Engineering Ethics

Lecture 2

Objectives

- ***Moral Reasoning:***
- Moral Choices and Ethical Dilemmas;
- Steps in Resolving Ethical Dilemmas;
- Right-Wrong or Better-Worse?
- Moral Decision Making as Design;

Moral Choices and Ethical Dilemmas

- Ethical (or moral) dilemmas are situations in which moral reasons come into conflict, or in which the applications of moral values are unclear, and it is not immediately obvious what should be done.
- *Ethical dilemmas* arise in engineering, as elsewhere, because moral values are many and varied and can make competing claims. Yet, although moral dilemmas comprise the most difficult occasions for moral reasoning, they constitute a relatively small percentage of moral choices, that is, decisions involving moral values.
- The vast majority of moral choices are clear-cut, although we sometimes fail to act responsibly because of **negligence and weakness of will**.

Designing Aluminium Cans

- The first aluminium can was designed in **1958** by **Kaiser Aluminium**, in the attempt to **improve on heavier and more expensive tin cans**.
- Aluminium proved ideal as a **lightweight, flexible material** that allowed manufacturing of the bottom and sides of the can from a single sheet, leaving the top to be added after the can was filled.
- The first aluminium cans, like the tin cans before them, were opened with a **separate opener**, which required additional manufacturing costs to make them readily available to consumers.
- In **1959**, **Ermal Fraze**, in 1959, who owned Dayton Reliable Tool and Manufacturing Company and was hence familiar with metal, envisioned a design for a small lever that was attached to the can but which was removed as the can opened.
- The **idea proved workable and was quickly embraced** by manufacturers. Gradual improvements were made over subsequent years to ensure easy opening and prevention of lip and nose injuries from the jagged edges of the opening.
- Within a decade an unanticipated crisis arose, however, creating an **ethical dilemma**. Fraze had not thought through the implications of billions of discarded pull tabs causing pollution, foot injuries, and harm to fish and infants who ingested them.
- The dilemma was **what to do to balance usefulness to consumers with protection of the environment**.
- In **1976 Daniel F. Cudzik** invented a simple, stay-attached opener of the sort familiar today.

Steps in Resolving Ethical Dilemmas

1. **Moral clarity:** Identify the relevant moral values.
2. **Conceptual clarity:** Be clear about key concepts.
3. **Informed about the facts:** Obtain relevant information.
4. **Informed about the options:** Consider all (realistic) options.
5. **Well-reasoned:** Make a reasonable decision. Arrive at a *carefully reasoned judgment* by weighing all the relevant moral reasons and facts.

Moral Decision Making as Design

- **John Dewey** (1859–1952) used engineering as a metaphor for thinking about moral reasoning in general.
- **Caroline Whitbeck** suggests that engineering design is in many respects a model for "*designing*" courses of action in many moral situations, in engineering and elsewhere.
- Whitbeck identifies five aspects of engineering decisions that highlight important aspects of many moral decisions in general.

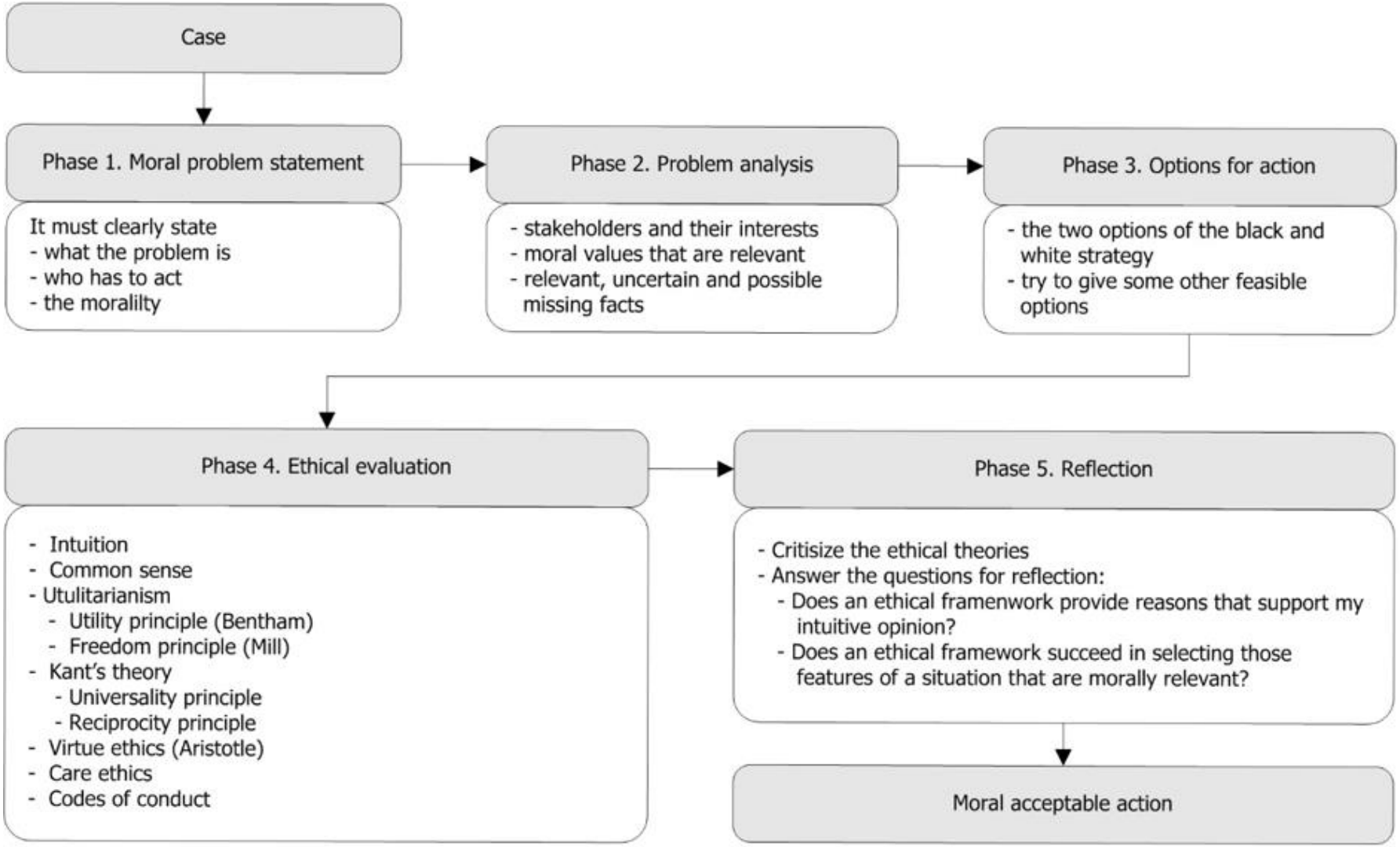
Moral Decision Making as Design

- **First**, usually there are alternative solutions to design problems, more than one of which is satisfactory or "satisfices."
- **Second**, multiple moral factors are involved, and among the satisfactory solutions for design problems, one solution is typically better in some respects and less satisfactory in other respects when compared with alternative solutions. No design is ideal in every regard, and each had strengths and weaknesses.
- **Third**, some design solutions are clearly unacceptable. In general, there are many "*background constraints*," for example justice and decency, which limit the range of reasonable moral options.
- **Fourth**, engineering design often involves uncertainties and ambiguities, not only about what is possible and how to achieve it, but also about the specific problems that will arise as solutions are developed.
- **Finally**, design problems are dynamic. In the real world the design of any engineering problem would go through much iteration, as feedback was received from testing and application.

Resolving Moral Dilemmas

1. Moral clarity
   - Need to know something is wrong! *Do not ignore problems!*
   - Loyalty to employer, responsibilities to public and environment (and complex relations between these)
2. Know the facts
   - Get hard, documented facts, discuss with others
   - Competence matters in gathering technical facts
3. Consider options
   - Diversity of actions to take? Evaluate/discuss.
   - Long-term, short-term perspectives, repercussions?
   - "Creative middle solution"?
4. Make a reasonable decision
   - Weigh all factors, recognize "gray areas"/compromises
   - An engineering design problem?

