:

- McDonald Douglas primarily used to supply military
    - DC-3 → used in WW2
- DC-9
    - Company had financial problems, began cutting financial corners (to compete with Lockheed L10-11)
- DC-10
    - McDonald has domestic market, but not the international market (as their planes did not fly far enough)
        - Lockheed sells safe airplanes, McDonald builds cheap airplanes

Paris: Preventable

- To make a wider airplane
    - Wider airplanes require 2x the width, height, length
    - Pressurization → Potential for windows to blow out
        - Sensors to detect loss of pressure in cargo
        - Hole in passenger area to allow for equilibrium of pressure
        - Rube-Goldberg: Overcomplicated design which achieves a simple task
            - Doors on Airplanes
                - Plug Doors: Hinges allow for doors to come outside of the airplane, 8 inches wider on sides and top than actual door frame, never fail
                - Wide Body Aircraft → Need of space for Cargo (which could be possible by opening door upwards)
                    - Lockheed: Teeth Doorframe, Teeth Door, When Door is inside, rotate to create a plug door
                        - Never Fails
                    - Boeing: Place rods on base of cargo, use semicircular rod in door to grasp cargo rods, rotate 180 and pop a pin to lock the door
                        - Sometimes Fails

- McDonald Douglas: Cargo handler pushes a button for indeterminate period of time while door closes, holds it for some more time to allow claws to grab rods. Push door handle to move rods and pop pins to prevent rotation

McDonald Douglas Door Blows out during pressure test:

- Add additional door which does not close if the latches do not lock (preventing pressurization)
- Dutch FAA notes that DC-10 pressurization holes were too small to create equilibrium
    - US FAA never questioned issue during qualification process

June 12, 1972: Flight from Detroit → New York

- Door closed by pressing the door shut, (no claws attached)
- Back Door Blows Out due to pressure
    - Partial Floor Collapse, Some Cargo (including a coffin) flies out

Rights Ethics Violation: Convair does nothing regarding door malfunctioning

- Band-Aid Solution: Add Brace underneath door to prevent denting

May 3, 1974: Flight from Paris → London

- Handler shoves door shut, Cargo Door Blows Out
    - Complete collapse of floor, 9 people fly out hole, 346 died

- Switch to mechanical: Pressurization only occurs when claw twisting is in place

Failed Opportunities with DC-10:

- Douglas
    - failed to go beyond minimal DAA design regulations
    - failed to design for air pressure equalization
    - and FAA ignore FAA input
    - forces electric door closer against Convair recommendations
    - censors FMEA
    - failrs to fully respond to Long Beach blowout
    - ignores Rigg's whistleblow of door redesign
    - did not respond in timely manner to fix door design
- Convair
    - Buries Applegate memorandum
        - Applegate does nothing more
- FAA
    - Did nothing
    - Does not force Douglas to fix door design in timely manner
    - Unexplained Quality Control inspection problems at Long Beach Plant

Chicago

- McDonald recommends removal of engine, then pylon, then wing
    - American removes pylon & engine as one unit to save money
        - Resulted in cracking of support plates

    - Calculates Loss of Engine and Asymmetric Slats as Independent Events
    - Does not add supportive motor but uses vibrator to provide electricity (however vibrator uses electricity from wing engine itself)
        - FAA does nothing regarding complaints from crash
- Hydraulics
    - Boeing places hydraulic lines behind wing spar (to avoid issues with hitting birds)
        - Uses 4 hydraulic lines
    - McDonald saves money by placing hydraulics in front of wing spar
        - Uses 3 hydraulic lines

Sioux City, Iowa:

- Loss of Pressure in hydraulic system would cause emergency hydraulic shut off valves
    - Japan Airlines Flight 123
        - Splice Plate used multiple plates, fractures and pressure tube blows off end of airplane
        - Crash results in Boeing implementing Shut Off Valves
- #2 Engine explodes
    - Shrapnel cuts all parallel hydraulic lines on wings
    - Backup Plan
        - Helicopters, Medical calls mid-clash

        - Categorization of injuries and all-hands-on deck approach to patient care
        - Closure of local interstate

The Boeing 737 MAX

- Engines originally low to ground to fly into developing countries
    - Engines move forward and caliber of engines squared off
        - Changes the Center of Mass for plane to nose up/stall
        - MCAS system makes nose go down
            - Angle stabilization occurs 2 degrees at a time
            - Programmers paid $9 an hour
- Boeing is concerned more about profits than engineering

