

Introduction to Ethics in Engineering

Professional Engineering CENG20008

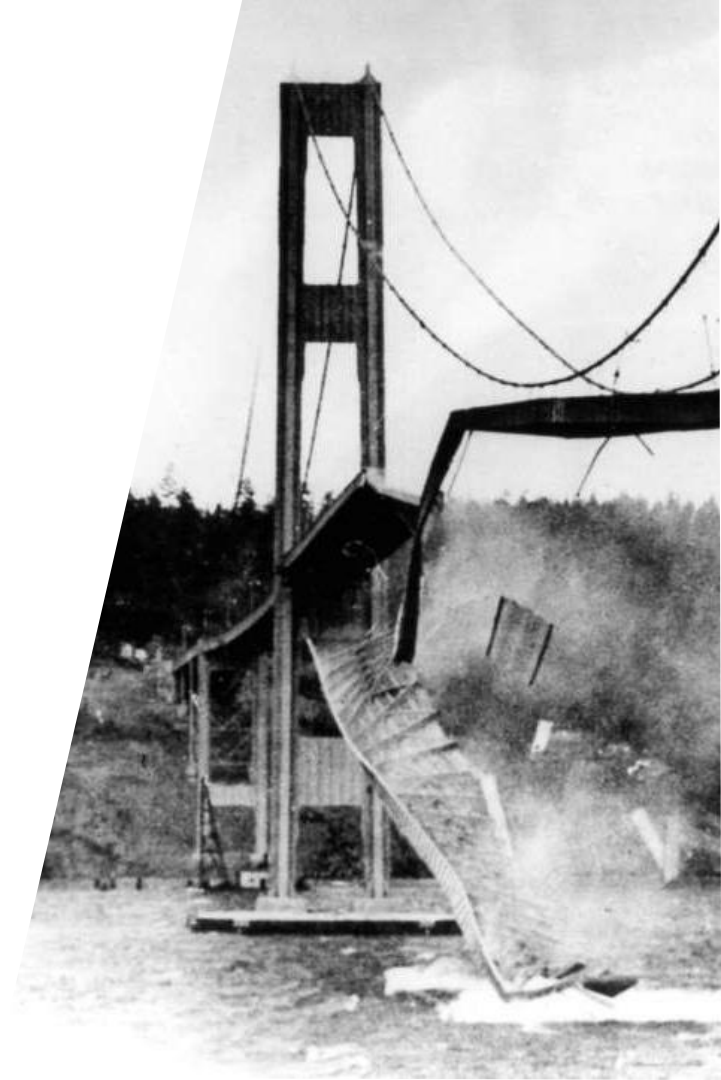
18th Dec 2018

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Aims of this lecture

- To understand basic ethical principles
- To understand what ethical principles, governance and codes of conduct apply to engineers
- To discuss ethical issues in practice with case studies
- To discuss areas of social, legal and corporate responsibility (in relation to your Professional Engineering project)



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“It occurred to me that if I could invent a machine – a gun – which could by its rapidity of fire, enable one man to do as much battle duty as a hundred, that it would, to a large extent supersede the necessity of large armies, and consequently, exposure to battle and disease [would] be greatly diminished.”

-Robert Gatling 1877



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“I would prefer to have invented a machine that people could use and that would help farmers with their work - for example a lawnmower.”

-Mikhail Kalashnikov



What is ethics?