Ethical Cycle



Resolving Moral Dilemmas: Case Study

Engineer **A** is employed by a software company and is involved in the design of specialized software in connection with the operations of facilities affecting the public health and safety (i.e., nuclear, air quality control, water quality control). As part of the design of a particular software system, Engineer **A** conducts extensive testing, and although the tests demonstrate that the software is safe to use under existing standards, Engineer **A** is aware of new draft standards that are about to be released by a standard setting organization—standards which the newly designed software may not meet. Testing is extremely costly and the company's clients are eager to begin to move forward. The software company is eager to satisfy its clients, protect the software company's finances, and protect existing jobs; but at the same time, the management of the software company wants to be sure that the software is safe to use. A series of tests proposed by Engineer **A** will likely result in a decision whether to move forward with the use of the software. The tests are costly and will delay the use of the software at least six months, which will put the company at a competitive disadvantage and cost the company a significant amount of money. Also, delaying implementation will mean the state public service commission utility rates will rise significantly during this time. The company requests Engineer A's recommendation concerning the need for additional software testing.

Analyzing the Case

- Moral clarity:
  - What is wrong? What is the core issue/ question?
  - Will the software meet the new standards?
  - Why are there new standards?
    - Experience shows new failure modes
    - New tests designed to test new failure modes
  - Engineer's role in new standards?
    - Development of new standards
    - Following new standards

Analyzing the Case

- Know the facts
  - It is critical software (health/safety of public)
  - New standards to test new failure modes (that you need to understand)
  - Testing is costly, company finances at stake
  - Need to protect existing jobs
  - Testing will delay release by > 6 months
  - Testing will hurt competitive advantage?
  - Utility rates will rise

Analyzing the Case

- Consider options
  - Option 1: Ignore the new tests, take risk to public safety/welfare, save time/money
  - Option 2: Conduct the tests, risk jobs, hurt finances, become certain software will work, protect safety/welfare of the public
  - Option 3: Creative middle of the road solution: Is there are limited version of full tests that could be conducted that would partially test, but save some money/time?

Analyzing the Case

- Make a reasonable decision
  - Pick Option 2 since safety/health/welfare of the public is paramount
  - If company says no, pick Option 3 and try to do a limited test for the failure mode (your competence in coming up with an economical test is critical here). In this option, all constraints considered, you *try* to protect the safety, health, and welfare of the public

Resolving moral dilemmas: Line Drawing

- Harris et al. idea to try to make solving moral dilemmas more analytical/ quantitative
- Given moral dilemma
  - Establish key features, issues
  - Establish extremes of features/issues and paradigms (indicating totally ethical vs. clearly unethical aspects)
  - Construct a line drawing (see below)
  - Evaluate "test case" (your current moral dilemma)

Line Drawing: Case Study

Victor is an engineer in a large construction firm. He has been assigned the task of being the sole person to recommend rivets for the construction of a large apartment building. After some research and testing, he decides to recommend ACME rivets for the job, which he determines are of the lowest cost and highest quality. On the day after Victor's decision was made, an ACME representative visits him and gives him a voucher for an all-expense-paid trip to the annual ACME Technical Forum, which meets in Jamaica. The trip will have considerable educational value, but will also provide day trips to the beach and other points of interest. Question: If Victor accepts, has he been bribed?

Line Drawing: Case Study

Feature	Paradigm (bribery)	Test case	Paradigm (not bribery)
Gift size	Large	---X----------	Small (<$1)
Timing	Before decision	----------X-----	After decision
Reason	Personal gain	----------X--------	Educational
Responsibility	Sole	--X----------	None
Product quality	Worst	----------X----	Best
Product cost	Highest	---X----------	Lowest

X – test case feature evaluation, X important issue
Do you see a "creative middle solution"?
What about affect on future decisions on ACME?
What is company policy? Is there an *appearance* of bribery?
May not be a bribe, but still may not be a good idea!

Line Drawing: Case Study

Although Victor's acceptance of the voucher might not constitute a paradigm instance of a bribery, the table suggests that it comes close enough to the paradigmatic case to raise a real worry. In looking at the various features, it is important to bear in mind just what is worrisome about bribery. Basically, bribery offers incentives to persuade someone to violate his or her responsibilities—in this case, Victor's responsibility to exercise good judgment in behalf of his company. Here, the worry is more about future decisions he might make rather than the one he has already made, but it is a real worry nevertheless. In any case, assessing the bribe requires more than determining where on the scale the various factors fall. The importance of each factor in particular cases must be weighted. Those two or three features that are judged most important in a particular case can be identified. (For example, in this table, the X's for gift size, timing, and responsibility might be highlighted.)