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Lecture 4_1: 4/23/24

Engineering Ethics in the Automobile Industry

Ch 5, Ch 6

Risk-Cost Benefit

Automobile Safety

Ford Pinto (Ignore the textbook)

- Costs less than $2000, less than 2000 lbs
    - Effectively did not have a rear bumper
        - Rear-ending would cause fires and combustion (from bumper hitting the gas tank)
- Differential held together by bolts
    - Bolts would fall, ripping open the gas tank and combusting into flames during rear-ending
        - Loses against a 1973 Pontiac Firebird I guess…
- Compressed Design Schedule
- Book: Ford Memo exposé from *Mother Jones*, Ford emphasizes money over ethics
    - Concerned about rollovers, not rear end collisions
    - Focused on all 11000000 cars sold in the US
        - Did not specifically mention the Pinto
        - Could not have affected its development
    - 900 reported Pinto deaths, 27 actual deaths
- Browne:

    - Ethical issue with Ford fighting upgraded fuel safety standards
    - Gas tank moved back because you could not fit a bag of golf clubs in the trunk

Ford Explorer

- Commercial SUVs required to meet fleight/fuel requirements
    - Rules did not apply to industrial vehicles
- Ranger Track is narrower (more likely to flip during turns)
    - Bronco, Explorer used same track
    - Solution (approved by management): Lower tire pressure
        - Explorer C-Class Tires began failing
            - Due to weight displacement from fuel tank and differential

General Motors Ignition Switch

- Shortcutted on spring
    - Key would wiggle while driving, sometimes turned off car
    - Lawyers concluded legal fees from deaths are cheaper than updating the springs (125 people died, $4.99 mill)
- Filed for bankruptcy and ran away from payouts (as it was a part of the old GM)

Volkswagen Defeat Device

- Volkswagen could not meet EU, US emission standards
    - Emission systems turned off on roads, releasing nitrogen oxide trap

    - Car turns on all emission systems while on test stand
- Loss of $33 billion USD

GM Cruise Autonomous

- Turns off in situations with construction, emergency vehicles
    - Ran over a woman in 2023 for 20 seconds

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Lecture 4_2: 4/25/24

Biomedical Ethics

Biomedical Ethics → Uniquely deals with FDA, medical, and engineering ethics

Therac-25

Radiation Therapy Machine

- Dual Mode → Xray Mode without collimator → Full exposure to radiation
    - Caused by 8 second delay which filled time with previous settings
        - 3 fatalities → 20,000 rad exposure
- Development Problems
    - Programming errors
    - Inadequate testing of software, design, safety
    - Inadequate reporting to FDA
        - Bad numbers in reported safety analysis
    - Inadequate response to problems

Bjork-Shiley Heart Valve

Created using two pieces (rim, inlet) welded to each other → Bad welds → Deaths

- Manufacturing level problem

Endovascular Technologies

To solve aortic aneurysm (ballooning of aorta from heart), use a stent (instead of surgery)

- Internal stent pulls aorta into itself
- 1/3 of units fail following switch to new management

Guidant Prizm Defibrillator

- Leaks when inside of patients → shorts and does nothing
- Guidant buys Endovascular Technologies Finances
    - Guidant paid ~$1 billion in damages

Olympus Duodenoscope

Used to diagnose problems in stomach (ulcers), esophagus

- Crevices of device were not fully cleaned, thus infectious particles transferred across patients
    - 25 deaths, >350 hospitalizations

Synthes Bone Cement

Injected into osteoporosis patients instead of stabilization pins and screws

- No Animal Testing → Patients die on the table → Jailtime

Cutter Polio Vaccine

- Developmentally disabled children home used as first testing point for vaccine
    - Judge, everyone involved believed testing was ethical

    - After case study of 400,000, vaccine deemed successful and passed by FDA
- Cutter, a vet medicine company, begins developing the Polio Vaccine
    - Sharing of space between treated and untreated vaccine
    - Disabled 18 monkeys, nothing was done to change

<u>Theranos</u>

Edison: Runs specific blood tests with only few drops of (not veiny) blood

- Different cartridges needed for different tests
- Using finger blood breaks some components of the blood
    - Theranos testing is significantly different from Quest<LabCorp testing
        - Never used any benchmark testing