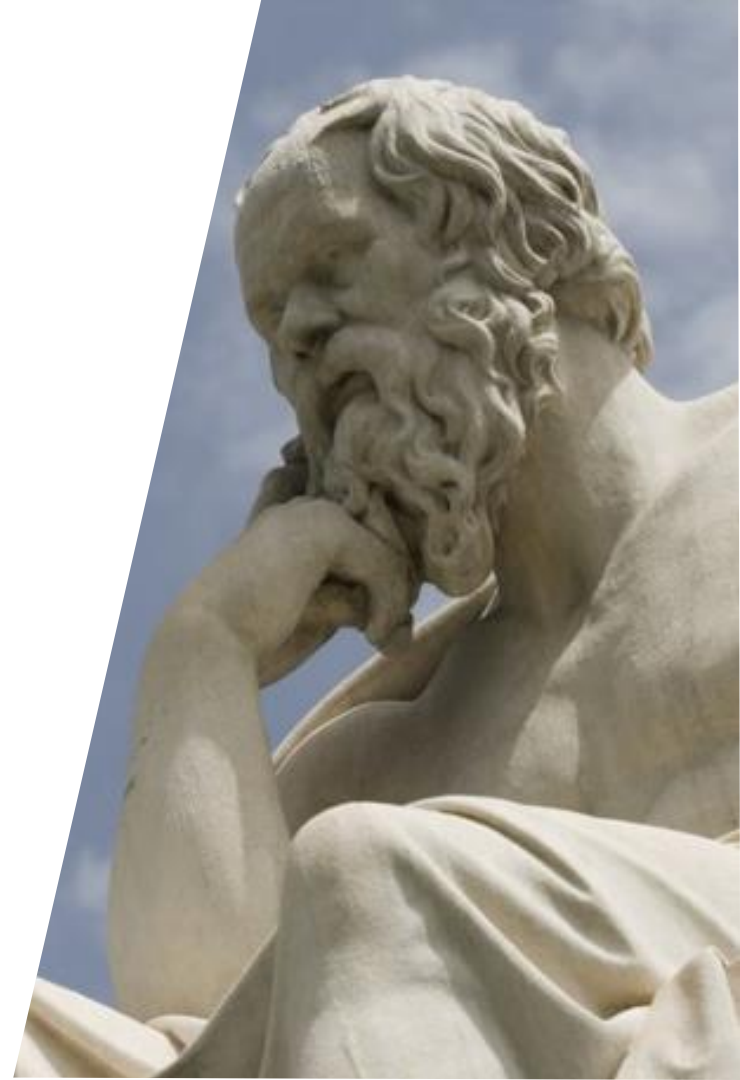
What is ethics?



“The moral principles that govern a person’s behaviour or the conducting of an activity”

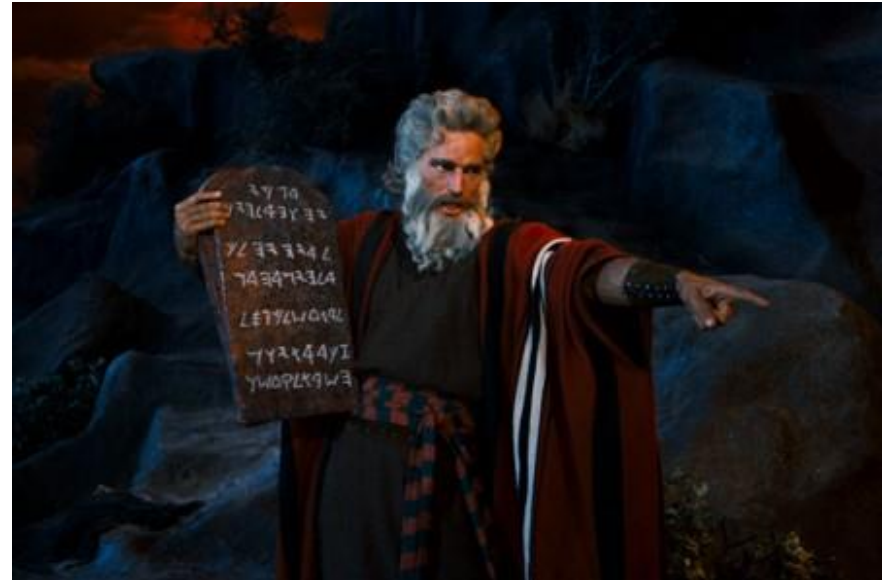
A crash course in ethics

- Greek philosopher Socrates introduced ethics & acceptable standards as a taught subject in 400BC
- Plato and Aristotle explored virtue ethics (Plato was one of Socrates students)
- Ethics is still a subject of deep philosophical debate, even today, but we have not got time to delve deeply!



Duty Ethics

- See also '[deontological ethics](#)'
- Actions are based on following ethical principles
- These rules could be codes of conduct, governance or personal/cultural values
- But may conflict with personal desires



Virtue Ethics

- See also '[aretaic ethics](#)' & [Stoicism](#)
- Actions are based on the moral & intellectual agents or 'virtue's' of an individuals character
- Driven by physical or emotional nature
- But no rules, every individual may have a different view of right or wrong