<u>Piccolo Express</u>

Performs 32 tests in 1/10 CC of blood using dried form of blood

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Lecture 5_1: 4/30/24

Ignore Biographical Stuff

CH 1

Active vs Passive Responsibility

- Passive: Backwards looking
    - Engineering Ethic Failures
        - Watch way engineers, management acts, what can we learn
- Active: Forward Looking
    - What can we learn from the past? How do we design things? What steps can we take to analyze through the design process?
        - Thought trees

Efficiency vs Effectiveness

- Efficiency: Speed/Percentage of which you achieve a goal
    - Efficiency more important examples:
        - Boeing Pushing Planes out of assembly line
        - Pinto cuts design process in half
        - Explorer uses existing assembly line
- Effectiveness: Product of the work

Ch 2 Codes of Conduct

No limitations

- IEEE → What if you're an EE but not a part of IEEE?

    - Your company, but no real mechanism to assure adherence to codes of conduct
        - 80 codes of ethics not required, we should strive for a singular code (like lawyers)

Ch 3 Normative Ethics

- Rights Ethics (not in textbook)
    - Government agency involvement in processes
        - DC-10 → Federal Aviation Administration ignored Dutch warning about the plane
        - Theranos → Chain deliberately held in house to avoid FDA (loophole)
        - Biomedical Equipment (Endovascular) → Minute FDA found out about what was going on, they searched the company and shut it down
        - Alaska Airlines grounded on Saturday (terrible maintenance history)
- Utilitarianism
    - Optimize the greatest good for the greatest number of people, however does not care for people on the “losing end” of the consideration
        - Ex: LA Water Supply
- Virtue Ethics
    - Care Ethics is a part of Virtue Ethics
    - CityCorp → Structural Engineer whistleblew on himself, problem is fixed

        - CityCorp is troubling: Unique design was not treated with special care during design phase
            - 3 Part Sequence, design pahse messed up
- Categorial vs Imperative
    - Reciprocity Principle: You don't use people to achieve your own goals

Ch 5 (ed 1) Ch 4 (ed 2)

- Ethical Cycle
    - Straight Line Diagram → Problems will create a feedback loop
        - 2 Flow Charts used in tandem

Airplanes

- "McDonald Douglas & Boeing (run by McDonald) like to build cheap airlines and its come back to haunt them"
    - Undercut Lockheed using the DC-10
        - Renewable source of energy to stick shaker, no shut off valve, no slat valves on wing
    - Max 8, Max 9
        - No serious inspections

Normative Relativism (Ch 3?)

- You should not critique ethics of other cultures

Primavation Norms??????

Automobile Problems

- Dieselgate → Pollution control on VW diesels

Theranos

- Elizabeth Holmes deliberately designed to be in-house (all devices on Theranos property) to avoid FDA approval
    - Failure of law, regulation, ethical, FDA
        - ExQ: Should we reform the regulatory procedures of the FDA?

Feedback Loops:

- Why doesn't class talk about more good cases?
    - Johnson & Johnson
    - Most things are handled internally

Whistleblowing:

- Endovascular Technologies:
    - Internal fixture of defibrillator not whistleblown → people die
- iPhone 4
    - Antennas could be shorted, should not be whistleblown due to small magnitude of issue
- Handle the issue in the company first before going to media
    - Browne exposure to fake MDA in medical school
- Consulting for Interior Department
    - Blue Envelope

Lecture 1: Teamwork

- How do teamwork principles permeate through every lecture?
    - Bad Management → Bad decisions, Bad Outcomes, Bad Ethics
        - Ex: Challenger
- Listening
    - Lloyd did not listen → Challenger Lost

Nylai

3 Paragraphs → More than 2 sentences per paragraph

- Don’t repeat the history
    - 4 required, pick 4 more that are optional, 12 total questions
- Avg 89 last quarter ☹

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Lecture 7_1: 5/14/24

Engineering Ethics & Society: Population Growth & Resources

Explosive Growth of Human Population

- Earth: 6 billion years
- Humans: 2 million years ago
- 1 billion people: 200 years ago

Population Growth Factors

- Agricultural
    - Animal Domestication (Use bulls to farm)
    - Intensive Crop Production
- Urbanization
    - Cities in rock formations
    - Concentrations of people
        - Requires more shelter
        - Creation of transportation to move people
        - Movement of Water and Energy
        - Standards for Sanitation and Health Services
- Industrialization
    - Society removes away from agricultural core, lives in the suburbs
    - Better food and medical products
- Biological
    - Isolating people when sick
    - Cleanliness required from Infection Prevention

- Fertility
    - Replacement Factor: Used to quantify population growth
        - *The Tragedy of Commons*
            - Commons: Resource that is not individually owned
                - Clean Air, Clean water
            - Adam Smith's theory that free market is optimal is flawed when applied to a commons
                - Governments, organizations, people act in ways that endanger tor destroy the commons
                    - Overpopulation
        - *The Population Bomb*
    - One Child Policy in China
    - Above ~2.1 = Growth, Below ~2.1 is decline
    - Higher birth rates are a primitive thing, mainly to ensure some offspring would survive in the future
- Longevity: Affluence (The amount of money you have)

<u>Human Needs vs. Limited Resources</u>

- 3 Technological Eras
    - Tool Making
    - Agricultural
    - Industrial

Electricity:

- Energy consumption increases faster than population
    - Oil is predominant source of Energy in the U.S.
    - Sulfur from coal + Water in air → ph Rain = 2.0-3.0/Acid Rain → Destruction of Watersheds
- Electricity Distribution:
    - Driven by global utilities (California Water, Department of Energy)
        - Physical bottlenecks due to varying degrees of quality/construction of energy pipelines

Water Resources:

- Majority (67%) of freshwater becomes flood runoff
- 23% is accessible base flow, 10% is remote base flow
- We are near limits of presently accessible resources
- 80% of freshwater in California goes to agriculture (used inefficiently)
    - 5 gallons of water in Central Valley → Couple salads
    - Same amount of water → 1 pistachio (The tree must stay alive)
    - California Water Lock → Only owns the land that is underneath it
        - No streams feed west of the Central Valley → Farms pump groundwater → There is no more groundwater in towns → Import water
            - Farmers now get a cut of Sierra Nevada Water after complaining to Congress
                - Donald Browne does not agree with this decision as it is unfair

- Wyoming: All groundwater belongs to the state/people
    - Major pumping requires permit from state engineer outlining annual water usage and general report of local impact

Land Resources:

- We don't have enough to sustain society
- Land is acquired by deforestation and/or improved irrigation
- Henry Wallis: GMOs
    - GMOs are run by large companies (DuPont, Monsanto)
        - Seeds are money makers for companies, but place farmers into debt
            - GMOs resistant to pesticides
    - Commercial seeds result in conflict
        - 1940 Mexico
            - Poor agricultural organization → Import rice, corn
            - Henry Wallis: Developed cross-bred corn varieties
                - Mexico had no concept of terrace farming
            - Rockefeller Foundation Research Group: Norman Borlaug
                - Prioritized grain variety
                    - Wheat
                        - Crossbreeding
                            - Rust free wheat
                            - Dwarf wheat
                    - Corn
                    - Rice

- 1970: Borlaug gets a phone call
    - Summoned before king of Norway → Nobel Peace Prize
- Henry Wallis: Elected VP of the U.S.

Mineral Resources:

- Lithium resources may be depleted by 2040
    - Deposit found in North Nevada
- Diminishing returns when recycled

Resource Impact is Disproportional

- Impact = Population * Affluence * Technology
    - Richest 20% own 84.7% of global income
    - Poorest 20% own 1.4% of global income

Individual Resource Use is Disproportional:

- US: 342.91 Gj energy consumption per capita
    - Due to distance: Transportation required to supply rural interior
- World: 60.97 Gj

<u>The Attack on our Natural Environment</u>

Port of Los Angeles: Largest Polluter of Los Angeles

- Trucks → Trucks → Trucks → Trucks

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Lecture 7_2: 5/16/24

Environmental Ethics

Boeing is under fire again!