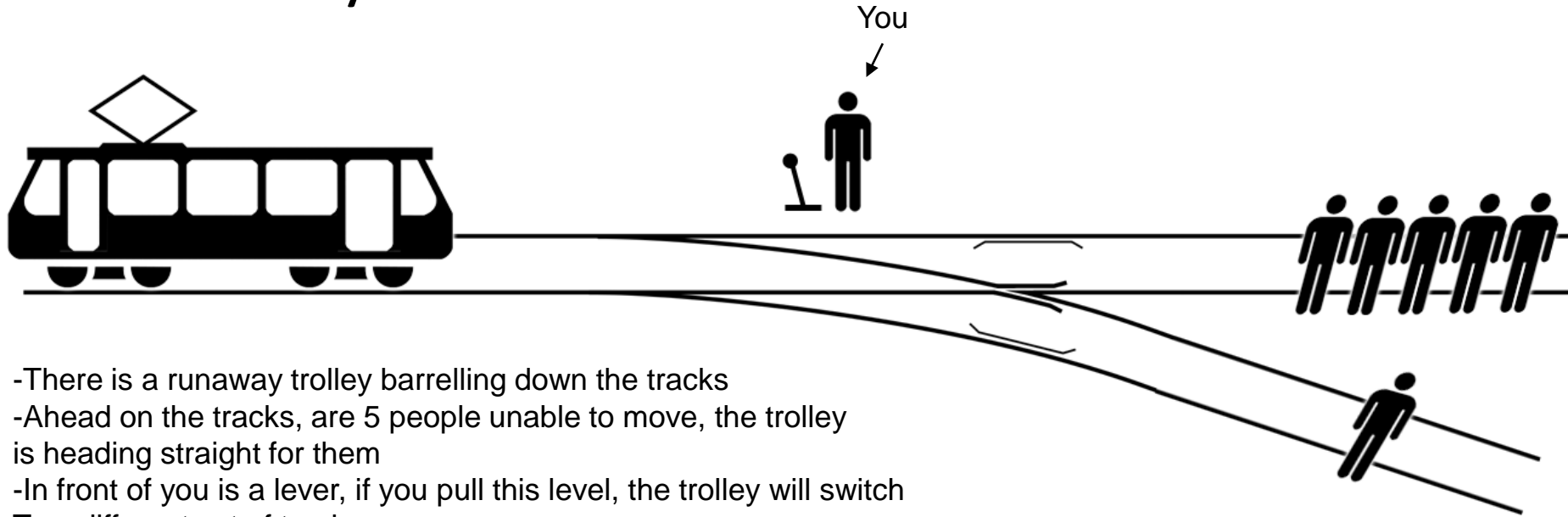
Consequentialism

- See also '[utilitarianism](#)'
- Actions are based on the *consequences* of conduct as a judgement of the rightness or wrongness of that conduct
- Driven by '*the greater good*' or the '*least harm/most happiness achieved*'
- But any method is acceptable to achieve morally important goals "*the ends justify the means*" and can lead to '*groupthink*'