- Boeing is now in deferred prosecution
    - “We won’t bring charges against you if you institute better ethics and better quality control, and you keep your nose clean for 3 years”
- Boeing breaks agreement
- Federal Government voids agreement and criminal charges are being filed against Boeing

Agriculture (Donald’s Soap Box for the Morning)

- Donald: We do not test GMOs enough
    - No testing to see if food genes cause negative health consequences to consumers
- Monsanto, DuPont get involved in Mexico
    - Farmers cannot afford commercially provided, private seeds
    - Climate shifts northward
        - Wheatbelt may shift northward
        - Development of wheat which can withstand climates

<u>Environmental Ethics</u>

Environment effects:

- Life

- Future of humanity
- Future species
- Earth

Silicon Valley

- Cost of Living is too high
    - Google gives housing allowances
- Forces employees to drive long distances to get to work
    - Stanford → Lives in Danville
    - Hewartt Packartt
        - Cell companies around country, Ohio does main printing

Los Angeles Smog

- Peaked in 1950's
    - Pilot could not land LAX
- Recognition (1953 – 1955)
- Removal of Home Incinerators (1957)
    - Place in backyard to burn newspapers
- Oil refineries, Tire Factory
    - Air toxins
    - Toxins produced by processes
    - Originally used Hydrofluoric Acid
- Automobile regulation
    - Catalytic Converters
    - Filling Shields

        - Vacuums at gas pumps to prevent bad chemicals from escaping the gas tank
    - Fuel Composition
        - Removal of Lead, old car uses tetraethyl
        - California: Places ethanol, MTBE in gasoline
            - Ethanol is straight alcohol, leaking tank means explosion
            - MTBE is a carcinogen, leaking tank runoff effects water supply
                - Destroyed a aquifer of the Santa Monica water supply south of Wilshire
    - Fuel Mileage
        - Lighter weight metals, plastic, crumple technology
            - Better Fuel Mileage
        - Station Wagons artificially oppressed actual performance of vehicle
            - Station wagons replaced by SUV
                - SUV are commercial vehicles not counted in fleet mileages
- Inversion Layer
    - Warm air from the city cannot escape city due to pressure from higher pressure, colder air
        - All pollution gets stuck under the inversion layer
- Ozone Layer Depletion
    - Caused by sunlight hitting reactant molecules
    - Peak Ozone Destruction in 1955

    - CFCs → Artificial chemicals, Actually attack the ozone by absorbing more UV rays
        - Used by air conditioning systems
        - Ozone hole over Antarctica vanished over 3-4 months (allowing for direct UV)
    - Greenhouse Effect
        - Rate of increase in Annual global temperature increases
        - Montreal Protocol: Reduces ODS consumption

Rising Sea Levels

- South Florida
    - King tides (High high tides) floods neighborhoods
    - City fathers fail to address issue, Governor DeSantos does not think climate change exists
- DC
    - Built on a swamp, so at low sea level
- New York
    - Dependence on automobile tunnels, subways
- LA Harbor
    - Mother's Beach and Seal Beach can flood
- Silicon Valley
    - Built on fill, 1-2 feet above sea level

If groundwater floods → All fish in nearby 100 miles will die

People need sewage treatments, hogs do not

Geoengineering

Following huge volcano explosion, global temperature decreases for the next few years

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Lecture 8_1: 5/12/24

The Ethics of Computing and Things Electronic

SONOS Speakers

- Issued a functional “downgrade”: Ability of blind to use the speaker is compromised

Patents: Right granted by the government to people who invent useful things

- Not everything is patentable
    - Water bottle design: No patentable
    - Cell phone Design Features (Swiping): Patented
- Establish priority of ideas

Atanasoff Berry Computer

- First attempt at electronic digital computing machine
- Mauchly files patents for ENIAC (military general purpose computer)
    - Many key concepts of ENIAC from Atanasoff
- Mauchly sold to Sperry Rand
    - Licensed rights to IBM, Honeywell
- Honeywell discovers Atanasoff, sues Sperry Rand in 1967
    - 1973: Federal judge invalidates Mauchly patents

Copyrights: Involves anything that you put on paper

- Ex: Donald’s slides, formalized by Library of Congress

- Company Secret:
    - Coca Cola Recipe: Exposed to a rabbi to make it kosher
        - Once a year, old formula (cane sugar) is used during cane sugar
            - Yellow Cap & Orthodox Union stamp, appears for once a year for around a month
        - Attempted sale of Coca Cola secrets to PepsiCo, reported to FBI

Hacking

- Military uses intranet networks

Privacy

- Privacy is seemed secondary is computer system development
- Donald's Concerns:
    - What does private industry know about you vs. Government
- Hollywood star, uses UCLA medical center for care
    - 2-3 days following visits, National inquire publishes medical records
    - Low level secretary sells medical documents to the Inquire
        - No notion of data security
    - Security should be integrated into design
        - Some people must be designated full access

AI

- ChatGPT-4 sounds like Scarlett Johansen

- Facial Recognition
    - Detroit police arrested man based on a facial recognition hit
        - District Attorney had previously banned use of facial recognition in criminal charges
        - Idea: Require warrant for Facial Recognition use
    - China:
        - Surveillance tied with social security
- Autonomous Vehicles, Volvo:
    - UBER ADS system:
        - hits a woman walking her bicycle
            - Driver was playing with her cell phone
            - Drove UBER out of autonomous vehicles
        - Could not identify kangaroos in Australia
        - Could not identify grizzlies in WY-399

Voting Technology:

- Pre 1970: Ballots counted in the precinct
    - Alternative: Automated mechanical voting machine
        - Left no paper trail, could be manipulated
- 1970s: Hollerith card/punch card
- IBM Card in Europe, Punch Voting
    - IBM Card counting machine Sorted by gender, age
    - Tom Watson, charged on treason
    - Accuracy of punch card voting:

        - Machines cannot fully punch sometimes to do excess use, creating “pregnant Chads”
- Mark Sense Voting
    - Replace card punch with rubber stamp
- Electronic Voting:
    - No paper trail
    - Diebold (Cash Register Company):
        - Used in Orange County, would cut off rest of candidates in more than 10 running (as you needed to scroll)

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Lecture 8_2: 5/23/24

Ethics and the Military

Military supported by:

- CIA, NSA, National Geospatial Group others

US uses $700b on Department of Defense:

- Aircraft Carrier: $5.2 b
- B-2 Spirit Bomber: $2.1b

War in Afghanistan:

- WWII D-Day Culture Book
    - No such book exists for 10 year in the war in Afghanistan
- Terrorist groups recruit through social media

US has no strategy for addressing guerilla warfare

- Israel has not figured it out either

Drones:

- Drone Pilot Burnout
- WWII Policy: No engagements of carpet bombing of civilian populations
    - Changed from Luftwaffe bombing

War Theory:

- The Right to defend yourself: Antiquity by St. Augustine
    - Donald’s Israel opinion: Article 4 of Geneva Convention of 1949
- Jus ad bello: Justice before war

Designing a Nuclear Bomb with Donald G Browne

- Hiroshima Bomb
    - Uranium the size of a pineapple
- Trinity Bomb (Oppenheimer)
    - Compression into critical mass → Explosion
- Modern Warheads:
    - 300000 tons of TNT
    - 10 warheads in on launch vehicles → limited to 3 by treaties

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Lecture 9_1: 5/28/24

Research Ethics: From Academia to Business

On Becoming a Scientist

- Aimed at Life Sciences, Postdocs

On Being a Scientist:

- School: Graduate Advisor → Work: Supervisor, Mentor
- TA on Medical Leave → Incomplete → F → Support from campus resources
    - Burrocrats at Murphy Hall → Talk to Person, You are not moving until you speak to the associate dean → Retroactively drop the class
        - To receive response, you had to force yourself into higher leadership
- UCLA TA → Teaching Associate in 1 Year
    - Donald knew the system → Mentor is good

Research Misconduct

- AT&T Jan Hendrik Schon
    - Premier US Physics Lab → Physicist churning paper a week
    - Same drawings across papers → Thrown out
- Lawrence Berkeley National Laboratory
    - Spectrographic data falsified
- Michael LcCour, UCLA Graduate Student

    - Medical Science Graduate, Thesis centered on acceptance of gays
    - Data is plagiarized → LcCour began “shoving it”
        - No IRB (Institutional Review Board) approval
            - IRB ensures the rights of test subjects
    - No professor oversight from Columbia
- UCLA Dental School Faculty Member
    - Requested to write review paper → Plagiarized half the paper
- AI Paper from UCLA → All BS according to Donald
    - Referenced Papers do not exist

Suspected Violations of Professional Standards

- Guidant Defibrillator
    - Engineers knew defibrillator kept killing people due to leaks