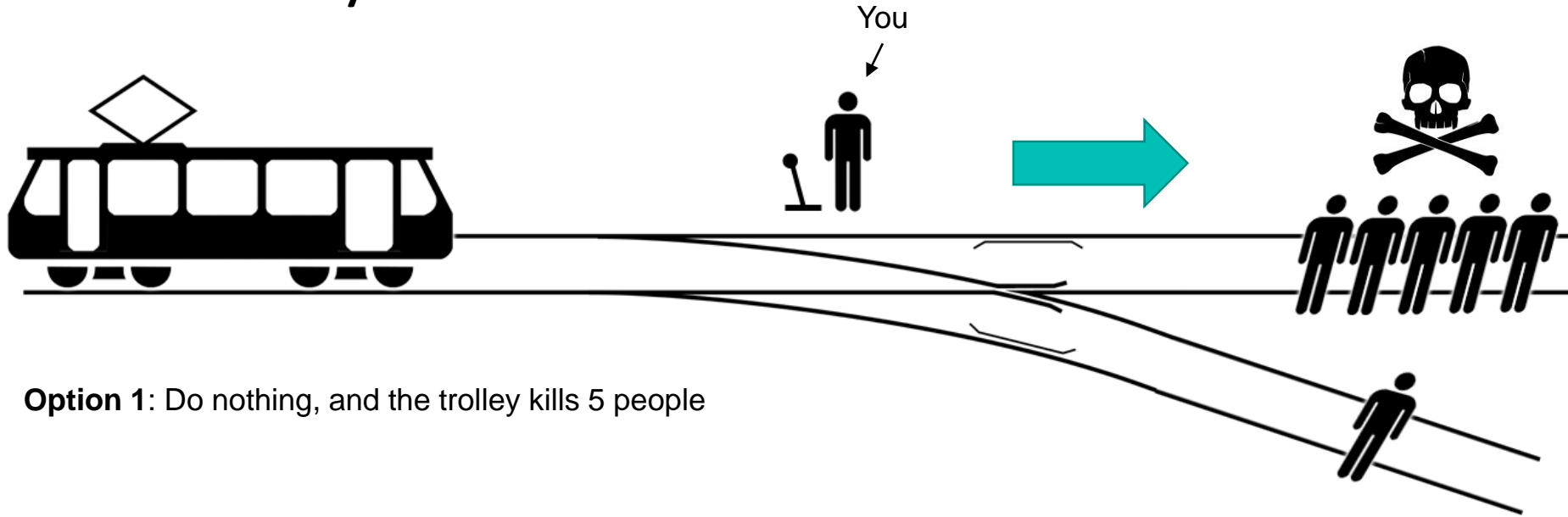
The Trolley Problem



- There is a runaway trolley barrelling down the tracks
- Ahead on the tracks, are 5 people unable to move, the trolley is heading straight for them
- In front of you is a lever, if you pull this level, the trolley will switch To a different set of tracks
- There is 1 person unable to move on this track

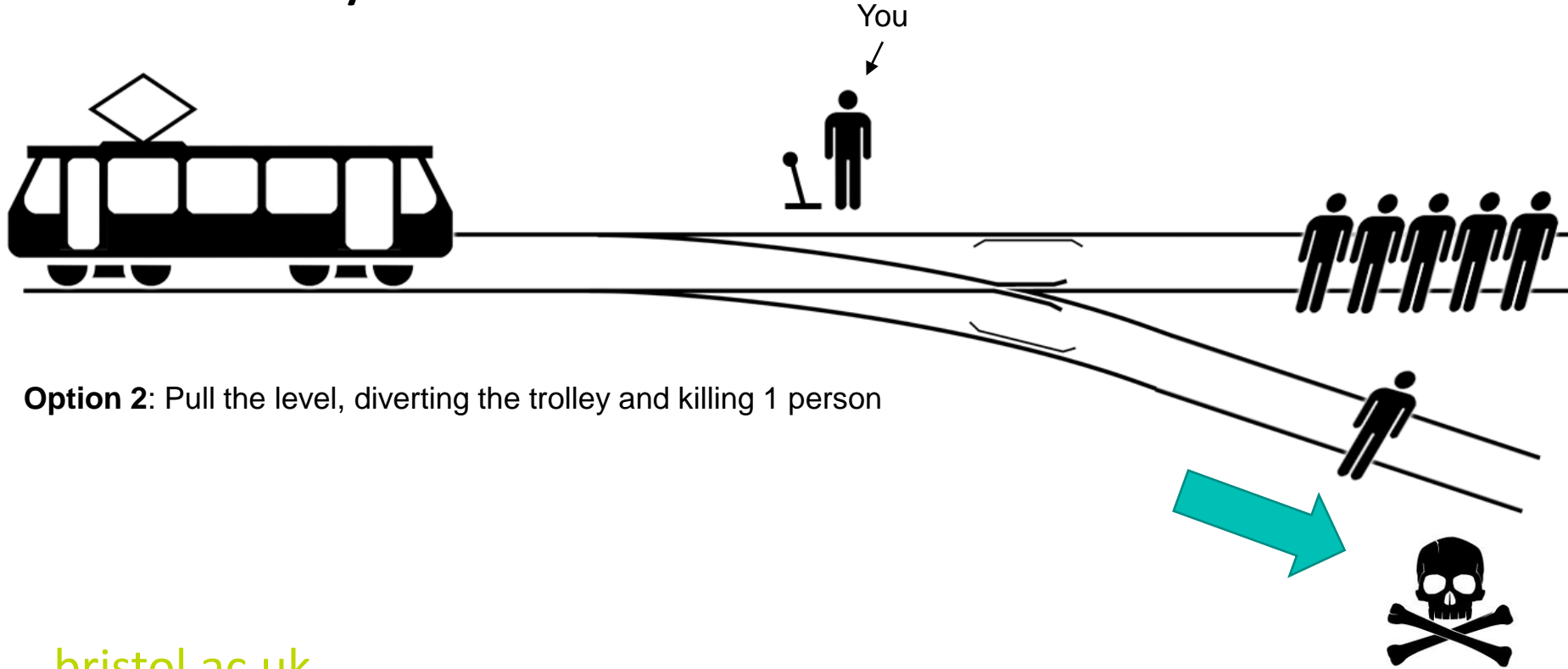
https://en.wikipedia.org/wiki/Trolley_problem

The Trolley Problem



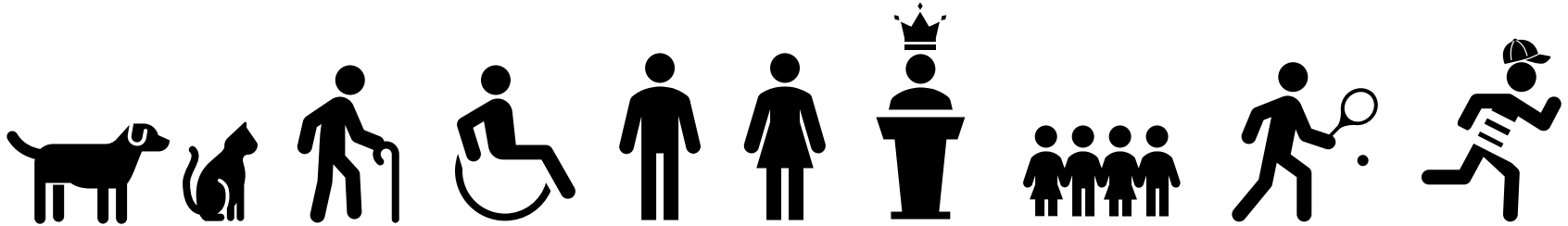
Option 1: Do nothing, and the trolley kills 5 people

The Trolley Problem



Option 2: Pull the lever, diverting the trolley and killing 1 person

The Trolley Problem



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<http://moralmachine.mit.edu/>

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Machine Ethics

- According to the Ethics Commission- Automated & Connected Driving 2017:
- If an accident cannot be avoided, human safety must take precedence over animals and property
- The software must avoid a collision altogether, but if not possible, it should take the action that does least harm to people



Engineering Ethics and Governance

- All professional engineers bound by governance and ethical codes of conduct
- Determined by engineering institutions such as the ICE, IET, RAEng and IMechE
- Lots of case studies (real and hypothetical) to help explore engineering ethics and what is the best course of action for a given situation



Engineering Ethics and Governance

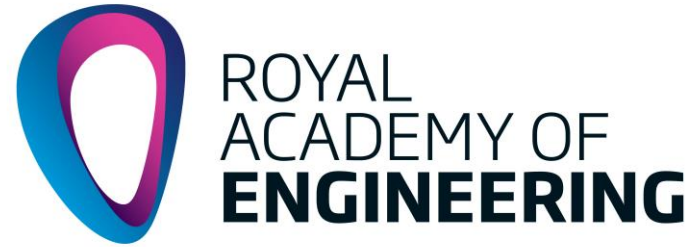
- Practice competently & maintain up to date knowledge and skills
- Act with integrity and respect for others
- Promote sustainability
- Exercise engineering leadership



<http://www.imeche.org/docs/default-source/governance-documents/coc-shortform-agreed-qmb---061216v2.pdf>

Engineering Ethics and Governance

- Honesty and Integrity
- Respect for life, law, the environment and the public good
- Accuracy and Rigour
- Leadership and Communication



<https://www.raeng.org.uk/policy/engineering-ethics/ethics>

Engineering Ethics and Governance

- Integrity
- Competence
- Fairness
- Health
- Safety and Risk
- Environmental Sustainability



<https://www.theiet.org/membership/career/ethics/rules/index.cfm>

Engineering Ethics and Governance

- Sustainability and the Environment
- Risk
- Preventing Disasters
- Structural Safety
- Whistleblowing
- Clarity of communication with clients
- Declaring an interest
- Comply with the law
- Respecting and Promoting Equality and Diversity
- Preventing Bribery and Corruption

<https://www.ice.org.uk/knowledge-and-resources/best-practice/civil-engineering-ethics-toolkit>



Engineering Ethics and Governance

- Keep knowledge & skills up to date
- Quantify risks
- Present data/evidence accurately without bias

Accuracy and
rigour

Honesty &
Integrity

- Be alert to the way your work and behaviour may affect others
- Avoid deception

- Health and safety of others is paramount
- Consider limited availability of natural/human resources
- Consider effects of environment/future generations

Respect for
Law, Life and
Public Good

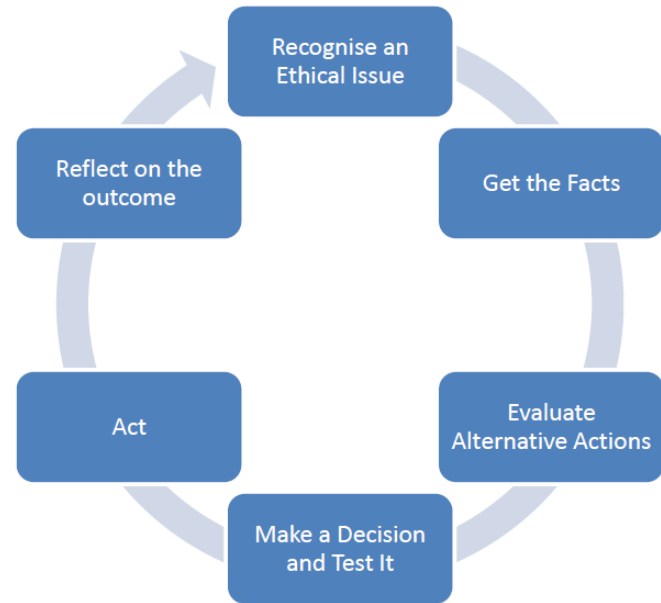
Responsible
Leadership

- Listen to the concerns of others
- Be objective and truthful in statements

Engineering Ethics and Governance

Framework for making ethical decisions

1. Recognise an ethical issue (Is there a right/wrong decision?)
2. Get the facts (Do we know enough to make a decision?)
3. Evaluate alternative actions (what are the consequences of getting it right/wrong?)
4. Make a decision and test it (consult and get feedback)
5. Act (implement and monitor results)
6. Reflect (How did it turn out? What has been learned?)



Engineering Ethics in practice “a major malfunction”

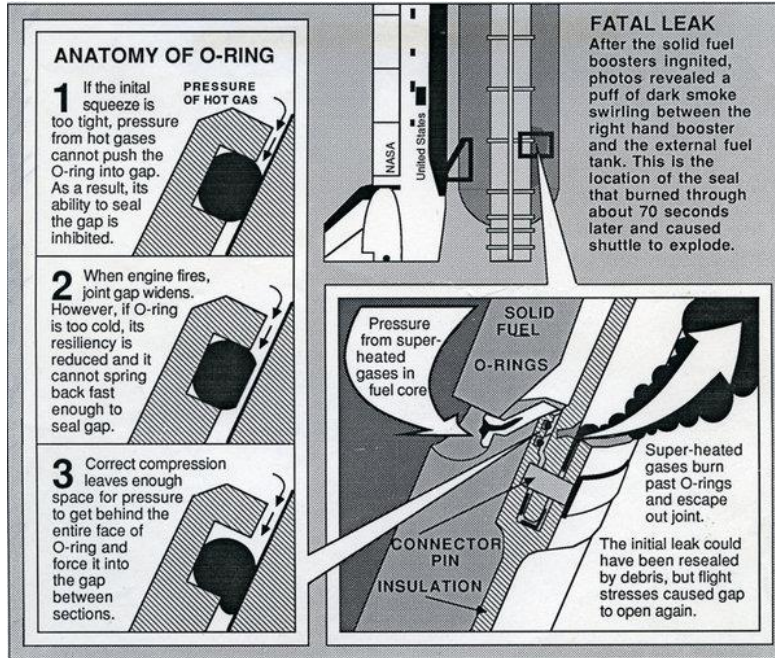


Engineering Ethics in practice “a major malfunction”

- On January 28, 1986 the Space Shuttle Challenger broke up 73 seconds after launch
- All 7 crew members were killed
- Space shuttle program grounded for 3 years
- New safety measures, solid rocket booster re-design, new policy on management decision making implemented
- Morton-Thiokol (the SBR manufacturer) paid out \$10 million in exchange for not accepting liability



Engineering Ethics in practice “a major malfunction”



Engineering Ethics in practice “a major malfunction”

- Financial pressure on NASA
- Pressure due to delays and setbacks
- Thiokol's engineers expressed concern over temperature & test data of solid booster o-rings
- Disaster largely due to organisational behaviour & utilitarian groupthink

“we all knew exactly what happened.” -
Roger Boisjoly, Thiokol whistleblower



Engineering Ethics in practice “a major malfunction”



"...Everything's ready. See you in a week's time. Watch me on TV for the takeoff!"

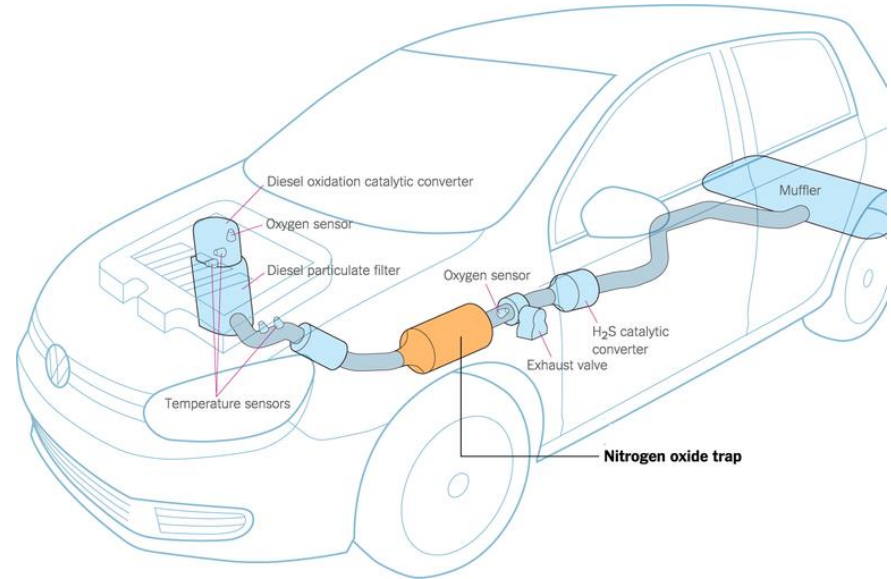
Engineering Ethics in practice “diesel-gate”

- On 20th Sept 2015, Volkswagen Group admit deceiving of emissions standards tests, after investigation by US Environmental Protection Agency
- Public and political outcry, 1000's of vehicles recalled, VW stock dropped 20% after announcement
- CEO Martin Winterkorn resigns in Sept 2015, charged with fraud in US-May 2018
- US CEO Michael Horn testifies before US congress in in Oct 2015, resigns in March 2016
- VW to pay \$billions in penalties, six VW executives are charged
- In Aug 2017, VW **engineer** James Laing is sentenced to 40 months in prison for his role in the scandal
- In June 2018, Audi CEO, Rupert Stadler is arrested in Germany-after Audi engines were discovered to be rigged in 2016.



Engineering Ethics in practice “diesel-gate”

- Accidental discovery by West Virginia University, Centre for Alternative Fuels, Engines & Emissions (CAFE)
- James Laing, the first VW employee to be sentenced, did not benefit financially from the scandal, but was too loyal & unwilling to expose the companies practices, and did not want to lose his job
- Oliver Schmit, head of development of the Volkswagen brand & engine development, faces up to 7 years in prison-he will be sentenced later this year



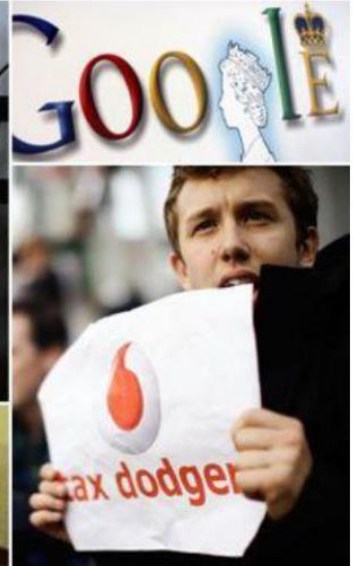
Engineering Ethics in practice “diesel-gate”

- Pressure due to US emissions standards
- Struggle to find technical solution in time frame and budget
- Scandal largely due to organisational behaviour & utilitarian groupthink
- VW crossed not only an ethical line, but a legal one too

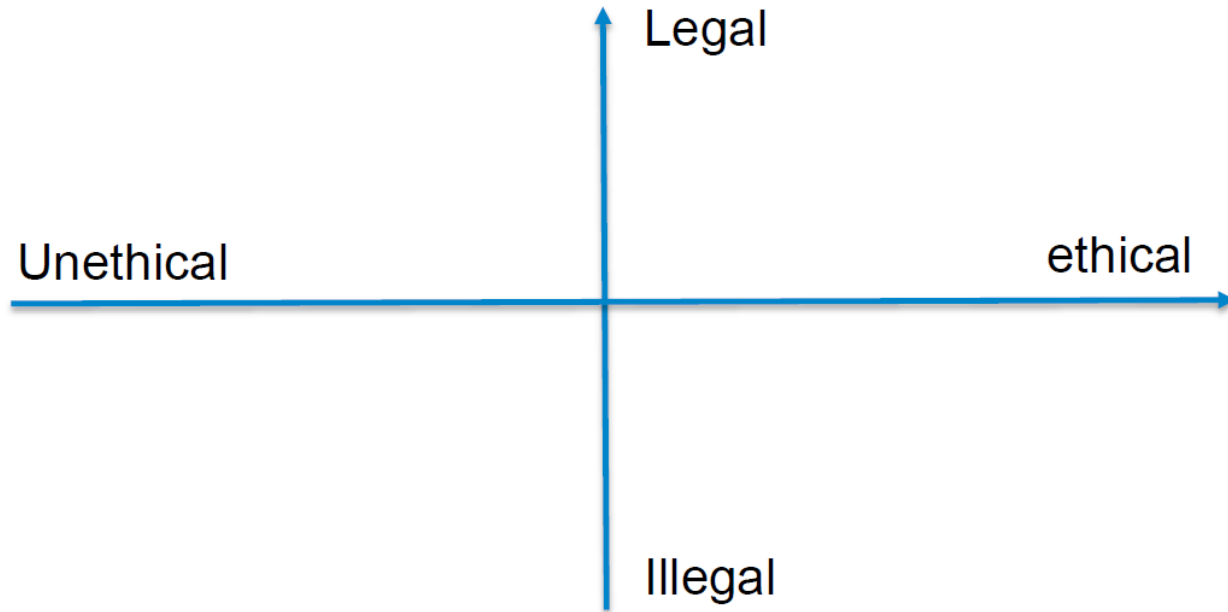
“Your cooperation and regret is noted, but it doesn’t excuse the conduct”-The judge sentencing James Laing



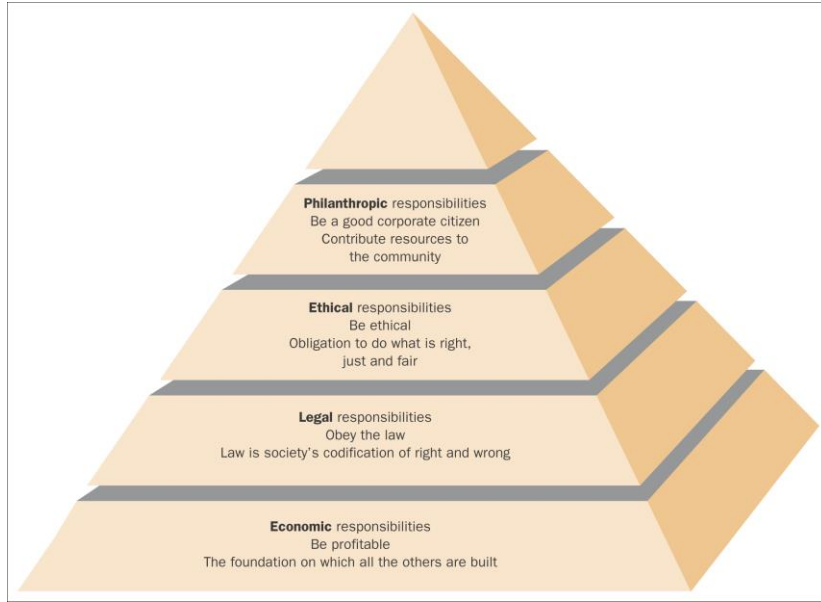
Business Ethics & Corporate Social Responsibility



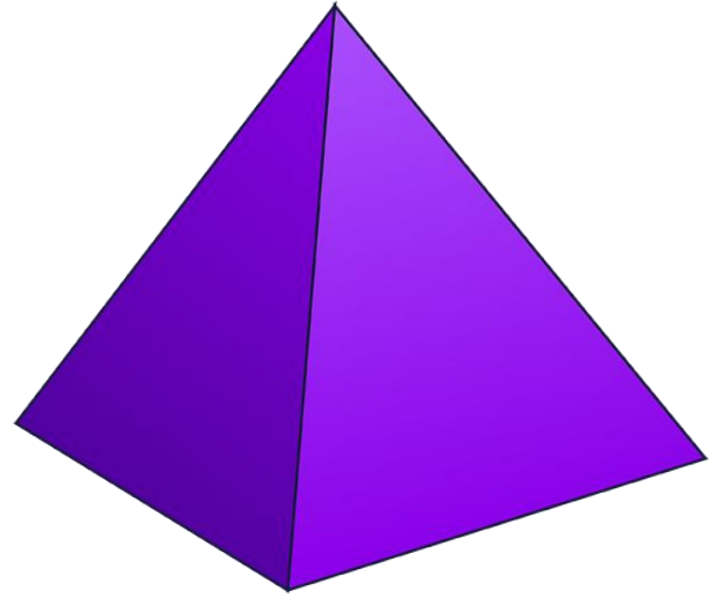
Business Ethics & Corporate Social Responsibility



Business Ethics & Corporate Social Responsibility



Carroll's CSR pyramid; Carroll (1983)



Engineers?

Any Questions?