Human Participants and Animal Subjects

- WWII German and Japanese Violations
- US Atomic Energy Commission radionuclide exposure
    - Weekly urine, stool samples → Test Subjects unaware why
- Tuskegee Syphilis Experiments
    - Alabama, US Public Health Service analysis entire life cycle of syphilis
    - Gathered poor black men with syphilis, lied about diagnosis to analyze effects of disease, other part of group was treated with then modern medicine

- Similar experiment in Central America: Deliberate infection of people with syphilis

Laboratory Safety

- UCLA Department of Chemistry and Biochemistry
  - Lab Assistant working with chemical that combusts when in contact with oxygen
  - No PPE → 2nd, 3rd degree burns across 80% of body
    - Died two weeks later
  - No safety expectations in lab
    - UCLA fined 500k
    - Professor got away with providing safety lessons

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Lecture 9_2: 5/30/24

Lifelong Learning and Whistleblowing

Day 90 for Boeing of convincing FAA of good job

Lifelong Learning

- Knowledge from school is incomplete

Loss of Shuttle Columbia

- Engineers were unanimous in belief that foam fell off, messing up weighting of launch
- Requests were squelched by management (Linda), more concerned with her own career and previous ships being “fucked up”
- Following Columbia: Numerous studies on weighting of rocket launches
    - Probabilistic risk analysis and risk-based priority scale for the tiles of the space shuttle
    - Risk Management for the Tiles of the Space Shuttle

Oroville Dam

- Highest dam in U.S.
- Nearly failed in 2017 due to excessive rainfall
- Main spillway was poorly build, not well evaluated. Water tore spillway up in 2017

    - ~200000 people downstream evacuated due to potential possibility of total dam failure
- Independent Forensic Team Report
    - Lack of proper technical training to address technical challenges of dam engineering

Fukushima (3/11/11)

- 9.1 Magnitude earthquake ensues total failure of Tepco nuclear plant
    - Prior to modern understanding of plate tectonics
        - 2 continental plates colliding
- Regulators, even in concerns of risks from tsunamis from seismologists, testimony stricken from record
- Tepco kept original design (which did not factor in seismic risks),
    - Did not think about tsunamis
        - Water flooded in emergency building
    - Great Alaska Tsunami → Wave was 100 ft high
    - Banda Aceh → Indonesian tsunami
    - Hurricane Katrina
        - Complete collapse of hospital → Morphine overdoses due to dire conditions
    - SF Seawalls → 100 year old seawalls lack funding

Aberfan

- Small coal mining town in Central Wales
- Coal mine underneath town, waste rock transferred via small railroad
    - Government run coal mine

- Mech E and EE assigned to designate location of new piles
    - Sited a new pile on active water spring
        - Water seeped up into pile
            - Friction on pile became so low (due to entrained water), pile slid down hill catastrophically.
- The accident was preventable
    - Coal tips had history of failing in Wales
        - Prior meetings regarding issue
        - Similar landslide decade earlier ten miles south of Aberfan
- Queen Elizabeth visited, emphasized London's disregard of severity of issue
    - Awarded 500 pounds in each lost life

Saint Francis Dam

- Built between 1925-1928, hour out from UCLA
- Dam failed catastrophically on first filling in 1928
    - Failed as director of Los Angles Water Department (Mulholland) was self-trained
        - Knew nothing about engineering aspects of dam design and construction
        - Forbade his engineers to follow engineering design suggestions from textbooks of the time
            - Design Issues
                - Failing to get an adequate geological report on site

        - Missing toe, height of dam raised by 20 feet without recalculation of needed concrete
        - Lack of uplift reliefs to relieve water pressure from dam
    - Concrete Issues
        - Failing to pour concrete of adequate density
        - Failure to cool setting concrete, resulting in contraction cracking
            - Insertion of cooling lines with cold water, filled cooling lines with concrete
        - Failure to pour concrete in interlocking manner
- PBS Flood in the Desert

VW Dieselgate

- West Virginia University developed engine test to track emissions
- Auto industry, people outside of industry were unaware/ignored the work
    - “Among the clueless, it later turned out, were the engineers in Wolfsburg”

Achieving Lifelong Learning

- Join appropriate engineering society: IEEE, ASME, AIChE, ASCE
- Continuing Education courses
  Internal corporate courses
- Read the newspaper

Whistleblowing

- Fisher-Price “Rock-and-Play”
    - Placing baby at 30 degrees results in 30 deaths due to poor research
    - Recalled
    - Someone should have blown the whistle
- Allan Macdonald
    - Engineer during Challenger launch
    - Attempted to refuse launch by refusing to sign launch authorization
        - NASA Vice President of Utah signs instead
    - Whistleblowing should be recommended during the case of public health and safety
- Citicorp Tower
- Endovascular Technologies
    - Machine is “bullshit”
- Theranos
- BART

Choices:

- No Ethics:
- Cheap Ethics: No pursuing of solutions
    - Dan Applegate → DC-10
        - No follow up
- Costly Ethics: Moral Courage

Westminster Avenue

- Queen’s funeral
- Great West Door → Preaching robe with large open Bible,

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Lecture 10_1: 6/4/24

2nd Midterm Review

UCLA AI Paper:

- Example for ethics in fall quarter
- 6 references → None exist
- Quality of writing was “pretty trashy”

Campus Police are looking for anti-protestors

- They have license plate numbers

12 hour window, 2 hours to take exam

- EXAM EXTENSION FOR THURS DISCUSSIONS

3 Chapters in 2nd edition

- 6th: Ethical Aspects
- 7: Distribution of Responsibility
- 8?: Ethical Aspects of Technical Risks

Chapter 6:

- Boeing → Business Firm after Merger
    - Issues with:
        - Fuselage, Door blows out
        - Quality Control
- Redundant Design
    - DC-10

        - 3 parallel hydraulic systems
            - Sioux City, all failed
    - Boeing
        - 4 hydraulic systems, saved the plane
    - Section 6.4 (Risk Assessment)
        - Engineering Risk Assessment: Will parts of a product fail?
            - Chicago Crash, DC-10
                - Failure of engine 10^-5
                - Probability of asymmetric slats: 10^-6
                - Multiplied failures to get 10^-11, but events are not independent
                    - Real percentage is 5.1 * 10^-5
        - Biological Risk Assessment: Effects on human health or the environment
            - Exposure Assessment: Testing on how gasoline can effect environment, society, air
            - Consequence Assessment: Toxicity of gasoline fumes?
    - Informed Consent
        - Pinto
    - Available Alternatives
    - Section 6.7: Precautionary Principles
        - If You don't have full information on something that is risky, maybe you should assume that there is risk, act accordingly
        - Ex: Nanoparticles???????

Discussion Questions ☹

Chapter 7: Distribution of Responsibility

- Section 7.1: Problem with many hands
    - Working in teams can make pointing failures at a person difficult
        - Citicorp
        - BP cuts corners in installing oil well in Gulf of Mexico, pipe casing was kinked due to bad cement job, rig bursts and spills millions of dollars of oil into the gulf
    - Section 7.2
        - Citicorp
        - Browne disagrees with analysis:
            - Book states nobody is responsible
            - Majorly (engineer) was responsible due to not sending own warning to New York
    - Moral, Legal Responsibility

Chapter 8: Sustainability

- Bron? Definition
    - European, You must worry about future generations
- Pg 260: Energy sector (WILL NOT BE TESTED >☺)

Review slides since the midterm

- Week 5, 6
- Population Resources

    - PAT Equation
        - Influence: Population * Affluence * Technology
    - Population will start declining, affluence and technology will start rising
        - Ex: 2030: Data centers will account for 20% of electricity use in the country
    - Affluence:
        - We may run out of lithium in a few years
            - Even with recycling, there is diminishing returns
- Los Angeles Smog
    - Fixed through technology, using cleaner burning fuels, automobile stuff (catalytic converters)
- Computing
    - Voting Technology
    - Medicine (major advances in AI)
        - Potential use in rural areas
    - Facial Recognition
        - Racism (Doesn't like dark skin)
        - Policing
- Research Ethics
    - Treatment of Data
    - Conflicts of Interest
- Lifelong Learning
    - Knowledge base must grow year by year
    - Program of approach, examples
    - 25% of class will work for Military

- Does this justify the atomic bomb?
- Ad bello: Justice before War
    - What are criterium to use when deciding to go to war?
- In bellum: The Right to defend yourself
    - Decisions governments make to protect civilian populations

Question Possibilities:

- PAT
- Lifelong Learning (possibly multiple)
- Many Hands Problems
    - Boeing, Citicorp
- Environmental
- Autonomous Vehicles
- AI
- Hypothetical: Ethical implications during a job

The Inventor: Theranos

Apollo 13: