Engineering Ethics Modules for Ethics Across the Curriculum

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C O N N E X I O N S

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Chapter 1

Introduction to Ethics in Engineering

1.1 Ethical Implications for Engineering - Student Module[1]

ENGINEERING ETHICS LINKS: Several links have been provided to give access to up to date information on different aspects of engineering ethics. These links are described below.

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    - Online Ethics is an excellent resource for cases and essays in engineering ethics.
It also provides links to other sites such as the Center for Engineering Ethics and Society,
a branch of the National Academy of Engineering.

- Computing Cases highlights three large case studies in computer and engineering ethics:
Therac-25, Hughes Aircraft, and Machado.  Clicking on the link provided above provides access
to the IEEE material on organizational and professional dissent.

- The National Institute of Engineering Ethics website can be access through the final
link.  It provides study materials on the videos Incident at Morales and Gilbane Gold.
It also contains the ethics cases developed by the National Society for Professional
Engineer's Board of Ethical Review.  Here, the BER publishes its decisions on cases
brought to it by members as a means of interpreting and clarifying the NSPE code of ethics.

- Other materials on engineering ethics can be accessed through these three links
mentioned above.
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Ethics for Engineering Presentation

This media object is a downloadable file. Please view or download it at
<EthicsforEngineeringICOMCapstone-1.pdf>

Figure 1.1: Clicking on this media file opens the presentation of this module given in March 2008 at the University of Puerto Rico at Mayaguez

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[1] This content is available online at <http://cnx.org/content/m17226/1.7/>.

1.1.1 Introduction

This module expands upon a presentation given to capstone classes in engineering at the University of Puerto Rico at Mayaguez. Designed by Luis Jimenez to provide students with an introduction to ethical approaches in the context of engineering, it has expanded to cover practical skills in problem solving and the professional context of engineering in Puerto Rico. For those interested in ABET accreditation and reaccreditation, it touches on the themes of (1) professional and ethical responsibility, (2) integrating ethics into design projects, and (3) generating awareness of the social and global impacts of engineering. Students and faculty consulting this module will find the capstone course presentation, background information pertinent to engineering ethics in Puerto Rico, and exercises that help students develop an active and practical understanding of how ethics fits into engineering practice.

1.1.2 What you need to know ...

1.1.2.1 Ethical Theories and Encapsulating Tests

Engineering ethics works with different ethical theories. This section will provide a brief outline of three: Deontology, Utilitarianism, and virtue ethics. At the bottom of this page, you will find a media file that presents in tabular form the concepts that underlie these three ethical approaches.

Deontological Ethical Theories.

- The word "deontology" comes from two Greek words, "deon (duty) and "logos" (account of or study of). Literally, then, deontology is the ethical theory that provides an account of duty. Deontology has different versions based on the different possible foundations for duty, including moral autonomy (Kant), a hypothetical social contract (Hobbes, Locke, Rawls), or natural law.
- Deontology differs from consequentialism. For consequentialism, the moral value of an action lies in its results or consequences. Deontology evaluates actions independently of their consequences; it places the moral value of an action on its formal characteristics. These include universalizability, reversibility, and autonomy.
- **Universalizability**: Actions that take on the form of duty are universalizable. Because they apply equally to all people at all times, they do not allow individuals to make themselves exceptions to the universal rule. Kant provides different tests to determine if an action exhibits the formal characteristics of duty. If the rule expressed by the action (its 'maxim') can be converted into a universal law without defeating itself, then it is a rule of moral duty. Truth telling expresses a rule that can be universalized. Telling lies does not. (Imagine a possible world in which everybody lied. If telling lies were universalized, then communication would become impossible. When universalized, the rule of telling lies is self-defeating.)
- **Reversibility**: Moral actions are also reversible. Here, duty functions more or less according to the Golden Rule. You treat others as you would have them treat you. The action, acceptable from the agent's perspective (the perspective of the doer), is also acceptable when viewed from the receiving end (the perspective of those under its impact).
- **Respect for Autonomy**: Rules of duty recognize and respect autonomy both in those suffering the impact of the action and in the agent. Kant expresses this last point in his formula of the end: Treat humanity (yourself included) always as ends and never merely as means. Treating individuals as ends implies recognizing that they, like you, have the capacity for autonomy, that is, they can formulate life plans and then organize and discipline themselves to carry them out; treating others as ends entails recognizing and respecting this autonomy. Treating someone merely as a means involves actions that circumvent autonomy through force, deception, manipulation, or fraud. Treating someone as a means (distinguished from treating them **merely** as a means), for example, hiring an individual to work for you as an employee, is morally permissible provided the relation is formed freely and knowingly.

Categorical Imperative or Self-Defeating Test

Step One	Formulate your maxim	I can tell a lie to escape a difficulty
Step Two	Universalize your maxim	Everyone can tell a lie to escape a difficulty.
Step Three	Ask the question: **Is the universalized maxim self-defeating**	What if everyone told a lie when they were in a difficulty? To escape from the difficulty, the lie would have to be believable. But nobody would believe a lie in a world where telling lies was the universal law.

Table 1.1

Self-Defeating test applied to copying an exam

- Consider another example.
- Suppose you are tempted to copy the answers for your exam from your neighbor's paper.
- **What is the maxim?**
- **Universalize the maxim.**
- **Is it self-defeating when universalized?**
- **Hint:** Think of the world in which copying is universalized as a room where everybody sits at desks arranged in a circle. You copy from your neighbor, your neighbor from her neighbor, and so on. Now, given this arrangement, is it is self-defeating?

These basic tenants of Deontology make it possible to understand basic rights and duties as measures taken to recognize and respect autonomy.

1. Definition: A **right** is an essential capacity of action that others are obliged to recognize and respect. "Essential" here is understood as necessary for the exercise of autonomy.
2. A right claim is legitimate if it protects a capacity of action that is **(a) essential** to autonomy, **(b) vulnerable** to a standard threat, and that (c) it's recognition and respect does not deprive others of something essential (**feasible**).
3. A **duty** is a principle or rule that obliges individuals to recognize and respect one another's rights.
4. Duties sort themselves out into three levels: (a) the most basic duties are those not to deprive others of their rights; (b) intermediate duties create obligations to prevent right deprivations; (c) the highest duty level lies in the obligation (most often social rather than individual) to aid those who have been deprived of their rights.
5. Rights and duties are **correlative**. This means that my rights impose on others the correlative duties to recognize and respect them. And I have correlative duties to recognize and respect the rights of others. The extent of the correlative duties we impose on ourselves and others is limited by feasibility; your rights claims over me do not extend to the point where they deprive me of something essential.

The following rights claims have been asserted by engineers against the business organizations for which they work. (These claims quoted directly from Bill Baker, Engineering Ethics: An Overview. Claims form a "Bill of Rights" set forth by Murray A. Muspratt of Chisholm Institute of Technology, Victoria, Australia (American society of Civil Engineers' Journal of Professional Issues in Engineering, October 1985)

1. "The right to act in according to ethical conscience and to decline assignments where a variance of moral opinion exists.
2. The right to express professional judgment, and to make public pronouncements that are consistent with corporate constraints on proprietary information.

3. The right to corporate loyalty and freedom from being made a scapegoat for natural catastrophes, administrative ineptitude or other forces beyond the engineer's control.
4. The right to seek self-improvement by further education and involvement in professional associations.
5. The right to participate in political party activities outside of working hours.
6. The right to apply for superior positions with other companies without being blacklisted.
7. The right to due process and freedom from arbitrary penalties or dismissal.
8. The right to appeal for ethical review by a professional association, ombudsman or independent arbitrator.

Consequentialism and Utilitarianism

- In consequentialism, the moral value of an action lies in the consequences or results it produces.
- The range of consequences that factor into a moral evaluation determines the form of consequentialism. If one seeks only to maximize good for oneself, then one is an **egoist**. **Utilitarians**, on the other hand, try to maximize the good for all of those who are affected by the action.
- Utilitarianism is based on a **principle of utility**: Choose that action or policy that maximizes utility, that is, brings about the **greatest good for the greatest number**.
- Utility is maximized by producing the greatest quantity of good things in conjunction with the smallest quantity of bad things. So **hedonists** seek to maximize pleasure and minimize pain. Other utilitarians seek to maximize things of **intrinsic value** (happiness, truth, beauty, friendship, knowledge) while minimizing things of negative value. **Individual preference utilitarians** seek to produce conditions where the maximum number of people can satisfy their preferences while minimizing conditions that frustrate the satisfaction of these individual preferences.
- A utilitarian-based decision requires going through several steps: (1) Determine the likely results of your action; (2)Determine the magnitude and range of these results by looking at how severe the impact are and how many people would be affected; (3) Sort these results into positive (goods/values/preferences/benefits) and negative (bads/lack of value/frustrated preferences/harms) categories; (4) Do this for all the available alternatives; (5)Determine which maximizes positives and minimizes negatives, i.e., determine which is utility maximizing.

Utilitarianism and Decision Making

1. **Determine the likely results of your action.**
2. Estimate the magnitude and range of these results. **Magnitude** is the severity of the impact. Does it lead to catastrophic harms? Uncertain but potentially great benefits? Are the impacts negligible in terms of their severity? **Range** focuses on the numbers of groups and individuals who feel the action's impacts. Are the impacts distributed over many people and groups or just a few? Considering the range and magnitude helps to identify the most important consequences and to set aside those least important.
3. Sort out the likely results with significant magnitudes and ranges into positive and negative categories. Positive consequences includes goods, values, preferences, and benefits. They also extended to rights protected or promoted. Negative consequences include bads, disvalues, frustrated preferences, and harms.
4. Repeat steps one through three for several courses of action. Come up with a rough calculation of positive and negative results factoring in the magnitude and range of these.
5. Determine which solution maximizes positive results and minimizes negative results. This will give you the utility-maximizing solution

Calculating Utility Using Markets (Based on Sagoff (1986)

- Your neighborhood has a vacant lot. After several years of disuse, different local special interest groups contend over how it should be used.

- A nation-wide department store chain wants to build a large store on this lot. The store would be surrounded by a parking lot. This would provide you and your neighbors with cheap goods. It would provide employment but would also seriously undermine some of the more traditional stores in your area.
- A local environmental group has petitioned the state to set aside this area as a nature preserve or park. It could serve as a buffer that would help contain pollution from the city. It would also provide recreation opportunities for you and your neighbors.
- Preference utilitarianism would create hypothetical markets to measure the value of these different use options. The utility maximizing solution would turn the land over to the most highly valued use.
- **Willingness to pay**: One way to find out how intensely you and your neighbors value turning the land over to recreation and park use would be to survey you all on whether and by how much would you be willing to have your taxes raised to buy this land and set it aside for park recreation use. If this willingness to pay higher taxes expressed by you and your neighbors exceeds the price the department store chain is willing to pay, then this would indicate that your preferences are more intense and utility would be maximized by satisfying them.
- But many object to the use of willingness to pay as a measure of preference intensity. Willingness to pay, they claim, is limited by ability to pay and while the national store chain may prefer it less, they may have more disposable income. A better measure of how the community values this land and the uses it may be put to, is to assume they own it and then ask how much they would be willing to accept from those who want to purchase it and use it to build a department store. **Willingness to sell** is less dependent on disposable income and therefore a better measure of how a commodity or utility is valued.
- Which measure do you think best records utility, willingness to pay or willingness to sell? Why?
- Could hypothetical markets be used to determine how much you value keeping your personal information private? Can we convert privacy to intellectual property and then calculate its value in terms of willingness to pay or willingness to sell? Or is privacy a distinct right whose value is intrinsic and cannot be subjected to actual or hypothetical markets?

Are you a Deontologist or a Utilitarian?

- Would you walk away from Omelas?
- Ursula LeGuin wrote a fascinating short story entitled, “The Ones Who Walked Away from Omelas.” It describes a city in which almost everything is perfect. Almost all the inhabitants are happy and prosperous. Everything seems perfect until the visitor to the city discovers that all the happiness and prosperity of the city are purchased by inflicting unimaginable suffering on one innocent young girl. She is kept alone in a dark room, denied kindness and human interaction, and forced to live in appalling material conditions. At the end of her story, LeGuin poses for us a choice: Would you choose to live in a city where the happiness of the many (including you) is purchased by channeling all unhappiness onto one unfortunate innocent victim?
- **Would a Deontologist walk away from Omelas? Why or why not?**
- **Would a Utilitarian walk away from Omelas? Why or why not?**

Virtue Ethics

- Virtue ethics differs from deontology and consequentialism.
- First, rather than focusing on the action it focuses on the agent. The action eminates from the character of the agent; hence, evaluate the action in terms of what it says about the agent.
- Second, it raises the bar in moral analysis. Instead of focusing on harm minimalization or on the moral minimum, virtue ethics is really about moral excellence. Virtue translates the Greek word, "arete" which can also be translated by excellence. Thus, virtues are excellences and moral virtues are moral excellences.
- Finally, virtues point, not just to the individual, but to the community. They represent habits of action performed by individuals that bring about the goods that sustain the social surroundings. Professional virtues are patterns of action performed by professionals that keep the profession healthy and vibrant.

Aristotle's definitions of Virtue or Arete

- "a state of character concerned with choice, lying in a mean, i.e., the mean relative to us, this being determikned by a rational principle and by that principle by which [a person] of practical wisdom would determine it." (Ross's translation in Nicomachean Ethics, 1106b, 36.
- Virtues are excellences of character. Aristotle finds them in the mean lying betweentwo extremes which are termed "vices." Invices of excess, we have too much of a good thing. So recklessness is too much courage. In vices of defect, we have too little of a good thing. So cowardice is the vice of too little courage.
- Cardinal Virtues: temperance, courage, wisdom, and justice. The last represents the ordering of temperance and courage under wisdom and insight into the nature of good.

MacIntyre's definition of virtue (MacIntyre 2007)

- "A virtue is an acquired human quality the possession and exercise of which tends to enable us to achieve those goods which are internal to practices and the lack of which effectively prevents us from achieving any such goods.
- Goods internal to engineering would include such things as (1) the health, safety, and welfare of the public which is served by the virtue of holding this good paramount in engineering design, (2) remaining loyal to the legitimate interests of the client which is displayed by the virtue of avoiding conflicts of interest, keeping client concerns confidential and exercising due care in engineering design, (3) upholding the honor and integrity of the profession which is upheld in displaying excellences in expert witnessing, superising the preparation of engineering plans, and upholding and advancing standards of excellent engineering practice, and (4) collegiality which is advanced through the excellence of treating peers respectfully, giving them credit, and working with them to advance engineering knowledge and practice.

Responsibility as a Virtue (Fingarette 1974)

- Herbert Fingarette, in **Criminal Insanity**, characterizes reponsibility as "responsiveness to essential relevance." (186) This implies, through perceptual, intellectual, and emotional sensitivities, the ability to recognize and respond appropriately to the (morally) relevant personal, moral, legal, and physical aspects of the situation. For example, engineers have the knowledge and skill to recognize threat to safety in situations that the rest of us might overlook. Thus, the civil engineer could spot weaknessness in a bridge that could lead to its collapse and would then be able to recommend fixes for this weakness based on engineering skill and knowledge.
- Part of this responding is the ability to attribute an action to an agent for the purpose of praising or blaming. We can praise or blame an individual for an action if that individual satisfy (1) an identity/causal condition in the sense that the agent caused the action and the agent's identity persists over time, (2) an agent has moral sense, that is, has general moral capabilitite that allow for the perception of moral relevance, and (3) that the agent owns the action in the sense that the action stems from situational knowledge and was not forced, manipulated, or compelled. This is a reactive sense of responsibility that focuses on the past.
- In responsibility as a virtue, we (1) diffuse blame avoidance strategies, (2) design role responsibilities that overlap, (3) extend the scope of depth of knowledge, (4) extend our powers and control in a situation, and (5) adopt a proactive, problem solving preventive approach.

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1.1.2.2 An Outline of Engineering Codes of Ethics

The relation between engineering as a profession and society can be understood as a **hypothetical** social contract. The contract is hypothetical because no actual agreement has taken place; representatives from

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engineering and society never sat down and negotiated terms of a social contract. Yet the relation that has naturally evolved between engineering and society can be summarized as a social contract where each party gives something beneficial to the other. Contracts, in general, are mutually beneficial exchanges; to be legitimate these agreements must be entered into knowingly and voluntarily. These two requirements form the basis of much of engineering ethics, especially the different codes set forth by different engineering professional societies. Engineers provide products and services that benefit clients and society. But these also entail risks that, while they cannot be eliminated, can be minimized. Engineers are duty-bound to minimize these risks and inform the client and public about the nature of these risks. They are also required to participate in the social, collective decision as to the acceptability of these risks by communicating technical engineering matters in a clear and accessible manner. The first table below summarizes the exchange between society and the profession of engineering that forms the basis of this social contract.

Engineering's Contract with Society

Society to Profession	**Profession to Society**
Autonomy (Society allows experts to regulate themseives)	Self-Regulation (Experts regulate themselves toward public welfare)
Prestige (Society gives engineers prestige and adequate compensation for services)	(Engineers promise to hold public welfare paramount in engineering practice)
Monopoly (Society allows profession to determine those allowed to practice)	Engineers promise to practice ethically and, through codes, to establish and enforce high practical and disciplinary standards)

Table 1.2

Working from this social contract, engineering has formulated various rules, principles, and duties that have been embodied in different codes of ethics such as that of the ECPD (Engineering Council for Professional Development), the NSPE (National Society of Professional Engineers), the ASME (American Society of Mechanical Engineers), the ASCE (American Society of Civil Engineers), and the CIAPR (Colegio de Ingenieros y Agrimensores de Puerto Rico). These codes can usefully be interpreted as stakeholder codes where different engineering stakeholders have been identified along with their needs and correlative engineering duties based on recognizing and respecting these needs. (An engineering stakeholder is any group or individual dependent on the activities of engineers. Their "stakes" consist of the needs and interests they have riding on the outcome of engineeirng decisions and actions.) The following table identifies four key engineering stakeholders, their interests and engineering duties based on preserving or promoting these stakes.

Outlines of Engineering Stakeholder Codes of Ethics

Engineering Stakeholder>	**>Stake, Need, or Interest>**	**>Engineering Duty>**
Public	Wellbeing, health, safety, environmental integrity	Duty to hold paramount the health, safety, welfare, and environment of the public
		continued on next page

Client	Due to knowledge gap, the need to have engineers treat their interests as their (engineer's) own	Exercising due care in professional judgment avoiding conflicts of interests and maintaining confidentiality
Profession	Reputation, honor, and dignity	Engineers have duty to uphold the reputation, honor, and dignity of the profession in activities like testifying in court as expert witnesses
Colleges/Peers (other engineers)	Collegial, cooperative relations with peers	Engineers must treat their colleagues with respect including avoiding disloyal competition, public criticism, and comparative advertising.

Table 1.3

1.1.3 What you will do ...

1.1.3.1 Exercise One: The Socio-Technical System for Engineering in Puerto Rico

Go to the next module in this course, "Socio-technical Systems in Professional Decision Making, m14025/latest. Study the text boxes on socio-technical systems and then construct a STS table on your branck of engineering in the Puerto Rican context. Use the sample STS Tables in the module to get you started but be sure to contextualize and specify your STS analysis.

1.1.3.2 Exercise Two: Preparing a Solution Evaluation Matrix

To carry out this exercise, go to the module in this course entitled, "Three Frameworks for Ethical Decisikon Making and Good Computing Reports," m13757. This module outlines three ethics tests to help generate, evaluate, and compare solution alternatives for ethical problems. It also proposes a Solution Evaluation Matrix to help you integrate ethical considerations into the decision making process. Finally, carry out the decision making exercise at the end of the module by working through the short problem scenario.

1.1.3.3 Exercise Three: Problem Solving and the Incident at Morales

Go to the module on Incident at Morales. Enact the public hearning with your teacher and classmates. Concentrate on approaching responsibility in its proactive sense by going beyond blame, working collectively to prevent future disasters (learn from the past), and look for ways of turning this unfortunate incident into an opportunity to realize value and achieve excellence.

1.1.3.4 Exercise Four: Working With the Code of Ethics

Write a code of ethics for engineers in your particular branch. First, identify the key stakeholders to engineering practice. Then identify their vulnerable needs. Finally, base your code of activities that engineers can perform to consistently maintain and enhance these stakeholder needs and interests.

1.1.4 What did you learn?

This section provides closure to the module for students. It may consist of a formal conclusion that summarizes the module and outlines its learning objectives. It could provide questions to help students debrief and reflect on what they have learned. Assessment forms (e.g., the "Muddiest Point" Form) could be used

to evaluate the quality of the learning experience. In short, this section specifies the strategy for bringing the module to a close.

1.1.5 Appendix

ABET 3f Ten Years Later
[Media Object][3]
Jeopardy for Engineering Ethics
[Media Object][4]
Engineering Ethics Across the Curriculum: Module 1
[Media Object][5]

1.1.5.1 Bibliography

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3. Mitcham, C. and Garcia de la Huerta, M. (2001) **La Etica En La Profesion de Ingeniero: Ingenieria y Ciudadania**. Santiago, Chile: EDEH. Universidad de Chile.

Insert paragraph text here.

This optional section contains additional or supplementary information related to this module. It could include: assessment, background such as supporting ethical theories and frameworks, technical information, discipline specific information, and references or links.

1.1.6 EAC ToolKit Project

1.1.6.1 This module is a WORK-IN-PROGRESS; the author(s) may update the content as needed. Others are welcome to use this module or create a new derived module. You can COLLABORATE to improve this module by providing suggestions and/or feedback on your experiences with this module.

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1.1.6.2 Funded by the National Science Foundation: "Collaborative Development of Ethics Across the Curriculum Resources and Sharing of Best Practices," NSF-SES-0551779

1.2 Values-Based Decision-Making in Gilbane Gold[7]

1.2.1 I. Module Introduction

The Federal Sentencing Guidelines introduced in the early 1990's have transformed the way businesses respond to ethics. Formerly, corporations relied on compliance measures which became activated only after wrongdoing occurred. Violations occurred and compliance responses consisted of identifying and punishing those responsible. But the Federal Sentencing Guidelines push corporations toward a much more proactive stance; if a corporation is found guilty of law violation, its punishment is determined by the measures the corporation has already implemented to prevent the crime as well as the measures the corporation develops in response to the crime to mitigate it and prevent future reoccurrences. Working to prevent crime, accepting responsibility for crimes that could not be prevented, and learning from past mistakes all serve to "flag" corporate intention. In other words, corporations can demonstrate good intentions by documenting measures implemented to prevent crime and by showing a "responsive adjustment" to crimes they could not prevent.

It is in this new corporate context that corporations have begun to adopt values-based decision making. Instead of setting forth rules that outline minimum levels of forced compliance, they now ask employees to work beyond the moral minimum and seek occasions to actually realize or enhance moral value. In the decision making context, employees ask: (1) What can I do to make this a more just environment? (2) How do I go about respecting my co-workers? and (3) How do I identify and carry out my responsibilities, including social responsibilities, in my daily work?" These questions, representing instances of values-based decision-making, serve to change your focus from getting by with the moral minimum to realigning your moral and workplace efforts toward moral excellence.

In this module you will learn about ethical leadership, ethical decision-making, corporate social responsibility, and corporate governance. The occasion for this learning is the classical ethics video, "Gilbane Gold." You will view the video and practice values-based decision-making from within the role of David Jackson, the young engineer around whom the narrative of this video is built. To get you started, you will use the values portrayed in the University of Puerto Rico's College of Business Administration Statement of Values. Module sections will outline what you will be doing and what you need to know as well as provide opportunities for you to reflect on what you have learned upon completion of this module.

1.2.2 II. What you need to know...

Value-Based Decision Making

In value-based decision-making, you use moral values to pose problems and solutions. For example, problems can be posed as conflicts between values (moral vs. non-moral or moral vs. moral), lack of information about how to realize or maintain values, and situations where key values need to be defended. The point in value-based decision making is to design solutions that realize the maximum number of values possible by integrating them, drawing successful compromises between them, or choosing to act upon the most important value given the situation. In this module, you will be working from within David Jackson's position to design a solution to his problem that best responds to the value needs in his situation.

Gilbane Gold

- You are David Jackson a young engineer working for the computer manufacturer, Z-Corp. Your studies into the waste emissions of Z-Corp indicate that they are a little bit over the boarderline of what is legally acceptable in the Gilbane metropolitan area. Two further issues complicate your findings. (1) Gilbane draws sludge from the river and sells it to farmers to cover their fields; if heavy metals are present in this sludge, they will be passed on to consumers who eat the vegetables grown in fields covered

[7] This content is available online at <http://cnx.org/content/m15783/1.8/>.

with this "Gilbane Gold." This could produce long and short term health problems for the Gilbane community. (2) Z-Corp has just entered into a new agreement with a Japanese company that will produce a five-fold increase in demand for their product. While this will also increase their emissions of heavy metals into the water supply by the same amount, it will not violate city regulations because these regulations only take into account the concentration of heavy metals in each discharge. Z-Corp merely dilutes the heavy metals dumped into Gilbane's water supply to reflect acceptable concentration levels. David Jackson holds that this loophole in environmental regulations could endanger the health and safety of the citizens in the Gilbane. But he has trouble sharing these concerns with his supervisors, Diane Collins, Phil Port, and Frank Seeders.

- David (you) has made several efforts to make his concerns known to Z-Corp officials, including Phil Port, Frank Seeders, and Diane Collins. Their response is that spending money on increased pollution control measures will threaten Z-Corp's thin profit margin. Diane puts the issue even more strongly when she says that Z-Corp's social responsibility is to provide the Gilbane community with good jobs and to obey local environmental regulations. If the city wants stricter regulations, then **they** need to pass them through the legislative process. But taking proactive measures on this count goes far beyond Z-Corp's ethical and social responsibilities to the Gilbane community.
- You are David. What values do you see involved in this situation? Design a solution that best preserves and integrates them.

Partial List of Characters

1. **David Jackson**: Young engineer whose measurements show that Z-Corp's emissions into the Gilbane water supply barely exceed local standards. He expresses concern to his supervisors on the impact on the safety and health of the local community.
2. **Diane Collins**: David's supervisor who is under strong pressure to maintain the Z-Corp Gilbane plant's thin profit levels. She is concerned about environment responsibility but defines it as staying within the limits of the law as put forth by the Gilbane community. Gilbane sets for the law and Z-Corp is responsible for staying within its limits. If the law is inadequate, then Gilbane is responsible for changing it.
3. **Tom Richards**: Environmental engineer hired to measure Z-Corp's heavy metal emissions into the Gilbane water supply. Richards warns David that he bears ultimate responsibility for Z-Corp's emisions into the Gilbane water supply.
4. **Phil Port**: Z-Corp's official in charge of the company's compliance with environmental regulations. He calls David during the TV documentary to claim that it portrays him as an "environmental rapist."
5. **Frank Seeders**: Frank is the point man on helping to gear up Z-Corp's operations to meet the new demand created by their recent venture with a Japanese company. He asks David to help him streamline Z-Corp's manufacturing process.
6. **Maria Renato**: Local reporter who produces documentary exposing Z-Corp's potentially dangerous emissions. She has prepared her report based on documentation provided by David Jackson.

Statement of Values List

1. **Justice / Fairness**: Be impartial, objective and refrain from discrimination or preferential treatment in the administration of rules and policies and in its dealings with students, faculty, staff, administration, and other stakeholders.
2. **Responsibility**: Recognize and fulfill its obligations to its constituents by caring for their essential interests, by honoring its commitments, and by balancing and integrating conflicting interests. As responsible agents, the faculty, employees, and students of the college of business Administration are committed to the pursuit of excellence, devotion to the community's welfare, and professionalism.
3. **Respect**: Acknowledge the inherent dignity present in its diverse constituents by recognizing and respecting their fundamental rights. these include rights to property, privacy, free exchange of ideas, academic freedom, due process, and meaningful participation in decision making and policy formation.

4. **Trust**: Recognize that trust solidifies communities by creating an environment where each can expect ethically justifiable behavior from all others. While trust is tolerant of and even thrives in an environment of diversity, it also must operate within the parameters set by established personal and community standards.
5. **Integrity**: Promote integrity as characterized by sincerity, honesty, authenticity, and the pursuit of excellence. Integrity shall permeate and color all its decisions, actions and expressions. It is most clearly exhibited in intellectual and personal honesty in learning, teaching, mentoring and research.

1.2.3 III. What you are going to do...

1. Watch the video and make sure you understand the situation from David's point of view. At the end David makes his decision. You should be open to the possibility that there may be other decisions that can be taken in this situation that may be better from a moral point of view.
2. What is David's problem? Try formulating it in terms of values that are under threat and conflicts between values. You may even want to identify information needs relevant to solving this problem?
3. What solutions do different individuals in the video recommend to David? How good are they in terms of realizing or protecting key moral values? Does David (and the video) pay sufficient attention to these different recommendations? Does he miss better value-integrative solutions?
4. Make your decision. Defend it in terms of key moral values. Use the values provided above in the UPRM College of Business Administration's Statement of Values.
5. Give special attention to the links provided in this module. Are there solutions to David's problem not mentioned in the video?

1.2.4 IV. Exercise: Problem Solving With Gilbane Gold

Directions

Copy-past this exercise and complete in your groups. If you have any questions on the stages of problem solving, consult the module "Three Frameworks for Ethical Decision Making and Good Computing Reports," module m13757.

Problem Specification

- Classify your problem. Is it a conflict between values, a conceptual disagreement, a factual disagreement, or an impending harm. Provide a one or two sentence justification for your problem classification
- Frame your problem in three different ways. How does Gilbane Gold appear from the frame of an environmental engineer? From the standpoint of a local farmer concerned about soil contamination? From the standpoint of a manager who is under pressure to maintain razor-thin profit margins as well as authority over those under her supervision?

Solution Generation

- Set 10 solutions as a quota. Then individually brainstorm as quickly as possible 10 solutions.
- Share your solutions with your group members. Make a special effort to suspend all criticism until all the solutions of all the group members have been listed.
- Refine your solution list into three solutions, two good ones and one bad one. Refine by developing a Plan A, Plan B, and Plan C sequence. Integrate similar solutions. Condense your bad solutions into one bad solution that will serve as a useful basis of comparison.
- Work first toward a value integrative solution. If this is not possible, seek a value compromise. As a last resort prioritize your values and trade off the less for the more important relative to the situation at hand.

Solution Testing

- Test ethically three solutions, your two best solutions and a bad one to serve as a basis of comparison.
- Use the three ethics tests: reversibility, harm, and publicity. You can substitute a rights test for reversibility and a values or virtues test for publicity.
- Tie breakers: meta tests. If tests converge on a solution, this is an independent signal of solution strength. If the tests diverge on a particular solution alternative, this is an independent sign of the solution's weakness.
- Is your best solution feasible? Ask this question globally.

Solution Implementation

- In this stage, you want to look carefully at the situation in which you are going to realize your solution. Are there factors in this situation that will constrain or limit implementation? What are they, and how will they do this?
- Are there factors present in the situation that will aid the implementation of one or the other of your good solutions? What are they?
- What are your resource constraints? Do you have enough time, money, or materials to realize your ethical solution? If not, are the constraints negotiable?
- What are your interest or social constraints? Are there individuals or groups who have agendas affected by your solution? Given these agendas will they be allies or opponents? How can you win opponents over your side? Think here about government regulations, supervisor interests, corporate or business procedures, community traditions, etc.
- Important in Gilbane Gold is whether your solution is technical feasible and how your solution will affect the chip-manufacturing process. Is your solution technically feasible? Does it require developing new technology or acquiring expensive technology? Are these technical or manufacturing constraints negotiable, that is, flexible or rigid?

1.2.5 V. Conclusion

More and more, business ethics is concentrating on four general themes or issues. In this section, you will use the video, "Gilbane Gold," to reflect on these different themes. Consider this your first incursion into business ethics. Most important, remember that ethics forms a central part of everyday business practice and is essential to good business.

Ethical Leadership: In terms of the values mentioned in the SOV, discuss and rate the following characters in terms of the leadership skills and qualities they exhibit:

- Diane Collins
- David Jackson
- Phil Port
- Tom Richards
- Frank Seeders

Social Responsibility:
David reminds Diane that corporations like Z-Corp are responsible for the health and safety impacts of their operations. Diane disagrees placing more emphasis on following the law and serving the community by creating economic opportunity and jobs. Who sets for the better argument? Using these positions as a springboard, set forth your own conception of corporate social responsibility.

Corporate Governance:
Toward the end of the video, David goes to local reporter, Maria Renato, and provides her with inside information on his and Tom Richards's environmental and safety concerns. Was this a necessary action? Did David have other options which would have allowed him to work within Z–Corp for an effective response to his concerns? How do engineers advocate within for-profit corporations for including ethical values into

corporate decisions? What do real world corporations do to recognize and respond to dissenting professional opinions held by their employees?

Notes on Gilbane Gold for Fall 2013

[Media Object][8]

Values in Gilbane Gold Handout

This media object is a downloadable file. Please view or download it at
<Values in Gilbane Gold Handout.doc>

Figure 1.2: This handout for students provides exercises based on Gilbane Gold that introduces the three AACSB business ethics themes: ethical leadership, ethical decision-making, and social responsibility.

Virtues for ADMI 3405

This media object is a downloadable file. Please view or download it at
<Virtues for ADMI 3405.pptx>

Figure 1.3: Clicking on this file are the virtues worked out in the previous module. Use these to carry out the values-based decision making exercise in Gilbane Gold.

Presentation on Values Based Decision Making

[Media Object][9] Working from an analogy between design and ethics problem-solving, this presentatio

Ethics Assessment Activity: Pre and Post Test

[Media Object][10] This is a short pre and post test to examine short term impact of the module.

Solution Brainstorm for Gilbane Gold

[Media Object][11]

[8] This media object is a downloadable file. Please view or download it at
<Notes on Gilbane Gold.pptx>

[9] This media object is a downloadable file. Please view or download it at

<Values Based Decision Making.pptx>

[10] This media object is a downloadable file. Please view or download it at

<Ethics Assessment.docx>

[11] This media object is a downloadable file. Please view or download it at
<Solutions to Gilbane Gold.docx>

1.3 Theory Building Activities: Mountain Terrorist Exercise[12]

1.3.1 Module Introduction

This module poses an ethical dilemma, that is, a forced choice between two bad alternatives. Your job is to read the scenario and choose between the two horns of the dilemma. You will make your choice and then justify it in the first activity. In the second activity, you will discuss your choice with others. Here, the objective is to reach consensus on a course of action or describe the point at which your group's progress toward consensus stopped. The Mountain Terrorist Exercise almost always generates lively discussion and helps us to reflect on of our moral beliefs. Don't expect to reach agreement with your fellow classmates quickly or effortlessly. (If you do, then your instructor will find ways of throwing a monkey wrench into the whole process.) What is more important here is that we learn how to state our positions clearly, how to listen to others, how to justify our positions, and how to assess the justifications offered by others. In other words, we will all have a chance to practice the virtue of reasonableness. And we will learn reasonableness not when it's easy (as it is when we agree) but when it becomes difficult (as it is when we disagree).

The second half of this module requires that you reflect carefully on your moral reasoning and that of your classmates. The Mountain Terrorist Exercise triggers the different moral schemas that make up our psychological capacity for moral judgment. Choosing one horn of the dilemma means that you tend to favor one kind of schema while choosing the other horn generally indicates that your favor another. The dominant moral theories that we will study this semester provide detailed articulations and justifications of these moral schemas. Reflecting on your choice, the reasons for your choice, and how your choice differs from that of your classmates will help you get started on the path of studying and effectively utilizing moral theory.

The following scenario comes originally from the philosopher, Bernard Williams. It is also presented in introductory ethics textbooks (such as Geoffrey Thomas' An Introduction to Ethics). The first time this module's author became aware of its use in the classroom was in a workshop on Agriculture Ethics led by Paul Thompson, then of Texas A&M University, in 1992.

1.3.2 Moral Theories Highlighted

1. Utilitarianism: the moral value of an action lies in its consequences or results
2. Deontology: the moral value of an action lies, not in its consequences, but in the formal characteristics of the action itself.
3. Virtue Ethics: Actions sort themselves out into virtuous or vicious actions. Virtuous actions stem from a virtuous character while vicious actions stem from a vicious or morally flawed character. Who we are is reveals through what we do.

1.3.3 Mountain Terrorist Scenario

You are in a remote mountain village. A group of terrorists has lined up 20 people from the village; they plan on shooting them for collaborating with the enemy. Since you are not from the village, you will not be killed. Taking advantage of your position, you plead with the terrorists not to carry out their plan. Finally, you convince the leader that it is not necessary to kill all 20. He takes a gun, empties it of all its bullets except one, and then hands it to you. He has decided to kill only one villager to set an example to the rest. As an honored guest and outsider, you will decide who will be killed, and you will carry out the deed. The terrorists conclude with a warning; if you refuse to kill the villager, then they will revert back to the original plan of killing all 20. And if you try any "funny business," they will kill the 20 villagers and then kill you. What should you do?

Your Options

1. Take the gun, select a villager, and kill him or her.

[12] This content is available online at <http://cnx.org/content/m13764/1.11/>.

2. Refuse the terrorists' offer and walk away from the situation.

Spanish Translation by Dr. Halley Sanchez
El Terrorista de la Montaña Tú eres un antropólogo que por un mes ha estado viviendo con y observando (o sea, estudiando) a los residents de una aldea en una area remota montañoza de un pais en América Latina. El día que te dispone irte de la aldea, aprece un grupo de hombres armados que reúnen a los aldeanos y les anuncian que se han enterado de que ellos han estado cooperando con el gobierno represivo y que, como lección, han de ejecutar viente de ellos. El líder de los terroristas te mira y te dice que tú te puedes ir, ya que no estás involucardo en la lucha patriótica y que ellos no están en la costumbre de tomar rehénes extranjeros. Debido a que te da la impresión de que el líder de los supuestos patriótas (terroristas?) es un hombre educado, tú te atreves tratar de razonar con él. Le explica que llevas un mes en la aldea y que los aldeanos no han cooperado de forma volutaria con el gobierno. Sí, por supuesto, las tropas del gobierno pasaron por la aldea y confiscaron algunas provisiones, pero los aldeanos no se las dieron libremente sino que estaban indefenso y no podieron prevenir que le confiscaran las mismas. El líder piensa un tiempo y te dice que por tú ser forastero y obviamente un antropólogo estudioso, te va a dar el benificio de la duda, y que por tanto no van a ejecutar viente aldeanos. Pero dado que la lucha patriótica está en un proceso crítico y que la aldea sí le proveyó provisiones al gobierno, por el bien de la lucha patriótica y el bien de la humanidad, es menester darle una lección a la aldea. Así que tan sólo han de ejecutar un aldeano. Más, como huesped, tú has de escoger quién ha de morir y tú has de matarlo tú mismo. Te da una pistola con una sola bala y te dice que proceda, mientras que a la vez te advierte que de tratar algo heroico, te ejecutarán inmediatamente y procederán a ejecutar a los viente aldeanos como dijeron al comienzo. Tú eres el antropólogo. ¿Qué harás?
Activity 1
In a short essay of 1 to 2 pages describe what you would do if you were in the position of the tourist. Then justify your choice.
Activity 2
Bring your essay to class. You will be divided into small groups. Present your choice and justification to the others in your group. Then listen to their choices and justifications. Try to reach a group consensus on choice and justification. (You will be given 10-15 minutes.) If you succeed present your results to the rest of the class. If you fail, present to the class the disagreement that blocked consensus and what you did (within the time limit) to overcome it.

1.3.4 Taxonomy of Ethical Approaches

There are many ethical approaches that can be used in decision making. The Mountain Terrorist Exercise is based on an artificial scenario designed to separate these theoretical approaches along the lines of the different "horns" of a dilemma. Utilitarians tend to choose to shoot a villager "in order to save 19." In other words they focus their analysis on the consequences of an action alternative and choose the one that produces the least harm. Deontologists generally elect to walk away from the situation. This is because they judge an action on the basis of its formal characteristics. A deontologist might argue that killing the villager violates natural law or cannot be made into a law or rule that consistently applies to everybody. A deontologist might say something like, "What right do I have to take another person's life?" A virtue ethicists might try to imagine how a person with the virtue of courage or integrity would act in this situaiton. (Williams claims that choosing to kill the villager, a duty under utilitarianism, would undermine the integrity of a person who abhorred killing.)

Table Connecting Theory to Domain

1. Row 1: Utilitarianism concerns itself with the domain of consequences which tells us that the moral value of an action is "colored" by its results. The harm/beneficence test, which asks us to choose the least harmful alternative, encapsulates or summarizes this theoretical approach. The basic principle of utilitarianism is the principle of utility: choose that action that produces the greatest good for the greatest number. Cost/benefits analysis, the Pareto criterion, the Kalder/Hicks criterion, risk/benefits analysis all represent different frameworks for balancing positive and negative consequences under utilitarianism or consequentialism.

2. Row 2: Deontology helps us to identify and justify rights and their correlative duties The reversibility test summarizes deontology by asking the question, "Does your action still work if you switch (=reverse) roles with those on the receiving end? "Treat others always as ends, never merely as means," the Formula of End, represents deontology's basic principle. The rights that represent special cases of treating people as ends and not merely as means include (a) informed consent, (b) privacy, (c) due process, (d) property, (e) free speech, and (f) conscientious objection.
3. Row 3: Virtue ethics turns away from the action and focuses on the agent, the person performing the action. The word, "Virtue," refers to different sets of skills and habits cultivated by agents. These skills and habits, consistently and widely performed, support, sustain, and advance different occupational, social, and professional practices. (See MacIntyre, After Virtue, and Solomon, Ethics and Excellence, for more on the relation of virtues to practices.) The public identification test summarizes this approach: an action is morally acceptable if it is one with which I would willingly be publicly associated given my moral convictions. Individual virtues that we will use this semester include integrity, justice, responsibility, reasonableness, honesty, trustworthiness, and loyalty.

Covering All the Bases				
Ethical Dimension	Covering Ethical Approach	Encapsulating Ethical Test	Basic Principles	Application or Bridging Tools
Consequences	Utilitarianism	Harm/Beneficence (weigh harms against benefits)	Principle of Utility: greatest good for greatest number	Benefit & cost comparisonUtility Maximization
Formal Characteristics of Act	Deontology (Duty-based, rights-based, natural law, social contract)	Reversibility (test by reversing roles between agent and object of action)	Categorical ImperativeFormula of EndAutonomy	Free & Informed Consent, Privacy, Property, Due Process, Free Speech, Conscientious objection
Skills and habits cultivated by agent	Virtue Ethics	Public Identification (impute moral import of action to person of agent)	Virtues are means between extremes with regard to agent and actionVirtues are cultivated dispositions that promote central community values	Integrity, justice, responsibility, reasonableness, honesty, trustworthiness, loyalty

Table 1.4

1.3.5 Comments on the Relation Between Ethical Approaches

The Mountain Terrorist Exercise has, in the past, given students the erroneous idea that ethical approaches are necessarily opposed to one another. As one student put it, "If deontology tells us to walk away from the village, then utilitarianism must tell us to stay and kill a villager because deontology and utilitarianism, as different and opposed theories, always reach different and opposed conclusions on the actions they recommend." The Mountain Terrorist dilemma was specially constructed by Bernard Williams to produce a situation that offered only a limited number of alternatives. He then tied these alternatives to different ethical approaches to separate them precisely because in most real world situations they are not so readily

distinguishable. Later this semester, we will turn from these philosophical puzzles to real world cases where ethical approaches function in a very different and mostly complimentary way. As we will see, ethical approaches, for the most part, converge on the same solutions. For this reason, this module concludes with 3 meta-tests. When approaches converge on a solution, this strengthens the solution's moral validity. When approaches diverge on a solution, this weakens their moral validity. A third meta-test tells us to avoid framing all ethical problems as dilemmas (=forced choices between undesirable alternatives) or what Carolyn Whitbeck calls "multiple-choice" problems. You will soon learn that effective moral problem solving requires moral imagination and moral creativity. We do not "find" solutions "out there" ready made but design them to harmonize and realize ethical and practical values.

Meta-Tests

- Divergence Test: When two ethical approaches differ on a given solution, then that difference counts against the strength of the solution. Solutions on which ethical theories diverge must be revised towards convergence.
- Convergence Test: Convergence represents a meta-test that attests to solution strength. Solutions on which different theoretical approaches converge are, by this fact, strengthened. Convergence demonstrates that a solution is strong, not just over one domain, but over multiple domains.
- Avoid Framing a Problem as a Dilemma. A dilemma is a no-win situation that offers only two alternatives of action both of which are equally bad. (A trilemma offers three bad alternatives, etc.) Dilemmas are better dissolved than solved. Reframe the dilemma into something that admits of more than two no-win alternatives. Dilemma framing (framing a situation as an ethical dilemma) discourages us from designing creative solutions that integrate the conflicting values that the dilemma poses as incompatible.

1.3.6 Module Wrap-Up

1. **Reasonableness and the Mountain Terrorist Exercise.** It may seem that this scenario is the last place where the virtue of reasonableness should prevail, but look back on how you responded to those of your classmates who chose differently in this exercise and who offered arguments that you had not initially thought of. Did you "listen and respond thoughtfully" to them? Were you "open to new ideas" even if these challenged your own? Did you "give reasons for" your views, modifying and shaping them to respond to your classmates' arguments? Did you "acknowledge mistakes and misunderstandings" such as responding critically and personally to a classmate who put forth a different view? Finally, when you turned to working with your group, were you able to "compromise (without compromising personal integrity)"? If you did any or all of these things, then you practiced the virtue of reasonableness as characterized by Michael Pritchard in his book, Reasonable Children: Moral Education and Moral Learning (1996, University of Kansas Press, p. 11). Congratulate yourself on exercising reasonableness in an exercise designed to challenge this virtue. You passed the test.
2. **Recognizing that we are already making ethical arguments.** In the past, students have made the following arguments on this exercise: (a) I would take the gun and kill a villager in order to save nineteen; (b) I would walk away because I don't have the right to take another's life; (c) While walking away might appear cowardly it is the responsible thing to do because staying and killing a villager would make me complicit in the terrorists' project. As we discussed in class, these and other arguments make use of modes of thought captured by ethical theories or approaches. The first employs the consequentialist approach of utilitarianism while the second makes use of the principle of respect that forms the basis of our rights and duties. The third works through a conflict between two virtues, courage and responsibility. This relies on the virtue approach. One accomplishment of this exercise is to make you aware of the fact that you are already using ethical arguments, i.e., arguments that appeal to ethical theory. Learning about the theories behind these arguments will help you to makes these arguments more effectively.
3. **Results from Muddy Point Exercises** The Muddy Point Exercises you contributed kept coming back to two points. (a) Many of you pointed out that you needed more information to make a decision

in this situation. For example, who were these terrorists, what causes were they fighting for, and were they correct in accusing the village of collaborating with the enemy? Your request for more information was quite appropriate. But many of the cases we will be studying this semester require decisions in the face of uncertainty and ignorance. These are unavoidable in some situations because of factors such as the cost and time of gathering more information. Moral imagination skillfully exercised can do a lot to compensate when all of the facts are not in. (b) Second, many of you felt overly constrained by the dilemma framing of the scenario. Those of you who entered the realm of "funny business" (anything beyond the two alternatives of killing the villager or walking away) took a big step toward effective moral problem solving. By rejecting the dilemma framing of this scenario, you were trying to reframe the situation to allow for more–and more ethically viable–alternatives. Trying to negotiate with the Terrorists is a good example of reframing the scenario to admit of more ethical alternatives of action than killing or walking away.

4. Congratulations on completing your first ethics module! You have begun recognizing and practicing skills that will help you to tackle real life ethical problems. (Notice that we are going to work with "problems" not "dilemmas".) We will now turn, in the next module, to look at those who managed to do good in the face of difficulty. Studying moral exemplars will provide the necessary corrective to the "no-win" Mountain Terrorist Exercise.

Chapter 2

Social and Global Impacts of Engineering

2.1 Socio-Technical Systems in Professional Decision Making[1]

2.1.1 Module Introduction

Milagro Beanfield War
Joe Mondragon has created quite a stir in Milagro, a small village in New Mexico. He has illegally diverted water from the irrigation ditch to his field to grow beans. Access to scarce water in New Mexico has created sharp political and social disputes which have reached a crises point in Milagro. Competing with traditional subsistence farmers like Joe is the profitable recreation industry. Ladd Devine, a wealthy developer, has joined with the state government in New Mexico to build a large recreational center consisting of a restaurant, travel lodge, individual cabins and a lavish golf course. Since there is not enough water to cover both recreational and agricultural uses and since Ladd Devine's project promises large tax revenues and new jobs, the state government has fallen behind him and has promised to give to the recreational facilities all the water it needs. Hence, the problem created by Mondragon's illegal act. You work for Ladd Devine. He has asked you to look into local opposition to the recreational facility. Along these lines, you attend the town meeting scheduled by Ruby Archuleta in the town's church. You are concerned about Charlie Bloom's presentation and the impact it may have on the local community. Prepare a STS analysis to test Bloom's assertions and better prepare Ladd Devine for local opposition to his facility.
Incident at Morales
Fred is a chemical engineer hired by Phaust Corporation to design and make operational a new chemical plant for the manufacture of their newly redesigned paint thinner. Under financial pressure from the parent French company, Chemistre, they have decided to locate their new plant in Morales, Mexico to take advantage of lower costs and more flexible government regulations. You are well on the way toward designing this new plant when news comes from Chemistre that all budgets are being cut 20% to finance Chemistre's latest takeover acquisition. You are Fred and are now faced with a series of difficult financial-engineering decisions. Should you hold out for the more expensive Lutz and Lutz controls or use the cheaper ones produced locally? Should you continue with the current plant size or cut plant size and capacity to keep within budgetary constraints? You have also been made aware of the environmental and health risks associated with not lining the waste ponds used by the plant. Do you advocate lining the ponds or not, the latter being within compliance for Mexican environmental and health regulations. Prepare a STS analysis to help you make and justify these decisions. Make a series of recommendations to your supervisors based on this study.
Puerto Rican Projects

- Your company, Cogentrix, proposes a cogeneration plant that uses coal, produces electricity, and creates steam as a by-product of electricity generation process. Because the steam can be sold to nearby tuna

[1] This content is available online at <http://cnx.org/content/m14025/1.12/>.

canning plants, your company wishes to study the feasibility of locating its plant in or near Mayaguez, Puerto Rico. (Co-generation technology has become very popular and useful in some places.) Carry out a STS analysis to identify potential problems. Make a recommendation to your company. If your recommendation is positive, discuss how the plant should be modified to fit into the Mayaguez, Puerto Rico STS.

- Your company, Southern Gold Resources, is interested in mining different regions in central Puerto Rico for copper and gold. But you know that twenty years earlier, two proposals by two international mining companies were turned down by the PR government. Carry out a STS study to examine the feasibility of designing a different project that may be more acceptable to local groups. What does your STS analysis tell you about social and ethical impacts, financial promise, and likely local opposition. Can profitable mining operations be developed that respect the concerns of opposed groups? What is your recommendation based on your STS analysis?
- Windmar, a company that manufactures and operates windmills for electricity generation has proposed to locate a windmill farm in a location adjacent to the Bosque Seco de Guanica. They have encountered considerable local opposition. Carry out a STS analysis to understand and clarify this opposition. Can the concerns of local stakeholders be addressed and the windmill farm still remain profitable? How should the windmill project be modified to improve its chances of implementation?

2.1.2 Things to Know about STSs

What is a Socio-Technical System? (STS)
A socio-technical system (=STS) is a tool to help a business anticipate and successfully resolve interdisciplinary business problems. "Interdisciplinary business problems" refer to problems where financial values are intertwined with technical, ethical, social, political, and cultural values. (Reference: Chuck Huff, Good Computing: A Virtue Approach to Computer Ethics, draft manuscript for Jones and Bartlett Publishers)

Some Things to Know About STSs

1. Socio-Technical systems provide a tool to uncover the different environments in which business activity takes place and to articulate how these constrain and enable different business practices.
2. A STS can be divided into different components such as hardware software, physical surroundings, people/groups/roles, procedures, laws/statutes/regulations, and information systems. Other components include the natural environment, markets, and political systems.
3. But while different components can be distinguished, these are, in the final analysis, inseparable. Socio-Technical Systems are first and foremost **systems**: their components are interrelated and interact so that a change in one often produces changes that reverberate through the system.
4. Socio-Technical systems embody moral values such as justice, responsibility, respect, trust, and integrity as well as non-moral values such as efficiency, satisfaction, productivity, effectiveness, and profitability. Often these values can be located in one or more of the system components. Often they conflict with one another causing the system as a whole to change.
5. STSs change, and this change traces out a path or trajectory. The normative challenge here is to bring about and direct changes that place the STS on a value-positive trajectory. In the final analysis, we study STS to make sure that they change in a value-realizing direction.

2.1.3 Constituents or Sub-Environments of Business Activity

Paragraph summary of sub-environments of business followed by a table devoted to each one.

- **Technology** including hardware, software, designs, prototypes, products, or services. Examples of engineering projects in Puerto Rico are provided in the PR STS grid. In the Therac-25 case, the hardware is the double pass accelerator, in Hughes the analogue-to-digital integrated circuits, and in

Machado the UNIX software system and the computers in the UCI laboratories that are configured by this system. Because technologies are structured to carry out the intentions of their designers, they embed values.

- **Physical Surroundings**. Physical surroundings can also embed values. Doors, by their weight, strength, material, size, and attachments (such as locks) can promote values such as security. Physical surroundings promote, maintain, or diminish other values in that they can permit or deny access, facilitate or hinder speech, promote privacy or transparency, isolate or disseminate property, and promote equality or privilege.
- **People, Groups, and Roles**. This component of a STS has been the focus of traditional stakeholder analyses. A stakeholder is any group or individual which has an essential or vital interest in the situation at hand. Any decision made or design implemented can enhance, maintain, or diminish this interest or stake. So if we consider Frank Saia a decision-maker in the Hughes case, then the Hughes corporation, the U.S. Air Force, the Hughes sub-group that runs environmental tests on integrated circuits, and Hughes customers would all be considered stakeholders.
- **Procedures**. How does a company deal with dissenting professional opinions manifested by employees? What kind of due process procedures are in place in your university for contesting what you consider to be unfair grades? How do researchers go about getting the informed consent of those who will be the subjects of their experiments? Procedures set forth ends which embody values and legitimize means which also embody values.
- **Laws, statutes, and regulations** all form essential parts of STSs. This would include engineering codes as well as the state or professional organizations charged with developing and enforcing them
- The final category can be formulated in a variety of ways depending on the specific context. Computing systems gather, store, and disseminate information. Hence, this could be labeled **data and data storage structure**. (Consider using data mining software to collect information and encrypted and isolated files for storing it securely.) In engineering, this might include the information generated as a device is implemented, operates, and is decommissioned. This information, if fed back into refining the technology or improving the design of next generation prototypes, could lead to uncovering and preventing potential accidents. Electrical engineers have elected to rename this category, in the context of power systems, rates and rate structures.

Technological Component

Component	Description	Examples	Frameworks	More Frameworks
Technological	Hardware: Machines of different kinds	Door (with tasks delegated to it such as automatically shutting and being locked)	Value Discovery (identifying and locating values in STS)	**Social Constructionism**>: Restoring interpretive flexibility to reconstruct a technology to remove bias and realize value
continued on next page				

	Code that configures machines around human purposes	Power generating technologies based on renewable and nonrenewable resources	Value Translation (Operationalizing and implementing values in a STS by designing and carrying out a procedure)	Identifying and mitigating complexity in the form of tightly-coupled systems and non-linear causal chains
	Technology can constrain business activity by de-skilling	Automobiles, computers, cell phones all of which have produced profound changes in our STSs	Value Verification (Using methods of participatory observation to determine how effectively values have been realized.)	De-centralizing control and authority
	Technology, especially software, can **instrument** human action	Microsoft Office, Firefox Browser, Google Chrome, Google Docs, Social Networking software	**Transperspectivity** discovering strands of construction of current STS; identifying possibilities for reconstruction	Designing to avoid the technological imperative and reverse adaptation (where humans abandon ends and serve the ends of technologies

Table 2.1: Technological component of STS

Table 2: Ethical and Social Component

Component	**Description**	**Examples**	**Frameworks**	**More Frameworks**
Ethical Environment	**Moral Constructs**: Spheres of justice where distribution takes place according to context-dependent rules (Rules)	**Basic Moral Concepts**: rights, duties, goods, values, virtues, responsibility, and justice	**Utilitarianism**: Happiness is tied to maximizing the satisfaction of aggregated preferences.	**Basic Capabilities**: life, bodily health, bodily integrity
				continued on next page

	Social Constructs: Power and its distribution among groups and individuals	**Intermediate Moral Concepts**: Privacy, Property, Informed Consent, Free Speech, due Process, Safety/Risk	**Rights**: Capacities of action that are essential to autonomy, vulnerable to standard threats, and correlated with feasible duties	**Cognitive Capabilities**: Sense, Imagination, Thought; Emotion; Practical Reason
	Right: A right is a capacity of action, essential to autonomy, that others are obliged to recognize and respect.	**Privacy**: If the information is directly relevant to the relation to the holder and the seeker, then it is not private.	**Virtues**: Settled dispositions toward choosing the mean between extremes of excess and defect. (Courage is the mean between cowardice and recklessness)	**Social Capabilities**: Affiliations, Other Species
	Duty: A duty is a principle that obliges us to recognize and respect the rights of others.	**Property**: That with which I mix my labor is mine. Intellectual property is non-rivalrous and non-excludable.	**Capabilities Approach**: For Nussbaum, capabilities answer the question, "What is this person able to do or be?" For Sen, capabilities are "'substantial freedoms,' a set of (causally interrelated) opportunities to choose and act."	**Capabilities that address vulnerabilities**: Play and Control over one's environment

Table 2.2: Ethical Environments of the socio-technical system

Physical Surroundings

Physical Surroundings	Description	Examples	Frameworks	Frameworks
	Physical environment imposes constraints (limits) over actions that restrict possibilities and shape implementation.	Influence of rivers, mountains, and valleys on social and economic activities such as travel, trade, economic and agricultural activity, commerce, industry, and manufacturing.	Classroom environment enables or constrains different teaching and learning styles. For example, one can pair off technically enhanced and technically challenged classrooms with student-centered and teacher-centered pedagogical styles and come up with four different learning environments. Each constrains and enables a different set of activities.	The physical arrangement of objects in the classroom as well as the borders created by walls, doors, and cubicles can steer a class toward teacher-centered or student-centered pedagogical styles.

Table 2.3: This table summarizes the physical environment of the STS and how it can constrain or enable action.

People, Groups, and Roles (Stakeholders)

Stakeholders	Description	Examples	Frameworks	Frameworks
	Any group or individual that has a vital interest at play (at stake) in the STS.	**Market Stakeholders**: Employees, Stockholders	**Non-Market Stakeholders**: communities, activist groups and NGOs	**Role**: The place or station a stakeholder occupies in a given organizational system and the associated tasks or responsibilities.

continued on next page

		customers, suppliers retailers/wholesalers, creditors	business support groups, governments, general public (those impacted by projects who do not participate directly in their development	**Interests**: Goods, values, rights, interests, and preferences at play in the situation which the stakeholder will act to protect or promote.
		(Distinction between market and non-market stakeholders comes from Lawrence and Weber, **Business and Society: Stakeholders, Ethics, Public Policy**, 12th edition. McGraw-Hill, 14-15.	Alliances are discussed by Patricia Werhane et al., **Alleviating Poverty Through Profitable Partnerships: Globalization, Markets, and Economic Well-being**. Routledge (2009).	**Relation**: Each stakeholder is related to other stakeholders in an alliance and each relation is tied to goods and values.

Table 2.4: This table shows the social or stakeholder environment of the STS. A stakeholder is any group or individual that has a vital interest at play in the STS.

Procedural Environment

Procedural	Description	Examples	Framework	Framework
	A series of interrelated actions carried out in a particular sequence to bring about a desired result, such as the realization of a value. Procedures can schematize value by setting out a script for its realization.	Hiring a new employee: (a) settling on and publishing a job description; (b) soliciting and reviewing applications from candidates; (c) reducing candidate list and interviewing finalists; (d) selecting a candidate; (e) tendering that candidate a job offer.Other procedures: forming a corporation, filing for bankruptcy, gaining consent to transfer TGI and PII to a third party (Toysmart: opt-in and opt-out procedures).	**Value Realization Process** in Software Engineering: (a) **Discovery**: Uncovering values shared by a given community; (b) **Translation**: operationalizing and implementing values in a given STS; (c) **Verification**: using methods of participatory observation (surveys and interviews) to validate that the values in question have been discovered and translated.	**Challenging the Statement of Values**: (a) A stakeholder group raises a conceptual, translation, range, or development issue; (b) Group presents their challenge and response to other stakeholders; (c) If other stakeholder groups agree, then the challenge leads to a revision in the SOV; (d) Community as a whole approves the revision.

Table 2.5

Legal Environment: Laws, Statutes, Regulations

Laws, Statutes, Regulations	Description	Examples	Frameworks	Frameworks
	Laws differ from ethical principles and concepts in that laws prescribe the minimally moral while ethical principles and concepts routinely explore higher moral "spaces."	**Criminal Law**: Applies to individuals; interested party in a criminal trial is society, not the victim.	**Civil Law**: Torts concern wrongful injury. The objective of a tort is to make the victim "while" after an injury.	US and British law work through a common law system where current decisions are based on past decisions or precedent.

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	Ethical principles challenge and criticize laws by bringing into question their normative content.	Involves proving a **mens rea** (guilty mind) and **actus reus** (guilty or law-breaking act) and that the mens rea caused the actus reus.	To prevail in a tort one ust prove (in order of severity) negligence, recklessness, or intent.	The Puerto Rican system of law is based on the Napoleonic code where decisions relate directly to existing law and statute and precedent plays a weaker role.
	Laws can challenge ethical principles and concepts by raising issues of practicality. Also, as in responsibility theory, the law can structure and inform the moral discussion.	Criminal law does not apply to corporations because they "have no soul to damn and no body to kick" Baron Thurlow	Negligence involves proving that the defendant failed to meet some standard of **due care**.	Question: How does the statute-based Napoleonic system in PR constrain and enable business practice in relation to other systems such as the British and American common law systems?
			Contract law concerns the violation of the terms of a contract.	

Table 2.6

Market Environment

Market Environment	**Description**	**Examples**	**Frameworks**	**Frameworks**
	Business takes place within different markets that shape supply, demand, and price. Globalization frequently requires that a business be adept at operating across different markets	**Laissez Faire**: Each economic unit makes choice based on rational (enlightened) self-interest. (Private ownership of goods.)	**Assumptions of a Free Market System**: (a) Individual decisions are aggregated. (b) Information flows through price structure.	**Recent economic studies of the limits of laissez faire markets**:

continued on next page

	Liberal use made here of notes from Economics class taught by CR Winegardner, University of Toledo, 1971-1972	**Liberal Democratic Socialism**: Limited government intervention is needed to improve upon the choice of individual economic units. (Mixture of private and public ownership)	(c) Free association. (d) Absence of force or fraud. (e) Individual agents are rational utility maximizer	(a) **Information Asymmetries** (as studied by Stiegliz). (b) **Monopolies** which, in the absence of competition, can dictate standards of price, product and service.
	Materials also take from Natural Capitalism from Lovins and Hawkings.	**Communist, Authoritarian Socialism**: The state is in the best position to know what choices and policies are beneficial for the economy as a whole and its component parts. (Public ownership of goods and services)	(f) Governments should adopt a hands-off stance because interference disrupts the ability of markets to produce utility-maximizing conditions.(4,4)	Animal spirits deflect economic decision-making away from perfect utility maximizing. They include confidence, fairness, corruption, money illusion, and stories.(4,5)
(5,1)	(5,2)	(5,3)	(5,4)	Ghoshal: bad management theories are destroying good mangement practices as they become self-fulfilling prophecies. Ghoshal is especially critical of agency theory, compliance/punitive approaches to corporate governance, and the theory of human nature he calls "Homo Economicus."(5,5)

Table 2.7

Information Environment: Collecting, Storing, and Transferring Information

Information Environment(1,1)	**Description**(1,2)	**Examples**(1,3)	**Frameworks**(1,4)	**Frameworks**(1,5)
(2,1)	How data and informaiton is collected, stored, and transmitted along with ethical issues such as informed consent and privacy that accompany information management (2,2)	**Informed Consent**: Obtaining consent from information holder when collecting, storing, and transferring personal identifying information or transaction generated information.(2,3)	**Privacy in Context** (2,4)	**Data Transfer and Informed Consent**(2,5)
(3,1)	(3,2)	**Belmont Report**: (a) Principles: Respect for persons, beneficence, and justice; (b) Application 1: Informed consent as "subjects to the degree that they are capable be given the opportunity to choose what shall or shall not happen to them;" (c) Application 2: assessment of risks and benefits; (d) Application 3: Selection of subjects for experiment.(3,3)	(a) Identify individuals in groups in a context; (b) Identify the roles played by these individuals and groups.(3,4)	**Opt-in**: Information is not transferred unless data-holder expressly consents; **Opt-out**: Data will be transferred unless holder expressly refuses or withdraws consent.(3,5)

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(4,1)	(4,2)	**Conditions of Informed Consent** Information, Comprehension, Voluntariness.(4,3)	(c) Identify context-relative norms that guide activities within context and between one context and another. (Materials on privacy in context are taken from Helen Nissembaum in her book, **Privacy in Context**(4,4)	**Fair Information Practices**: (a) Notice: full disclusure and redress (way to resolve problems); (b) Choice: Choice about how informaitn is to be used; (c) Access: access to stored and about to be disclosed information; (d) Security: ways that information will be kept secure and unauthorized access prevented incollection, storage, and transfer of information.(4,5)

Table 2.8

System of the Natural Environment

Natural Environment(1,1)	**Description**(1,2)	**Examples**(1,3)	**Frameworks**(1,4)	**Frameworks**(1,5)
(2,1)	**Wicked Problems**(2,2)	**Principles of Systainability according to B. Norton**(2,3)	**Four Theoretical Approaches to Environmental Ethics**(2,4)	**Environmental Value as determined by shadow markets**(2,5)
(3,1)	(a) Difficulties in formulating and structuring problem; (b) Non-compatibility of solutions (several ways of stating solutions).(3,2)	**Precautionary Principle**: "in situations of high risk and high uncertainty,always choose the lowest risk option." (Cass Sunstein distinguishes several senses of the PP including one which makes it impossible to deviate from the status quo) (Norton 348)(3,3)	(a) **Extensionism**: Peter Singer's extension of Utilitarianism to cover sentient beings; (b) Tom Regan's ascription of rights to select animals. **Biocentrism**: Taylor's attribution of moral consideration to all teleological centers of a life.(3,4)	**Willingness-to-pay**: Resource in question would go to the highest bidder, that is, value is dependent on most intense preference and the disposable income to assert that preference(3,5)
(4,1)	(c) Wicked problems are "non-repeatable" in that they are context-dependent. This renders learning from previous problems and solutions much more difficult; (d) Wicked problems involve "competing values" that cannot be realized at the same time and that cannot be homogenized or plotted on a single scale; (e) Wicked problems exhibit "open-ended inter-temporal effects". **Closely paraphrased from Norton, Systainability, 133-5**(4,2)	**Safe Minimum Standard**: "save the resource, provided the costs of doing so are bearable" (Norton 346)(4,3)	**Land Ethics**: A thing has value or is good insofar as it promotes the integrity, stability, and beauty of the biotic community. Biotic community includes humans, non-humans, species, and ecosystems all interacting as a system. From Aldo Leopole, Sand County Almanac; **Virtue Environmental Ethics**: Approach centers on virtues as habits that promote sustainable transactions with the natural environment. Hursthouse provides a provocative example of the virtue, respect for nature.(4,4)	**Willingness-to-sell**: Resource is owned by the public so its value is determined by its selling rather than buying price. This frees bid fromdisposable income. Now value becomes more reflective of the identity-conferring beliefs and attitudes of a community and its members.(4,5)

Table 2.9

2.1.4

Ethics of STS Research

- **Right of Free and Informed Consent**: This is the right of participants in a research project to know the harms and benefits of the research. It also includes the right not to be forced to participate in a project but, instead, offer or withdraw voluntarily their consent to participate. When preparing a STS analysis, it is mandatory to take active measures to facilitate participants's free and informed consent.
- Any STS analysis must take active measures to recognize potential harms and minimize or eliminate them. This is especially the case regarding the information that may be collected about different individuals. Special provisions must be taken to maintain confidentiality in collecting, storing, and using sensitive information. This includes careful disposal of information after it is no longer needed.

2.1.5 Participatory Observation

- As we said above, a socio-technical system (STS) is "an intellectual tool to help us recognize patterns in the way technology is used and produced." Constructing these tools requires combining modes of analysis that are ordinarily kept separate. Because STSs embed values, they are normative. These values can help to chart out trajectories of change and development because they outline values that the system needs to realize, maintain, or even enhance. In this way, the study of STSs is normative and a legitimate inquiry for practical and professional ethics. On the other hand, STS analysis requires finding out what is already there and describing it. So STS analysis is descriptive as well. In this textbox, we will talk briefly about the descriptive or empirical components of STS analysis. This material is taken from the draft manuscript of Good Computing: A Virtue Approach to Computer Ethics and has been developed by Chuck Huff.
- **Interviews**: Semi-Structured and Structured Interviews conducted with those familiar with a given STS provide an excellent source of information on the constituents of a given STS and how these fit together into an interrelated whole. For example, the STS grid on power systems was put together by experts in this area who were able to provide detailed information on power rates and protocols, software used to distribute energy through the gridlines, and different sources (representing both hard and soft technologies) of power generation.
- **Field Observation**: Those constructing a STS analysis go directly to the system and describe it in its day-to-day operation. Two books provide more information on the types and techniques of field observation: 1. David M. Fetterman, Ethnography: 2nd Edition, Applied Social Research Methods Series, Vol 17. London, UK.: Sage Publishers, 1998 and 2. James P. Spradley, Participant Observation. New York, Harcourt, 1980. The data collected in this method can also be used to construct day-in-the-life scenarios that describe how a given technology functions on a typical day. These scenarios are useful for uncovering value conflicts and latent accidents. See James T. Reason, Human Error, Cambridge, UK.: Cambridge University Press, 1990 for information on latent accidents, how they are detected, and how they are prevented.
- **Questionnaires**: Questionnaires are useful for gathering general information from large numbers of people about a STS. Constructing good questionnaires is a difficult process that requires patience as well as trial and error. (Trying out questions on classmates and friends is the best way to identify unclear or misleading questions.) Avoiding complex, overly leading, and loaded questions represent a few of the challenges facing those who would construct useful questionnaires.
- **Archival and physical trace methods**: Looking at user manuals provides insight into how a system has been designed and how it works. Studying which keys are worn down on computer keyboards provides information on the kind of work being done. Comparing how a system is intended to work

with how it is in fact being used is also illuminating, especially when one is interested in tracing the trajectory of a STS. Working with archival and physical trace methods requires critical thought and detective work.

- None of the above methods, taken in isolation, provides complete information on a STS. Triangulation represents the best way to verify data and to reconcile conflicting data. Here we generate evidence and data from a variety of sources then compare and collate. Claims made by interviewees that match direct on-site observations confirm one another and indicate data strength and veracity. Evidence collected through questionnaires that conflicts with evidence gathered through archival research highlights the need for detective work that involves further observation, comparison, interpretation, and criticism.
- Developing STS analyses bears a striking resemblance to requirements analysis. In both cases, data is collected, refined, and put together to provide an analysis. A key to success in both is the proper combination of normative and descriptive procedures.

2.1.6 Exercise 1: Make a Table that Describes the Socio-Technical System

Directions: Identify the constituents of the Socio-Technical System. Use the broad categories to prompt you.

1. What are the major hardware and software components?
2. Describe the physical surroundings.
3. What are the major people groups or roles involved?
4. Describe any procedures in the STS.
5. Itemize the laws, statutes, and regulations.
6. Describe the data and data structures in your STS. Use the two templates below that fill in this table for energy generation systems and for engineering ethics in Puerto Rico.

Socio Technical System Table

	Hardware	**Software**	**Physical Surroundings**	**People, Groups, Roles**	**Procedures**	**Laws**	**Data and Data Structures**

Table 2.10

2.1.7 Exercise 2: Identify Value Mismatches in the STS

Directions: identify the values embedded in the STS. Use the table below to suggest possible values as well as the locations in which they are embedded.

1. **Integrity**: "Integrity refers to the attributes exhibited by those who have incorporated moral values into the core of their identities. Such integration is evident through the way values denoting moral excellence permeate and color their expressions, actions, and decisions. Characteristics include wholeness, stability, sincerity, honesty to self and others, suthenticity, and striving for excellence.

2. **Justice**: Justice as fairness focuses on giving each individual what is his or her due. Three senses of justice are (1) the proper, fair, and proportionate use of sanctions, punishments and disciplinary measures to enforce ethical standards (retributive justice), (2) the objective, dispassionate, and impartial distribution of the benefits and burdens associated with a system of social cooperation (distributive justice), (3) an objectively determined and fairly administered compensation for harms and injustices suffered by individuals (compensatory justice), and (4) a fair and impartial formulation and administration of rules within a given group.
3. **Respect**: Respecting persons lies essentially in recognizing their capacity to make and execute decisions as well as to set forth their own ends and goals and integrate them into life plans and identities. Respects underlies rights essential to autonomy such as property, privacy, due process, free speech, and free and informed consent.
4. **Responsibility**: (Moral) Responsibility lies in the ability to identify the morally salient features of a situation and then develop actions and attitudes that answer to these features by bringing into play moral and professional values. Responsibility includes several senses: (1) individuals are responsible in that they can be called upon to answer for what they do; (2) individuals have responsibilities because of commitments they make to carrying out the tasks associated with social and professional roles; (3) responsibility also refers to the way in which one carries out one's obligations (This can range from indifference to others that leads to minimal effort to high care for others and commitment to excellence)
5. **Free Speech**: Free Speech is not an unlimited right. Perhaps the best place to start is Mill's argument in **On Liberty**. Completely true, partially true, and even false speech cannot be censored, the latter because censoring false speech deprives the truth of the opportunity to clarify and invigorate itself by defending itself. Mill only allows for a limitation of free speech based on harm to those at which the speech is directed. Speech that harms an individual (defamatory speech or shouting "fire" in a crowded theatre) can be censored out of a consideration of self-defense, not of the speaker, but of those who stand to be harmed by the speech.
6. **Privacy**: If an item of information is irrelevant to the relation between the person who has the information and the person sho seeks it, then that information is private. Privacy is necessary to autonomy because control over information about oneself helps one to structure and shape one's relations with others.
7. **Property**: According to Locke, we own as property that with which we have mixed our labor. Thomas Jefferson argues that ideas are problematic as property because, by their very nature, they are shared once they are expressed. They are also nonrivalrous and nonexclusive.

Drawing Problems from Embedded Values

- Changes in a STS (e.g., the integration of a new technology) produce value mismatches as the values in the new component conflict with those already existing within the STS. Giving laptops to children produces a conflict between children's safety requirements and the safety features embedded in laptops as designed for adults.
- Changes within a STS can exaggerate existing value conflicts. Using digitalized textbooks on laptop computers magnifies the existing conflict concerning intellectual property; the balance between copyrights and educational dissemination is disrupted by the ease of copying and distributing digitalized media.
- Changes in STS can also lead to long term harms. Giving laptops to children threatens environmental harm as the laptops become obsolete and need to be safely disposed of.

Values Embedded in STS

	Hardware	Software	Physical Surroundings	People, Groups, Roles	Procedures	Laws	Data and Data Structures
Integrity							
Justice							
Respect							
Responsibility for Safety							
Free Speech							
Privacy							
Intellectual Property							

Table 2.11

2.1.8 Using Socio-Technical System Grids for Problem Specification

The activity of framing is a central component of moral imagination. Framing a situation structures its elements into a meaningful whole. This activity of structuring suggests both problems and solutions. Framing a situation in different ways offers alternative problem specifications and solution possibilities. Since skillful framing requires practice, this part of the module suggests how socio-technical system tables can help provide different frames for problem specification and solution generation.

Different Problem Frames

- **Technical Frame**: Engineers frame problems technically, that is, they specify a problem as raising a technical issue and requiring a technical design for its resolution. For example, in the STS grid appended below, the Burger Man corporation wishes to make its food preparation areas more safe. Framing this technically, it would be necessary to change the designs of ovens so they are more accident-proof.
- **Physical Frame**: How can the Burger Man corporation redesign its restaurants as physical facilities to make them more accessible? One way is to change the access points by, say, designing ramps to make restaurants wheel chair accessible. Framing this as a physical problem suggests solutions based on changing the physical structure and arrangement of the Burger Man STS.
- **Social Frame**: Burger Man as a corporation has stakeholders, that is, groups or individuals who have an essential interest at play in relation to the corporation. For example, framing the problem of making Burger Man more safe as a social problem might suggest the solution of integrating workplace safety into worker training programs and conducting regular safety audits to identify embedded risks.
- **Financial or Market-Based Frames**: Burger Man is a for-profit corporation which implies that it has certain financial responsibilities. Consequently, Burger Man should be concerned with how to provide safe, child-proof chairs and tables that do not cut unduly into corporate profits. But like the legal perspective, it is necessary to conduct ethical and social framing activities to compensate for the one-sidedness of financial framing.
- **Managerial Frame**: Many times ethical problems can be framed as managerial problems where the solution lies in changing managerial structures, reporting relations, and operating procedures. For example, Burger Man may develop a specific procedure when a cashier finishes a shift and turns over the cash register and its contents to another cashier. Burger Man may develop cleaning procedures and routines to minimize the possibility of serving contaminated or spoiled food to customers.

- **Legal Frame**: Burger Man may choose to frame its environmental responsibilities into developing effective procedures for complying with OSHAA and EPA regulations. Framing a problem legally certainly helps to identify effective and necessary courses of action. But, because the ethical and social cannot be reduced to the legal, it is necessary to apply other frames to uncover additional risks not suggested by the legal framing.
- **Environmental Framing**: Finally, how does Burger Man look from the environmental standpoint? Does it consider environmental value (environmental health, safety, and integrity) as merely a side constraint to be addressed only insofar as it interferes with realizing supposedly more important values such as financial values? Is it a value to be traded off with other values? (For example, Burger Man may destroy the local environment by cutting down trees to make room for its latest restaurant but it offsets this destruction through its program of planting new trees in Puerto Rican tropical rain forests.) Framing a problem as an environmental problem puts the environment first and sets as a goal the integration of environmental values with other values such as worker safety and corporate profits.

Burger Man Socio-Technical System Table

This media object is a downloadable file. Please view or download it at
<Socio Technical System Grid for Business Ethics.docx>

Figure 2.1: Clicking on this figure will open as a Word file a STS table based on the fictional corporation, Burger Man. Below are a list of problems suggested by the STS analysis.

2.1.9 Media File Uplinks

This module consists of two attached Media Files. The first file provides background information on STSs. The second file provides two sample STS grids or tables. These grids will help you to develop specific STSs to analyze cases in engineering, business, and computer ethics without having to construct a completely new STS for each case. Instead, using the two tables as templates, you will be able to zero in on the STS that is unique to the situation posed by the case. This module also presents background constraints to problem-solving in engineering, business, and computer ethics. These constraints do not differ absolutely from the constituents of STSs. However, they pose underlying constraints that outline the feasibility of an ethical decision and help us to identify obstacles that may arise when we attempt to implement ethical decisions.

Socio-Technical Systems

This media object is a downloadable file. Please view or download it at
<STS_Background_V3.doc>

Figure 2.2: Socio-Technical Systems: Constituents, Values, Problems, and Constraints.

STS Templates

This media object is a downloadable file. Please view or download it at
<STS_Templates.doc>

Figure 2.3: Two STSs, Power Engineering and the Puerto Rican Context of Engineering Practice.

Socio-Technical Environments Table
[Media Object][2]

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2.2 Responsible Choice for Appropriate Technology[3]

2.2.1 I. Introduction

The goal of this module is to help you to think about technology in a different way. We tend to think of technologies as value-neutral tools not good by themselves but only in terms of the uses we put them to. The moral value of the hammer depends on the user and use. It can push nails into wood to build a house or hit someone on the head expressing unjustified anger and aggression against another.

[2]This media object is a downloadable file. Please view or download it at
<STS2.pdf>

[3]This content is available online at <http://cnx.org/content/m43922/1.24/>.

But technologies are more than just value neutral tools. They are enacted in different worlds characterized by our activities, projects, institutions, cultures, and physical environments. At times they become extensions of our hands and feet and are called prosthetics. At other times, when they fail to fulfill the functions we have assigned them, they become obstacles that thwart or oppose our desires. (In the hands of the carpenter, the hammer pounds nails quickly and flawlessly into roof tile while the inexperienced home improver finds it a clumsy tool that bends nails.) Wanda Orlikowski encourages us to think of technologies less as external objects and more as enactments. She presents a case study that shows how a word processing program takes on four very different value colorings as it is enacted in each of four different socio-technical systems. This module is designed to help you to visualize how technologies that shape, magnify, extend, and constrain human activity. (See Orlikowski below.)

Some other goals

In this module you will...

- examine cases where a community exercises technological choice
- practice socio-technical sensitivity by describing the socio-technical system that underlies your group's case
- learn frameworks that guide the choice of appropriate technology
- develop an active understanding of how technologies form one environment alongside other environments that shape, enable, magnify, circumscribe, and constrain human action

2.2.2 II. What you need to know.

Responsibility in the context of technological choice.

Herbert Fingarette in the Meaning of Criminal Insanity (see below) characterizes moral responsibility as (moral) response to (moral) relevance. This means responsibility is a skill that combines two components. First one exercises techno-social sensitivity to uncover those aspects of a situation that have moral relevance. To a person sitting on a crowded bus, of all the things going on, the fact that an older man is awkwardly standing, uncomfortable and holding several boxes, is morally relevant. Picking this out of a complex situation draws upon a sophisticated set of emotional, cognitive, and perceptual skills. Second, having focused on what is morally relevant in a situation, a responsible agent then sets about devising action that is responsive to this relevance. The individual on the crowded bus, in response to the relevance of the man awkwardly standing, stands up and offers him a seat. Socio-technical System description and analysis provide a formal way of uncovering moral relevance in a concrete situation. This module will give you an opportunity to practice this skill. The value realization framework laid out in this module(see Flanagan, Howe, and Nissenbaum below), provides a structure for using value realization as a response to relevance. This part of the module will get you thinking about how to develop value realizing actions that respond to the relevance uncovered in STS description. See Harris below for a description of techno-socio sensitivity that falls in nicely with the account of moral responsibility as response to relevance.

Understanding appropriate technological choice requires that you learn a basic vocabulary. This section presents short, informal descriptions of "appropriate," "technology," "capability," "social construction of technology," and "technological determinism." At the end, you will find a media file for a Jeopardy to help you learn these terms.

Technology

Technology: As was said in the previous section, a technology is more than just a physical object. It is a device activated within a network of social relations called a socio-technical system. (See below for more on socio-technical systems or STSs.) Technologies are much more than value neutral tools; a technological object or artifact can become an extension of the human body, a prosthesis, that magnifies, focuses, intensifies, shapes, channels, and constrains human actions and activities. Taken by themselves they are incomplete and indeterminate; enacted within a socio-technical system, they accomplish human activities.

Socio-Technical System

Socio-technical System. Determining whether a technology is appropriate requires close attention to the socio-technical background which forms a system, a "complex environment of interacting components, to-

gether with the networks of relationships among them." According to Huff, a socio-technical system is "an intellectual tool to help us recognize patterns in the way technology is used and produced." For example, Huff has his computing students write "Social Impact Statements" to outline the impact a computing technology would have on the socio-technical system (STS) in which it is being integrated. Students triangulate their impact claims through day-in-the-life scenarios, participatory observation, and surveys; any claim made on the impact of a technology has to be substantiated through three different methods of observation (in private conversations).

Socio-technical systems, thus, exhibit several characteristics.

- STS analysis helps us understand how occupational and professional practice is shaped and constrained by different surrounding environments.
- Socio-technical systems are first and foremost systems. While they are composed of discrete parts, these are embedded in a network of relations and interact with one another. Hence, STS description requires systemic or ecological thinking; a STS must be approached as a whole which is not reducible to the sum of its parts
- The different components of a STS can include hardware, software, physical surroundings, people/groups/roles, procedures, laws/statutes/regulations, and information systems. This list of distinguishable components varies according to context and purpose. These distinguishable components are, nevertheless, inseparable from one another. Repeating the previous point, *STSs are, first and foremost, systems.*
- STSs *embody or embed values.* This makes it possible to prepare Social Impact Statements that identify and locate embedded values, chart out potential conflicts, and recommend system adjustments to remediate these. STS analysis, thus, adds a dimension to the determination of the appropriateness of a given technology by raising the question of whether its incorporation into a specific STS leads to value conflicts or resolves value vulnerabilities.
- STSs *change* due to internal value issues as well as issues stemming from their interactions with other STSs. STS changes are directional in that they trace out trajectories or paths of change. Thus, another test of appropriate technology is whether its integration into a STS places that system on a *positive or negative trajectory of change.*
- To repeat a point made just above, STS analysis employs *systems or ecological thinking.* Just as important as the properties of the parts that compose a socio-technical system are the relations between these parts and the ways in which they interact. These relations and interactions give rise to properties that STSs as wholes display but which cannot be found when analyzing the constituent parts in isolation from one another. Another way of putting this is that STSs require holistic think that is markedly different from what sociologists call "methodological individualism."
- Werhane et al. in Alleviating Poverty provide an insightful account of systems and systems thinking. They see this as necessary in building and analyzing alliances between stakeholders devoted to diminishing poverty.

Appropriate Technology

Appropriate Technology. The term "appropriate technology" comes from economist E. F. Schumacher and plays a prominent role in his book, *Small Is Beautiful.* For Schumacher, an *appropriate* technology is an *intermediate* technology which stands between the "indigenous technology of developing countries" and the "high capital intensive technology" of developed countries. Appropriate technology represents a step or a bridge that moves a community cautiously and continuously toward a developmental goal.

Thus, intermediate technology is *appropriate* in the sense that it reduces or eliminates the harmful impacts of moving too quickly from indigenous, labor intensive technology to high capital intensive technology. Technology that is appropriate to orderly, sustainable, and humane development ...

- gives "special consideration...to context of use, including environmental, ethical, cultural, social, political, and economical aspects";
- seeks simplicity as opposed to (manifest or latent) complexity;

- chooses decentralization because it is more orderly, sustainable, and human than authoritarian centralization;
- employs labor intensive as opposed to capital intensive strategies;
- addresses itself to the unique characteristics of the surrounding community
- This description of appropriate technology quotes directly from Wikipedia and from Schumacher. See below.

Capabilities or Human Development Approach

The Capabilities or Human Development Approach: Technologies need to be evaluated within the context of human projects, communities, and activities. In particular, they should be evaluated in terms of whether they promote or frustrate a life of dignity that can be spelled out in terms of substantial freedoms that Amaryta Sen and Martha Nussbaum term *capabilities*. Sen and Nussbaum argue that a given capability, say bodily health, can be realized in different ways. The specific way a capability is realized is called its functioning. Resoures (personal, social, and natural) that help turn capabilities into functionings are called conversion factors. (A bicycle is a physical conversion factor that (under favorable conditions such as roads with decent surfaces) turn the capability of bodily integrity into movement from home to work.)

The Capabilities Approach changes the way we view developing communities and their members, replacing the view of developing communities as beset with needs and deficiencies with the view that they are repositories of valuable capabilities. Humans should strive to shape and reshape the surrounding socio-technical system to bring about the exercise and expression of fundamental human capacities. According to Nussbaum, capabilities answer the question, "What is this person able to do or be?" Nussbaum and Sen characterize capabilities as "'substantial freedoms,' a set of (causally interrelated) opportunities to choose and act. [T]hey are not just abilities residing inside a person but also freedoms or opportunities created by a combination of personal abilities and the political, social, and economic environment." The Capabilities Approach, thus, adds depth to appropriate technology by providing criteria for choice; a technology derives its "appropriateness" from how it resonates with basic human capabilities and more specifically by whether it provides "conversion factors" that transforms basic capabilities into active functionings.

Nussbaum's List

Nussbaum discusses the capabilities approach in several works most notable of which are Frontiers in Justice and Creating Capabilities. Sen lays out his version in several publications. **Development as Freedom** is referenced below. Finally, Robeyns discusses conversion factors in an article in the Standford Encyclopedia referenced below.

Basic Capabilities

- **Life**
- **Bodily Health**
- **Bodily Integrity**
- These capabilities overlap with basic rights. But the capability approach moves beyond the rights perspective by exploring the social and community-based dimensions of human agency; rights on the other hand are more individualistic. (See Werhane on this.) Bodily Integrity would include, for example, freedom from marital rape and the ability to move about freely within one's own country.

Cognitive Capabilities

- **Sense, Imagination, Thought**
- **Emotion**
- **Practical Reason**
- **Note**: Nussbaum's description of cognitive experience is richer than that allowed through the concept of homo economicus (the economic human) avowed by economical theory. (Homo economicus is driven by a narrow view of rational self-interest.) Emotions incorporate judgment, and practical reason overlaps with the autonomous ability to formulate and carry out thoughtfully life plans. Imagination and sensation are not separate from the knowing and cognitive faculties as they are, say, for Kant but

closely connected with these as they are in the ethical theory of Aristotle. Full exercise of thought, sensation, and imagination could occur in aesthetic expression or religious experience. We explore emotions imaginatively through literature, drama, and cinema.

Social or Out-Reaching Capabilties

- **affiliation**: This capability allows forming alliances with others such as friendships and collegial workplace relations. This would include the capability to form associations such as a church, an NGO, or a political interest group.
- **Other Species**: Here Nussbaum is setting forth the rudiments of an environmental ethics where nature as a whole and the individuals within nature place constraints on human action. But, rather than formulating this traditionally in terms of the extension of utilitarianism or deontology, Nussbaum sees our ability to commune with nature as a necessary constituent of a life of human dignity or human flourishing.

Agent-Based Capabilities

Control Over One's Environment
Play
The capability of play is deformed by child labor. Adam Smith, for example, comes out strongly against child labor in his economic theory and advocates strong government intervention to protect this capability. Childhood labor prevents children from reaping the developmental and psychological benefits of play. This capability militates directly against the idea that play is isolated and does not contribute to the formation of other cognitive and practical abilities such as emotion, thought/sensation/imagination, or practical reason. On the other hand control over one's environment works directly against such poverty traps as uninsurable risk, lack of working capital, non-workable property practices, etc. See Stephen Smith below.

Capabilities lists vary. Nussbaum allows that others have different lists and that hers will certainly be modified as time passes and conditions change. Insofar as a technology plays the role of a **conversion factor** that transforms a capability into a functioning, then it is—-in the humanistic sense of the term—-appropriate. On the other hand, insofar as it thwarts capabilities and suppresses their expression it fails the test of appropriateness. When business and engineering professionals take a Human Development approach to their work, they broaden the design process and the development of new products and services to include a close examination of how the proposed novelty can either encourage or diminish the conversion of capabilities into functionings.

An advantage of the Capabilities or Human Development Approach over other approaches such as social contract theories of justice lies in its ability to extend the umbrella of justice to cover three challenges that have traditionally been ignored:

1. The capabilities and ranges of action of humans operating under physical and cognitive disabilities
2. Human individuals who have been born and live in nations of poverty, economic inequality, political oppression, and demeaning work and social roles and stations. In her book, *Creating Capabilities*, Nussbaum profiles a woman who is abused by her alcoholic husband, works longs hours in a demeaning job and returns home to the domestic responsibilities of being the primary care-giver to a family of four.
3. Natural ecosystems as well as natural species including domesticated animals, wild animals, and the entities that populate the natural environment.

Social Construction of Technology
This branch of technology studies provides insight into how technologies are socially constructed. Pinch and Bijker provide a case history of how the current bicycle design emerged from a social process of construction. In an initial stage of "interpretive flexibility," users interacted with different designs as they negotiated in

public space whether bicycles were for leisure, racing, touring, basic transportation, or sporting activities. As design variations were set aside and user goals and interests focused, this stage of interpretive flexibility narrowed and closed. In the final stage, a dominating design emerges that serves as a black box. With interpretive flexibility a thing of the past, the black box, the dominant design, takes on the appearance of inevitably; it captures the meaning of bicycle that was earlier up for grabs. (Pinch and Bijker discuss social constructionism in their paper referenced below. This can be easily found in the Johnson and Wetmore anthology, Technology and Society. This account builds on their discussion of the process of social construction: interpretive flexibility, closing of interpretive flexibility, and technological black box.)

The paper "Manufacturing Gender in Commercial and Military Cockpit Design," argues that it was necessary to reopen the black box of airplane cockpit design to reveal its instantiation of gender bias. Women were unable to fly airplanes because airplanes were not designed to accommodate their arm and leg reach, physical strength, height, and weight. This gender bias could only be removed through the restoration of interpretive flexibility. The gender biased design of airplane cockpits had to be revealed as a contingency rather than as a necessity.

Interpretive flexibility relies on an imaginative attitude that Steven Winter terms "transperspectivity." Designers must first "unravel or trace back the strands by which our constructions weave our world together" then "imagine how the world might be constructed differently." The capabilities approach compliments social construction of technology in that it asks how background social conditions can be changed to facilitate the realization of capabilities. Instead of forcing women to conform to inappropriate cockpit design, we ask how cockpit design can be reworked to facilitate the realization of the capability of women to fly planes.

Technological Determinism

Technological Determinism is the opposite of social construction. Where the position of social construction argues that society constructs or determines technology, the position of technological determinism argues that technology constructs or determines the dominant forms of social interaction. While Langdon Winner is not a technological determinist, he lays out a terminology that dramatizes how technologies can cease to function as tools and, instead, take on the role of centers of concentrated power that dictate social forms and relations. Technologies create their own imperatives, that is, they assert their requirements as needs that demand fulfillment if we are to continue their functioning. These technological imperatives create the need for reverse adaptations. Instead of our designing and modifying technologies to fit our needs (technologies serve us), we set aside our needs and adapt ourselves to serving the requirements of complex technologies (we serve technologies). Winner discusses the technological imperative and reverse adaptability in Autonomous Technology. Larry Hickman provides an excellent summary of Winner's approach in John Dewey's Pragmatic Technology.

Questions for assessing the appropriateness of a technology

1. *Does the technology in question play the role of a conversion factor that changes capabilities into active functionings?* (Conversion factors are a bit like resources or means and can be personal, social, or environmental: see Robeyns) Review the ten capabilities outlined by Nussbaum. Does the technology in question help to realize a capability in the STS of your case? Which one? How? On the other side, does the technology threaten to thwart the realization of a capability? Which one? How?
2. *Does the technology in question embrace simplicity and avoid (manifest or latent) complexity?* The more complex a technology, the harder it is to control. As technologies become more complex they take on lives of their own. So one way of approaching this question is to assess the complexity of technology in terms of the background STS. Manifest complexity lies in the complexity that is obvious. Latent complexity is a negative factor in the appropriateness of a technology because latent complexity can often lead to unpredictable breakdowns and accidents.
3. *Does the technology embody a decentralized approach to control, one that disperses control over many localized centers or does it telescope control in one, centralized powerful locale?* Amish communities do not reject electricity per se but refrain from hooking up to power grids maintained by large public utilities in part because of this issue. As a general rule, a technology is more appropriate when it can be instantiated and managed through decentralized points of control rather than through large, bureaucratic, authoritarian centralized points of control and management. Windmills would be prefer-

able on this criterion to nuclear reactors because the latter are subject to catastrophic failures; this requires the exercise of tight managerial controls better brought through centralized and concentrated points of control and management.

4. *Does the technology realize or protect values (or resolve value conflicts) in such a way as to put the STS on a value-positive trajectory?* This, more than any of the other criteria of technological choice, requires holistic thinking. Bringing a technology into a STS should require mutual adjustment. How will the STS have to be adjusted to incorporate the technology with the minimum number of value issues (value vulnerabilities or value conflicts)? Will these adjustments place the STS on a value-positive trajectory? On the other hand, how malleable is the technology? (This is something you have already begun to answer as you looked at the technology's complexity and centralization.) If malleable, it can be adopted to the surrounding STS. If not, then the problem of reverse adaptation arises.
5. *Does the technology provide for a just distribution of relevant costs and benefits? Technologies create benefits and costs.* Utilitarianism argues that the only relevant factor is the ratio of benefits to costs; if benefits are maximized and costs minimized, the utilitarianism enjoins that we adopt the technology. This criteria provides an important caveat; not must benefits be maximized and costs minimized but benefits and costs must be broadly and equitably distributed among the stakeholders. Net benefit maximization often stands side by side with massive inequities in the distribution of costs and benefits; everybody benefits from cheaper gas prices made possible by the refinery located near a lower class neighborhood. But those living next to the refinery bear the brunt of the costs if the gas is made cheap by sacrificing pollution controls.

2.2.3 III. What you are going to do.

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In this section, you will learn about five cases of technological choice. You and your group will be assigned a case and will carry out a series of exercise in relation to it. Specifically you will...

1. Learn about your case by reading the article on which it is based and discussing it with other members of your group.
2. Describe your technology: (a) Identify its key features; (b) Provide a history of its social construction; (c) Identify its competitors. (Think about the racing versus safety models of the early bicycle)
3. Prepare a socio-technical description of your case: (a) Identifies it major components. Start with hardware, software, physical surroundings, stakeholders, procedures, laws, and information systems. Add or subtract as required by the particularities of your STS. (b) Describe each component in detail (c) Provide a table that summarizes your description
4. Assess your case's technology using the questions on appropriate technological choice presented in the previous section
5. Draw conclusions about the instances of technological choice portrayed in your case. Is it appropriate or inappropriate? Explain your group's position.
6. Prepare a poster summarizing your group work and present it to the class
7. Listen carefully to the presentations of the other groups in your class

2.2.4 IV. Cases of Responsible Choice of Appropriate Technologies

A. Technological Choice in Amish Communities

- "Amish Technological Choice: Reinforcing Values and Building Commitments" by Jamison Wetmore
- How do the Amish choose and modify technology so that it is compatible with community values and supports community ways of life

- Values: Amish values are centered around the community's Orduung. In general, Amish evaluate technologies in terms of the values of humility, equality, simplicity, and community. (See Wetmore)
- Examples: (a) Using power tools with rechargeable batteries to work around the need to connect to Electric company power grids; (b) Refraining from plugging into the grid of public utilities; (c) Purchasing cars and phones but restricting ownership to the community and use to business purposes; (d) Negotiating accommodations on government regulations so as to minimize impacts on community values and ways of life. (Example of not delivering milk on Sundays); (e) Securing community and individual identity by drawing, through technological choice, contrasts with the outside, surrounding, English community.

B. Removing Gender Bias from Airplane Cockpit Design

- "Manufacturing Gender in Commercial and Military Cockpit Design" by Rachael Weber
- This case describes the process of changing the design of airplane cockpits to remove gender bias.
- Values: (a) gender parity and equality; (b) respect (recognizing capabilities of women and designing airplanes around these capabilities); (c) justice in the form of an equitable distribution of the role and the benefits and burdens attached to the role of airplane pilots
- Article describes changes in the STS: (a) Norms: how do changes in society's norms help facilitate the redesign of airplanes and the cockpits? (b) Laws: how did changes in laws and regulations help uncover the gender bias in designs and spur the development of new designs that removed this gender bias? (c) Markets: The initial reaction of airplane manufacturers and consumers was that this would make airplanes prohibitively expensive. What changes in the market or financial context averted this threat? (d) Architecture: How did changing the JPATS help to solve this problem?

C. Uchangi Dam

C. Honest Brokering in India

- "People's Science in Action: The Politics of Protest and Action" by Pradkhe
- Retired engineers working with NGOs in India help resolve a 14 year standoff between the Indian government and villagers in Chafawade and Jeur. The engineers carried out detailed studies into the STS surrounding these villagers including land use mappings. They were able to formulate plans for a different irrigation system that had less impact on these communities but still delivered the basic functions of an irrigation project.
- Values: (a) Responsibility: Shift design responsibility from a bureaucratic government agency to local communities empowered by work with NGO engineers; (b) Justice: Develop and design an alternative irrigation project that bettered distributed harms and benefits of irrigation among all the stakeholders; (c) Community Solidarity: Use government challenge as an opportunity to discover community values and give these voice through locally organized resistance and value responsive engineering plans
- Technologies: (a) Replace single large scale dam with several smaller dams; (b) Relocate water storage sites away from Chafawade and Jeur; (c) Redistribute and spread both the benefits and harms associated with the Uchangi dam and irrigation project. (d)Reconstruct the stakeholder alliance to represent better the interests of small villages in this region of India

D. Rapunsel: Designing Value into Educational Software

- M. Flanagan, D. Howe, and H. Nissenbaum, "Embodying Values in Technology: Theory and Practice," in *Information Technology and Moral Philosophy*, Jeroen van den Hoven & John Weckert, Eds. Cambridge, UK: Cambridge University Press, 2008, pp. 322-353.

- Educators in software development notice that there is a shortage of women programmers. Further investigation reveals that part of the problem is the gender bias inherent in software development including pedagogical materials (educational software) that is biased toward male and against female students. Educational specialists develop new educational software called Rapunsel that is geared

toward computer programming to girls. Developers enact a value realization process that includes the discover of key values, their translation of these values into a design prototype that operationalizes and implements these values in software, and a rigorous process to verify that the design in question actually realizes these values.

- Framework: (a) Discover by examining project definition, design features, designer values, user values including the values inherent in "subversive uses" (b) Translation that includes the operationalization of values in a design and their implementation in a concrete STS; (c) Verification brought about through the triangulation of methods of participatory observation that include questionnaires, interviews, and day-in-the-life-scenaios
- Values: (a) Project Definition: social and civil interaction, privacy, security, equity; (b) Design features: social and civil interaction, cooperativeness, fair and equitable representation; (c) Designer Values: diversity, distributive justice, gender equity; (d) User values: self-expression, authorship, collaboration
- Examples: (a) Educational software to teach girls computer programming; (b) Enacted in the form of a game environment; (c) Modified in light of participatory observation and "subversive uses"

E. One Laptop Per Child

- Kenneth L. Kraemer, Jason Dedrick, and Prakul Sharma. "One Laptop Per Child: Vision versus Reality." Communications of the ACM. June 2009, Vol. 52, No. 6: 66-73
- This case explores the challenges of implementing a laptop computer designed as an educational tool for children in developing nations. Laptops are chosen because, in the minds of the designers, they can deliver the tools of education in one convenient package. They present and create modes of interacting with educational software; they provide a convenient way of storing and displaying reading material and promise to replace traditional printed media; they create an environment where students can learn writing working through word processing media. And the innovation of the XO laptop is that it has been designed for use by children in areas that lack infrastructure for other, traditional educational media.
- Values: (a) Distributive Justice. XO laptops, because they are cheap and linked with sponsorship by developed world institutions, promise to reduce the digital divide by giving children (and their families) in developing nations access to computers, the Internet, and all the information that the two can bring. (b) Realizing Capabilities. XO laptops can play the role of conversion factors transforming the following capabilities into functionings: Sense, imagination, and thought; Emotion; Practical Reason; Affiliation; Play
- Examples: (a) Fedora Linux Operating System; (b) WiFi access to Internet; (c) Hand cranks to recharge batteries. XO laptops are designed to operate in zones where there is no or insufficient electricity; (d) No drives. Relying on less sophisticated operating system software reduces the demand for storage capacity. (Given Internet access, many storage needs can be delegated to the Internet.) This further simplifies the system and makes it unnecessary to install a hard drive. (e) Designed for children. Hard, durable plastic casing and keyboards shaped for children's hands

F. Case for Waste for Life

- This case studies a press that produces building materials made from waste products and plant fibers.
- One chapter examines the integration of this technology into Lesotho.
- The other chapters look at the STS in Buenos Aires, Argentina and how it constrains the integration of similar technology there.
- This case study is available to UPRM students through the university's library. It is a part of the Morgan and Claypool series found in the section on electronic books.
- Complete Bibliographical Reference: C. Baillie, E. Feinblatt, T. Thamae, and E. Berrington. (2010). **Needs and Feasibility: A Guide for Engineers in Community Projects–The Case for Waste for Life**. Morgan and Claypool.

G. Aprovecho

- Aprovecho is a non-profit organization that specializes in stoves for developing nations.
- Respiratory disease from the pollution from stoves used indoors is a major cause of death for children under 5 years old in developing nations.
- Aprovecho is considering setting up a regional center for testing and distributing stoves in Puerto Rico.
- Are these stoves an appropriate technology for PR or even parts of PR?
- Be sure to listen to the NPR story on Aprovecho and the NPR series on Social Entrepreneurship
- Link given above: http://www.aprovecho.org/lab/index.php

2.2.5 V. Case Table

This table updates the technology choice cases used in this module.
Technology Choice Cases

Technology Choice Cases

	Description	Capabilities	Technology choice Issues	Puerto Rico Pivot(s)
One Laptop Per Child	Distributing laptops to school children in developing nations	Affiliation, play and practical reason	For or not for profit?	Laptops to PR public school children--Would it work?
Amish TC	How Amish use community values to choose and modify technologies	Emotion, affiliation, Thought Practical reason Control over env.	Not anti-tech; adopt and adapt using community values	Consider citizens of Vieques and whether they should allow windmill farms.
Gender Bias in Airplane Design	Redesigning airplane cockpits for women pilots	Control over one's environment	Going from women can't fly to planes are badly designed for women pilots	Are there designs in Puerto Rico that exhibit gender bias?
Bamboo	Using bamboo grown in PR as construction material	Other species, control over one's environment	Appropriateness and conversion of natural artifacts into technical	Creating a resource that is locally grown, harvested, and used
Biosand Filters in Haiti	Teaching people in Haiti how to use biosand filters to clean water	Health, bodily movement, affiliation	Using modern knowledge, simple artifacts, decentralization and other AT criteria	Lessons of community development and decentralization
Uchangi Dam	NGO engineers resolve a dispute between local communities and big government	Affiliation, bodily movement, control over env	NGO professionals as honest brokers in technological choice	Using values mapping to build local relevance into engineering designs
Aprovecho	Designing stoves to alleviate problems of indoor smoke and deforestation	Health, other species	Participation of local community in design of technical artifact	Listening to users and communities: an Inverse Peace Corps
Waste For Life	Using a hot press to recycle plastic in Argentina and Lesotho	Health, other species, cont. over env.	Same artifact, different STS, different results	The influence of surrounding environments on technical functioning

2.2.6 VI. Instructions for Poster Session

In this activity you will carry out the following tasks:

1. Read carefully the article that presents your case study in technological choice. Prepare an outline.
2. Prepare a poster that discusses your case in terms of the following framework.
3. **Zoom in**. Describe and classify the artifact that highlights your case. Give its physical structure, how it functions when it is working properly, and its "user manual."
4. **Zoom out**. Describe the socio-technical system that surrounds your artifact by constructing a table that outlines hardware, software, physical surroundings, people/groups/roles, procedures, laws, and

information systems. Pay special attention to how the surrounding STS constrains and enables the functioning of your technical artifact.

5. **Discuss/Evaluate how "appropriate" your technical artifact is to its surrounding environment.** Is it "supportive of production by the masses," does it make use of the "best of modern knowledge and experience," does it trend toward "decentralization," does it fit in with the "laws of ecology," is it "gentle in the use of scarece resources," and does it serve human rather than constrain humans to serve it."
6. How does your technical artifact stand in relation to Nussbaum's list of **capabilities**? Most importantly, does it serve as a tool to address personal, social, and environmental conversion factors that help convert capabilities into functionings?

Close-out Writing Assignment

1. Choose a technical artifact from another group's poster. (Not the one prepared by your group.)
2. In one or two sentences, describe what is happening when the technology is fully functioning. This is called **"zooming in."**
3. Next, choose the two elements of the surrounding socio-technical system that most effect this technical artifact and its functioning. For example, the lack of electricity in communities in Zimbabwe have a strong impact on whether and how podcast broadcasts will take place.This focusing on the socio-technical system will help you to **"zoom out."**
4. Choose a capability from Nussbaum's list that is pertinent to the technical artifact you have chosen. Does this artifact serve as a conversion factor that converts the capability into a specific functioning? What personal or environmental factors could effect this conversion?
5. Formulate a test question (multiple choice format) that you think would arise from this group's poster and their technology choice case.
6. Zooming in and zooming out comes from Ilse Oosterlaken and can be found in **The Capability Approach, Technology and Design**, Ilse Oosterlaken and Jeroen van den Hoven, eds. New York: Springer, 2012.

2.2.7 VII. What have you learned?

- Technological choice is as much a skill as a set of concepts that you learn. This module has given you the opportunity to practice frameworks of technological choice in the context of real world cases. To help you capture what you have learned, reflect on the following questions:
- How does practicing technological choice help us to see technologies less as isolated objects and more as enactments?
- Using your case and the cases presented by the other groups in class in what sense and to what extent is the nature and structure of technology determined or constituted by social structure?
- Again, working with the cases studied in the module, under what conditions can technologies escape our control and, in turn, control us?
- What are the features and uses of a good, concrete STS description?

2.2.8 VIII. Jeopardy for Responsible Technological Choice

These exercises using the format of Jeopardy will help you learn the vocabulary of responsible technological choice. Click on the media file and download the Jeopardy as a PowerPoint. To play the game, simply put the PowerPoint in presentation mode. Several of the slides also have links to information slides that explain further the relation between question and answer.

Socio-Technical Systems in Incident at Morales

[Media Object][4]

[4]This media object is a downloadable file. Please view or download it at <Jeopardy_STS_IM.pptx>

More Jeopardy on Socio-Technical Systems
[Media Object][5]
Cases of Responsible Technological Choice
[Media Object][6]
Presentation: Training responsible agents for global contexts
[Media Object][7]
Technology Choice Jeopardy
[Media Object][8]
Socio-Technical Systems, Technology, and Human Capabilities
[Media Object][9]
STS PowerPoint
[Media Object][10]
Writing Cases Pesentation
[Media Object][11]
Technology Choice Presentation
[Media Object][12]

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Chapter 3

Ethical Decision Making in Engineering

3.1 Three Frameworks for Ethical Decision Making and Good Computing Reports[1]

3.1.1 Module Introduction

In this module you will learn and practice three frameworks designed to integrate ethics into decision making in the areas of practical and occupational ethics. The first framework divides the decision making process into four stages: problem specification, solution generation, solution testing, and solution implementation. It is based on an analogy between ethics and design problems that is detailed in a table presented below. The second framework focuses on the process of solution testing by providing four tests that will help you to evaluate and rank alternative courses of action. The reversibility, harm/beneficence, and public identification tests each "encapsulate" or summarize an important ethical theory. A value realization test assesses courses of action in terms of their ability to realize or harmonize different moral and nonmoral values. Finally, a feasibility test will help you to uncover interest, resource, and technical constraints that will affect and possibly impede the realization of your solution or decision. Taken together, these three frameworks will help steer you toward designing and implementing ethical decisions the professional and occupational areas.

Two online resources provide more extensive background information. The first, www.computingcases.org, provides background information on the ethics tests, socio-technical analysis, and intermediate moral concepts. The second, http://onlineethics.org/essays/education/teaching.html, explores in more detail the analogy between ethics and design problems. Much of this information will be published in Good Computing: A Virtue Approach to Computer Ethics, a textbook of cases and decision making techniques in computer ethics that is being authored by Chuck Huff, William Frey, and Jose A. Cruz-Cruz.

3.1.2 Problem-Solving or Decision-Making Framework: Analogy between ethics and design

Traditionally, decision making frameworks in professional and occupational ethics have been taken from rational decision procedures used in economics. While these are useful, they lead one to think that ethical decisions are already "out there" waiting to be discovered. In contrast, taking a design approach to ethical decision making emphasizes that ethical decisions must be created, not discovered. This, in turn, emphasizes the importance of moral imagination and moral creativity. Carolyn Whitbeck in Ethics in Engineering Practice and Research describes this aspect of ethical decision making through the analogy she draws between ethics and design problems in chapter one. Here she rejects the idea that ethical problems are multiple choice problems. We solve ethical problems not by choosing between ready made solutions given with the situation;

[1] This content is available online at <http://cnx.org/content/m13757/1.23/>.

rather we use our moral creativity and moral imagination to design these solutions. Chuck Huff builds on this by modifying the design method used in software engineering so that it can help structure the process of framing ethical situations and creating actions to bring these situations to a successful and ethical conclusion. The key points in the analogy between ethical and design problems are summarized in the table presented just below.

Analogy between design and ethics problem-solving	
Design Problem	Ethical Problem
Construct a prototype that optimizes (or satisfices) designated specifications	Construct a solution that integrates and realizes ethical values (justice, responsibility, reasonableness, respect, and safety)
Resolve conflicts between different specifications by means of integration	Resolve conflicts between values (moral vs. moral or moral vs. non-moral) by integration
Test prototype over the different specifications	Test solution over different ethical considerations encapsulated in ethics tests
Implement tested design over background constraints	Implement ethically tested solution over resource, interest, and technical constraints

Table 3.1

3.1.3 Software Development Cycle: Four Stages

(1) problem specification, (2) solution generation, (3) solution testing, and (4) solution implementation.

3.1.4 Problem specification

Problem specification involves exercising moral imagination to specify the socio-technical system (including the stakeholders) that will influence and will be influenced by the decision we are about to make. Stating the problem clearly and concisely is essential to design problems; getting the problem right helps structure and channel the process of designing and implementing the solution. There is no algorithm available to crank out effective problem specification. Instead, we offer a series of guidelines or rules of thumb to get you started in a process that is accomplished by the skillful exercise of moral imagination.

For a broader problem framing model see Harris, Pritchard, and Rabins, **Engineering Ethics: Concepts and Cases,** 2nd Edition, Belmont, CA: Wadsworth, 2000, pp. 30-56. See also Cynthia Brincat and Victoria Wike, **Morality and Professional Life: Values at Work**, New Jersey: Prentice Hall, 1999.

Different Ways of Specifying the Problem

- Many problems can be specified as disagreements. For example, you disagree with your supervisor over the safety of the manufacturing environment. Disagreements over facts can be resolved by gathering more information. Disagreements over concepts (you and your supervisor have different ideas of what safety means) require working toward a common definition.
- Other problems involve conflicting values. You advocate installing pollution control technology because you value environmental quality and safety. Your supervisor resists this course of action because she values maintaining a solid profit margin. This is a conflict between a moral value (safety and environmental quality) and a nonmoral value (solid profits). Moral values can also conflict with one another in a given situation. Using John Doe lawsuits to force Internet Service Providers to reveal the real identities of defamers certainly protects the privacy and reputations of potential targets of defamation. But it also places restrictions on legitimate free speech by making it possible for powerful wrongdoers to intimidate those who would publicize their wrongdoing. Here the moral values of privacy

and free speech are in conflict. Value conflicts can be addressed by harmonizing the conflicting values, compromising on conflicting values by partially realizing them, or setting one value aside while realizing the other (=value trade offs).

- If you specify your problem as a disagreement, you need to describe the facts or concepts about which there is disagreement.
- If you specify your problem as a conflict, you need to describe the values that conflict in the situation.
- One useful way of specifying a problem is to carry out a stakeholder analysis. A stakeholder is any group or individual that has a vital interest at risk in the situation. Stakeholder interests frequently come into conflict and solving these conflicts requires developing strategies to reconcile and realize the conflicting stakes.
- Another way of identifying and specifying problems is to carry out a socio-technical analysis. Socio-technical systems (STS) embody values. Problems can be anticipated and prevented by specifying possible value conflicts. Integrating a new technology, procedure, or policy into a socio-technical system can create three kinds of problem. (1) Conflict between values in the technology and those in the STS. For example, when an attempt is made to integrate an information system into the STS of a small business, the values present in an information system can conflict with those in the socio-technical system. (Workers may feel that the new information system invades their privacy.) (2) Amplification of existing value conflicts in the STS. The introduction of a new technology may magnify an existing value conflict. Digitalizing textbooks may undermine copyrights because digital media is easy to copy and disseminate on the Internet. (3) Harmful consequences. Introducing something new into a socio-technical system may set in motion a chain of events that will eventually harm stakeholders in the socio-technical system. For example, giving laptop computers to public school students may produce long term environmental harm when careless disposal of spent laptops releases toxic materials into the environment.
- The following table helps summarize some of these problem categories and then outlines generic solutions.

Problem Type	Sub-Type	Solution Outline		
Disagreement	Factual		Type and mode of gathering information	
	Conceptual		Concept in dispute and method for agreeing on its definition	
Conflict	Moral vs. Moral	Value Integrative	Partially Value Integrative	Trade Off
	Non-moral vs. moral			
	Non-moral vs. non-moral			

continued on next page

Framing	Corruption Social Justice Value Realization	Strategy for maintaining integrity	Strategy for restoring justice	Value integrative, design strategy
Intermediate Moral Value	Public Welfare, Faithful Agency, Professional Integrity, Peer Collegiality	Realizing Value	Removing value conflicts	Prioritizing values for trade offs

Table 3.2

Instructions for Using Problem Classification Table

1. Is your problem a conflict? Moral versus moral value? Moral versus non-moral values? Non-moral versus non-moral values? Identify the conflicting values as concisely as possible. Example: In Toysmart, the financial values of creditors come into conflict with the privacy of individuals in the data base: financial versus privacy values.
2. Is your problem a disagreement? Is the disagreement over basic facts? Are these facts observable? Is it a disagreement over a basic concept? What is the concept? Is it a factual disagreement that, upon further reflection, changes into a conceptual disagreement?
3. Does your problem arise from an impending harm? What is the harm? What is its magnitude? What is the probability that it will occur?
4. If your problem is a value conflict then can these values be fully integrated in a value integrating solution? Or must they be partially realized in a compromise or traded off against one another?
5. If your problem is a factual disagreement, what is the procedure for gathering the required information, if this is feasible?
6. If your problem is a conceptual disagreement, how can this be overcome? By consulting a government policy or regulation? (OSHA on safety for example.) By consulting a theoretical account of the value in question? (Reading a philosophical analysis of privacy.) By collecting past cases that involve the same concept and drawing analogies and comparisons to the present case?

If you are having problems specifying your problem

- Try identifying the stakeholders. Stakeholders are any group or individual with a vital interest at stake in the situation at hand.
- Project yourself imaginatively into the perspectives of each stakeholders. How does the situation look from their standpoint? What are their interests? How do they feel about their interests?
- Compare the results of these different imaginative projections. Do any stakeholder interests conflict? Do the stakeholders themselves stand in conflict?
- If the answer to one or both of these questions is "yes" then this is your problem statement. How does one reconcile conflicting stakeholders or conflicting stakeholder interests in this situation?

Framing Your Problem

- We miss solutions to problems because we choose to frame them in only one way.
- For example, the Mountain Terrorist Dilemma is usually framed in only one way: as a dilemma, that is, a forced decision between two equally undesirable alternatives. (Gilbane Gold is also framed as a dilemma: blow the whistle on Z-Corp or go along with the excess polution.)
- Framing a problem differently opens up new horizons of solution. Your requirement from this point on in the semester is to frame every problem you are assigned in at least two different ways.
- For examples of how to frame problems using socio-technical system analysis see module m14025.
- These different frames are summarized in the next box below.

Different Frames for Problems

- **Technical Frame**: Engineers frame problems technically, that is, they specify a problem as raising a technical issue and requiring a technical design for its resolution. For example, in the Hughes case, a technical frame would raise the problem of how to streamline the manufacturing and testing processes of the chips.
- **Physical Frame**: In the Laminating Press case, the physical frame would raise the problem of how the layout of the room could be changed to reduce the white powder. Would better ventilation eliminate or mitigate the white powder problem?
- **Social Frame**: In the "When in Aguadilla" case, the Japanese engineer is uncomfortable working with the Puerto Rican woman engineer because of social and cultural beliefs concerning women still widely held by men in Japan. Framing this as a social problem would involve asking whether there would be ways of getting the Japanese engineer to see things from the Puerto Rican point of view.
- **Financial or Market-Based Frames**: The DOE, in the Risk Assessment case below, accuses the laboratory and its engineers of trying to extend the contract to make more money. The supervisor of the head of the risk assessment team pressures the team leader to complete the risk assessment as quickly as possible so as not to lose the contract. These two framings highlight financial issues.
- **Managerial Frame**: As the leader of the Puerto Rican team in the "When in Aguadilla" case, you need to exercise leadership in your team. The refusal of the Japanese engineer to work with a member of your team creates a management problem. What would a good leader, a good manager, do in this situation? What does it mean to call this a management problem? What management strategies would help solve it?
- **Legal Frame**: OSHA may have clear regulations concerning the white powder produced by laminating presses. How can you find out about these regulations? What would be involved in complying with them? If they cost money, how would you get this money? These are questions that arise when you frame the Laminating Press case as a legal problem.
- **Environmental Framing**: Finally, viewing your problem from an environmental frame leads you to consider the impact of your decision on the environment. Does it harm the environment? Can this harm be avoided? Can it be mitigated? Can it be offset? (Could you replant elsewhere the trees you cut down to build your new plant?) Could you develop a short term environmental solution to "buy time" for designing and implementing a longer term solution? Framing your problem as an environmental problem requires that you ask whether this solution harms the environment and whether this harming can be avoided or remedied in some other way.

3.1.5 Solution Generation

In solution generation, agents exercise moral creativity by brainstorming to come up with solution options designed to resolve the disagreements and value conflicts identified in the problem specification stage. Brainstorming is crucial to generating nonobvious solutions to difficult, intractable problems. This process must take place within a non-polarized environment where the members of the group respect and trust one another. (See the module on the Ethics of Group Work for more information on how groups can be successful and pitfalls that commonly trip up groups.) Groups effectively initiate the brainstorming process by suspending criticism and analysis. After the process is completed (say, by meeting a quota), then participants can refine the solutions generated by combining them, eliminating those that don't fit the problem, and ranking them in terms of their ethics and feasibility. If a problem can't be solved, perhaps it can be dissolved through reformulation. If an entire problem can't be solve, perhaps the problem can be broken down into parts some of which can be readily solved.

Having trouble generating solutions?

- One of the most difficult stages in problem solving is to jump start the process of brainstorming solutions. If you are stuck then here are some generic options guaranteed to get you "unstuck."

- **Gather Information**: Many disagreements can be resolved by gathering more information. Because this is the easiest and least painful way of reaching consensus, it is almost always best to start here. Gathering information may not be possible because of different constraints: there may not be enough time, the facts may be too expensive to gather, or the information required goes beyond scientific or technical knowledge. Sometimes gathering more information does not solve the problem but allows for a new, more fruitful formulation of the problem. Harris, Pritchard, and Rabins in Engineering Ethics: Concepts and Cases show how solving a factual disagreement allows a more profound conceptual disagreement to emerge.
- **Nolo Contendere**. Nolo Contendere is latin for not opposing or contending. Your interests may conflict with your supervisor but he or she may be too powerful to reason with or oppose. So your only choice here is to give in to his or her interests. The problem with nolo contendere is that non-opposition is often taken as agreement. You may need to document (e.g., through memos) that your choosing not to oppose does not indicate agreement.
- **Negotiate**. Good communication and diplomatic skills may make it possible to negotiate a solution that respects the different interests. Value integrative solutions are designed to integrate conflicting values. Compromises allow for partial realization of the conflicting interests. (See the module, The Ethics of Team Work, for compromise strategies such as logrolling or bridging.) Sometimes it may be necessary to set aside one's interests for the present with the understanding that these will be taken care of at a later time. This requires trust.
- **Oppose**. If nolo contendere and negotiation are not possible, then opposition may be necessary. Opposition requires marshalling evidence to document one's position persuasively and impartially. It makes use of strategies such as leading an "organizational charge" or "blowing the whistle." For more on whistle-blowing consult the discussion of whistle blowing in the Hughes case that can be found at computing cases.
- **Exit**. Opposition may not be possible if one lacks organizational power or documented evidence. Nolo contendere will not suffice if non-opposition implicates one in wrongdoing. Negotiation will not succeed without a necessary basis of trust or a serious value integrative solution. As a last resort, one may have to exit from the situation by asking for reassignment or resigning.

Refining solutions

- Are any solutions blatantly unethical or unrealizable?
- Do any solutions overlap? Can these be integrated into broader solutions?
- Can solutions be brought together as courses of action that can be pursued simultaneously?
- Go back to the problem specification? Can any solutions be eliminated because they do not address the problem? (Or can the problem be revised to better fit what, intuitively, is a good solution.)
- Can solutions be brought together as successive courses of action? For example, one solution represents Plan A; if it does not work then another solution, Plan B, can be pursued. (You negotiate the problem with your supervisor. If she fails to agree, then you oppose your supervisor on the grounds that her position is wrong. If this fails, you conform or exit.)
- **The goal here is to reduce the solution list to something manageable, say, a best, a second best, and a third best. Try adding a bad solution to heighten strategic points of comparison. The list should be short so that the remaining solutions can be intensively examined as to their ethics and feasibility.**

3.1.6 Solution Testing: The solutions developed in the second stage must be tested in various ways.

1. Reversibility: Is the solution reversible between the agent and key stakeholders?
2. Harm/Beneficence: Does the solution minimize harm? Does it produce benefits that are justly distributed among stakeholders?

3. Publicity: Is this action one with which you are willing to be publicly identified? Does it identify you as a moral person? An irresponsible person? A person of integrity? An untrustworthy person?
4. Code: Does the solution violate any provisions of a relevant code of ethics? Can it be modified to be in accord with a code of ethics? Does it address any aspirations a code might have? (Engineers: Does this solution hold paramount the health, safety, and welfare of the public?)
5. Global Feasibility: Do any obstacles to implementation present themselves at this point? Are there resources, techniques, and social support for realizing the solution or will obstacles arise in one or more of these general areas? At this point, assess globally the feasibility of each solution.
6. The solution evaluation matrix presented just below models and summarizes the solution testing process.

Solution/Test	Reversibility	Harm/ Beneficence	Publicity/Values	Code	Global Feasibility
Description	Is the solution reversible with stakeholders? Does it honor basic rights?	Does the solution produce the best benefit/harm ratio? Does the solution maximize utility?	Does the solution express and integrate key virtues?	Does the solution violate any code provisions?	Are there constraints or obstacles to realizing the solution?
Best solution					
Second Best					
Worst					

Table 3.3

3.1.7 Solution Implementation

The chosen solution must be examined in terms of how well it responds to various situational constraints that could impede its implementation. What will be its costs? Can it be implemented within necessary time constraints? Does it honor recognized technical limitations or does it require pushing these back through innovation and discovery? Does it comply with legal and regulatory requirements? Finally, could the surrounding organizational, political, and social environments give rise to obstacles to the implementation of the solution? In general this phase requires looking at interest, technical, and resource constraints or limitations. A Feasibility Matrix helps to guide this process.

The Feasibility Tests focuses on situational constraints. How could these hinder the implementation of the solution? Should the solution be modified to ease implementation? Can the constraints be removed or remodeled by negotiation, compromise, or education? Can implementation be facilitated by modifying both the solution and changing the constraints?

Feasibility Matrix		
Resource Constraints	Technical Constraints	Interest Constraints
		Personalities
Time		Organizational
Cost	Applicable Technology	Legal
Materials	Manufacturability	Social, Political, Cultural

Table 3.4

Different Feasibility Constraints

1. The Feasibility Test identifies the constraints that could interfere with realizing a solution. This test also sorts out these constraints into **resource** (time, cost, materials), **interest** (individuals, organizations, legal, social, political), and **technical** limitations. By identifying situational constraints, problem-solvers can anticipate implementation problems and take early steps to prevent or mitigate them.
2. **Time**. Is there a deadline within which the solution has to be enacted? Is this deadline fixed or negotiable?
3. **Financial**. Are there cost constraints on implementing the ethical solution? Can these be extended by raising more funds? Can they be extended by cutting existing costs? Can agents negotiate for more money for implementation?
4. **Technical**. Technical limits constrain the ability to implement solutions. What, then, are the technical limitations to realizing and implementing the solution? Could these be moved back by modifying the solution or by adopting new technologies?
5. **Manufacturability**. Are there manufacturing constraints on the solution at hand? Given time, cost, and technical feasibility, what are the manufacturing limits to implementing the solution? Once again, are these limits fixed or flexible, rigid or negotiable?
6. **Legal**. How does the proposed solution stand with respect to existing laws, legal structures, and regulations? Does it create disposal problems addressed in existing regulations? Does it respond to and minimize the possibility of adverse legal action? Are there legal constraints that go against the ethical values embodied in the solution? Again, are these legal constraints fixed or negotiable?
7. **Individual Interest Constraints**. Individuals with conflicting interests may oppose the implementation of the solution. For example, an insecure supervisor may oppose the solution because he fears it will undermine his authority. Are these individual interest constraints fixed or negotiable?
8. **Organizational**. Inconsistencies between the solution and the formal or informal rules of an organization may give rise to implementation obstacles. Implementing the solution may require support of those higher up in the management hierarchy. The solution may conflict with organization rules, management structures, traditions, or financial objectives. Once again, are these constraints fixed or flexible?
9. **Social, Cultural, or Political**. The socio-technical system within which the solution is to be implemented contains certain social structures, cultural traditions, and political ideologies. How do these stand with respect to the solution? For example, does a climate of suspicion of high technology threaten to create political opposition to the solution? What kinds of social, cultural, or political problems could arise? Are these fixed or can they be altered through negotiation, education, or persuasion?

3.1.8 Ethics Tests For Solution Evaluation

Three ethics tests (reversibility, harm/beneficence, and public identification) encapsulate three ethical approaches (deontology, utilitarianism, and virtue ethics) and form the basis of stage three of the SDC, solution testing. A fourth test (a value realization test) builds upon the public identification/virtue ethics test by evaluating a solution in terms of the values it harmonizes, promotes, protects, or realizes. Finally a code test provides an independent check on the ethics tests and also highlights intermediate moral concepts such as safety, health, welfare, faithful agency, conflict of interest, confidentiality, professional integrity, collegiality, privacy, property, free speech, and equity/access). The following section provides advice on how to use these tests. More information can be found at www.computingcases.org.

3.1.9 Setting Up the Ethics Tests: Pitfalls to avoid

Set-Up Pitfalls: Mistakes in this area lead to the analysis becoming unfocused and getting lost in irrelevancies. (a) Agent-switching where the analysis falls prey to irrelevancies that crop up when the test application is

not grounded in the standpoint of a single agent, (b) Sloppy action-description where the analysis fails because no specific action has been tested, (c) Test-switching where the analysis fails because one test is substituted for another. (For example, the public identification and reversibility tests are often reduced to the harm/beneficence test where harmful consequences are listed but not associated with the agent or stakeholders.)

Set up the test

1. Identify the agent (the person who is going to perform the action)
2. Describe the action or solution that is being tested (what the agent is going to do or perform)
3. Identify the stakeholders (those individuals or groups who are going to be affected by the action), and their stakes (interests, values, goods, rights, needs, etc.
4. Identify, sort out, and weigh the consequences (the results the action is likely to bring about)

3.1.10 Harm/Beneficence Test

- What harms would accompany the action under consideration? Would it produce physical or mental suffering, impose financial or non-financial costs, or deprive others of important or essential goods?
- What benefits would this action bring about? Would it increase safety, quality of life, health, security, or other goods both moral and non-moral?
- What is the magnitude of each these consequences? Magnitude includes likelihood it will occur (probability), the severity of its impact (minor or major harm) and the range of people affected.
- Identify one or two other viable alternatives and repeat these steps for them. Some of these may be modifications of the basic action that attempt to minimize some of the likely harms. These alternatives will establish a basis for assessing your alternative by comparing it with others.
- Decide on the basis of the test which alternative produces the best ratio of benefits to harms?
- Check for inequities in the distribution of harms and benefits. Do all the harms fall on one individual (or group)? Do all of the benefits fall on another? If harms and benefits are inequitably distributed, can they be redistributed? What is the impact of redistribution on the original solution imposed?

Pitfalls of the Harm/Beneficence Test

1. “Paralysis of Analysis" comes from considering too many consequences and not focusing only on those relevant to your decision.
2. Incomplete Analysis results from considering too few consequences. Often it indicates a failure of moral imagination which, in this case, is the ability to envision the consequences of each action alternative.
3. Failure to compare different alternatives can lead to a decision that is too limited and one-sided.
4. Failure to weigh harms against benefits occurs when decision makers lack the experience to make the qualitative comparisons required in ethical decision making.
5. Finally, justice failures result from ignoring the fairness of the distribution of harms and benefits. This leads to a solution which may maximize benefits and minimize harms but still give rise to serious injustices in the distribution of these benefits and harms.

3.1.11 Reversibility Test

1. Set up the test by (i) identifying the agent, (ii) describing the action, and (iii) identifying the stakeholders and their stakes.
2. Use the stakeholder analysis to identify the relations to be reversed.
3. Reverse roles between the agent (you) and each stakeholder: put them in your place (as the agent) and yourself in their place (as the one subjected to the action).
4. If you were in their place, would you still find the action acceptable?

Cross Checks for Reversibility Test (These questions help you to check if you have carried out the reversibility test properly.)

- Does the proposed action treat others with respect? (Does it recognize their autonomy or circumvent it?)
- Does the action violate the rights of others? (Examples of rights: free and informed consent, privacy, freedom of conscience, due process, property, freedom of expression)
- Would you recommend that this action become a universal rule?
- Are you, through your action, treating others merely as means?

Pitfalls of the Reversibility Test

- Leaving out a key stakeholder relation
- Failing to recognize and address conflicts between stakeholders and their conflicting stakes
- Confusing treating others with respect with capitulating to their demands ("Reversing with Hitler")
- Failing to reach closure, i.e., an overall, global reversal assessment that takes into account all the stakeholders the agent has reversed with.

3.1.12 Steps in Applying the Public Identification Test

- Set up the analysis by identifying the agent, describing the action, and listing the key values or virtues at play in the situation.
- Association the action with the agent.
- Describe what the action says about the agent as a person. Does it reveal him or her as someone associated with a virtue or a vice?

Alternative Version of Public Identification

- Does the action under consideration realize justice or does it pose an excess or defect of justice?
- Does the action realize responsibility or pose an excess or defect of responsibility?
- Does the action realize reasonableness or pose too much or too little reasonableness?
- Does the action realize honesty or pose too much or too little honesty?
- Does the action realize integrity or pose too much or too little integrity?

Pitfalls of Public Identification

- Action not associated with agent. The most common pitfall is failure to associate the agent and the action. The action may have bad consequences and it may treat individuals with respect but these points are not as important in the context of this test as what they imply about the agent as a person who deliberately performs such an action.
- Failure to specify moral quality, virtue, or value. Another pitfall is to associate the action and agent but only ascribe a vague or ambiguous moral quality to the agent. To say, for example, that willfully harming the public is bad fails to zero in on precisely what moral quality this ascribes to the agent. Does it render him or her unjust, irresponsible, corrupt, dishonest, or unreasonable? The virtue list given above will help to specify this moral quality.

3.1.13 Code of Ethics Test

- Does the action hold paramount the health, safety, and welfare of the public, i.e., those affected by the action but not able to participate in its design or execution?
- Does the action maintain faithful agency with the client by not abusing trust, avoiding conflicts of interest, and maintaining confidences?
- Is the action consistent with the reputation, honor, dignity, and integrity of the profession?
- Does the action serve to maintain collegial relations with professional peers?

3.1.14 Meta Tests

- The ethics and feasibility tests will not always converge on the same solution. There is a complicated answer for why this is the case but the simple version is that the tests do not always agree on a given solution because each test (and the ethical theory it encapsulates) covers a different domain or dimension of the action situation. Meta tests turn this disadvantage to your advantage by feeding the interaction between the tests on a given solution back into the evaluation of that solution.
- When the ethics tests converge on a given solution, this convergence is a sign of the strength and robustness of the solution and counts in its favor.
- When a given solution responds well to one test but does poorly under another, this is a sign that the solution needs further development and revision. It is not a sign that one test is relevant while the others are not. Divergence between test results is a sign that the solution is weak.

3.1.15 Application Exercise

You will now practice the four stages of decision making with a real world case. This case, Risk Assessment, came from a retreat on Business, Science, and Engineering Ethics held in Puerto Rico in December 1998. It was funded by the National Science Foundation, Grant SBR 9810253.

Risk Assessment Scenario

Case Scenario: You supervise a group of engineers working for a private laboratory with expertise in nuclear waste disposal and risk assessment. The DOE (Department of Energy) awarded a contract to your laboratory six years ago to do a risk assessment of various nuclear waste disposal sites. During the six years in which your team has been doing the study, new and more accurate calculations in risk assessment have become available. Your laboratory's study, however, began with the older, simpler calculations and cannot integrate the newer without substantially delaying completion. You, as the leader of the team, propose a delay to the DOE on the grounds that it is necessary to use the more advanced calculations. Your position is that the laboratory needs more time because of the extensive calculations required; you argue that your group must use state of the art science in doing its risk assessment. The DOE says you are using overly high standards of risk assessment to prolong the process, extend the contract, and get more money for your company. They want you to use simpler calculations and finish the project; if you are unwilling to do so, they plan to find another company that thinks differently. Meanwhile, back at the laboratory, your supervisor (a high level company manager) expresses to you the concern that while good science is important in an academic setting, this is the real world and the contract with the DOE is in jeopardy. What should you do?

Part One: Problem Specification

1. Specify the problem in the above scenario. Be as concise and specific as possible
2. Is your problem best specifiable as a disagreement? Between whom? Over what?
3. Can your problem be specified as a value conflict? What are the values in conflict? Are the moral, nonmoral, or both?

Part Two: Solution Generation

1. Quickly and without analysis or criticism brainstorm 5 to ten solutions
2. Refine your solution list. Can solutions be eliminated? (On what basis?) Can solutions be combined? Can solutions be combined as plan a and plan b?
3. If you specified your problem as a disagreement, how do your solutions resolve the disagreement? Can you negotiate interests over positions? What if your plan of action doesn't work?
4. If you formulated your problem as a value conflict, how do your solutions resolve this conflict? By integrating the conflicting values? By partially realizing them through a value compromise? By trading one value off for another?

Part Three: Solution Testing

1. Construct a solution evaluation matrix to compare two to three solution alternatives.
2. Choose a bad solution and then compare to it the two strongest solutions you have.
3. Be sure to avoid the pitfalls described above and set up each test carefully.

Part Four: Solution Implementation

1. Develop an implementation plan for your best solution. This plan should anticipate obstacles and offer means for overcoming them.
2. Prepare a feasibility table outlining these issues using the table presented above.
3. Remember that each of these feasibility constraints is negotiable and therefore flexible. If you choose to set aside a feasibility constraint then you need to outline how you would negotiate the extension of that constraint.

Decision-Making Presentation

This media object is a downloadable file. Please view or download it at
<Decision Making Manual V4.pptx>

Figure 3.1: Clicking on this figure will allow you to open a presentation designed to introduce problem solving in ethics as analogous to that in design, summarize the concept of a socio-technical system, and provide an orientation in the four stages of problem solving. This presentation was given February 28, 2008 at UPRM for ADMI 6005 students, Special Topics in Research Ethics.

Problem Solving Presentation
[Media Object][2]
Shortened Presentation for Fall 2012
[Media Object][3]
Vigo Socio-Technical System Table and Problems
[Media Object][4]

Decision Making Worksheet

This media object is a downloadable file. Please view or download it at
<Decision Making Worksheet.docx>

Figure 3.2: This exercise is designed to give you practice with the three frameworks described in this module. It is based on the case, "When in Aguadilla."

Test Rubric Fall 2009: Problem-Solving
[Media Object][5]

[2] This media object is a downloadable file. Please view or download it at <Decision Making Manual V5.pptx>
[3] This media object is a downloadable file. Please view or download it at <Decision Making Manual V6.pptx>
[4] This media object is a downloadable file. Please view or download it at <Vigo STS.docx>
[5] This media object is a downloadable file. Please view or download it at <PE_Rubric_EO_S09.docx>

Chapter 4

Professional Responsibility in Engineering

4.1 Professional Ethics in Puerto Rico: Codes, Problem Solving, and Ethical Dissent[1]

4.1.1 I. Module Introduction

In this module, you will view the DVD Incident at Morales and carry out a series of activities designed to familiarize you with issues in ethical leadership, social responsibility, and globalization. Links to interviews with major figures on globalization, to the Connexions module "Socio Technical Systems in Decision Making" and to online material on "Incident at Morales" will help you to gather the information you need to complete this module.

4.1.2 Issues in Incident at Morales

The "Incident at Morales" is the dramatization of a series of decisions and actions that culminate in the actual incident. It provides an excellent opportunity to discuss a number of issues in engineering and professional ethics: conflict of interest, confidentiality, the paramountcy of public welfare (including environmental integrity), and the way in which engineering and business constraints interact to create ethical dificulties. A chemical engineer, Fred, is hired by Phaust Chemical to build a plant for manufacturing a paint stripper, one of Phaust's leading products. While Phaust officials deny that they hired Fred because his previous job was with their main competitor, Chemitoil, they nevertheless press Fred for details about the Chemitoil plant Fred just designed. When mergers and acquisitions of Phaust's parent company in France translate into sharp budget cuts on the new plant Fred is designing, he finds himself confronted with a series of ethical problems that become increasingly difficult to resolve.

Below is a list of ethical issues raised in the video. The quotes below come from the Study Guide to "Incident at Morales"

- Confidentiality: "Although the lawyers note that Fred has no legal obligations to Chemitoil because he did not sign a non-disclosure agreement, does Fred have a moral obligation to ensure the confidentiality of the information he may have learned at Chemitoil?
- Wally's "One Rule": What is the impact of Wally's "One Rule" on Fred's ability to do his job? More importantly, does this interfere with Fred's ability to meet his professional ethical obligations in the course of conducting his job?"

[1] This content is available online at <http://cnx.org/content/m15501/1.8/>.

- **Lutz and Lutz** Controls: Wally claims that **Lutz and Lutz** controls are the best among the available alternatives. He also claims that the fact that Chuck's brother-in-law works with **Lutz and Lutz** is not a relevant factor. How should Fred choose in this situation regarding controls?
- Couplings: In choosing both the type of couplings and piping as well as to use a local (Mexico) supplier without a plant inspection, what factors should Fred take into account? What should be the margin of error in terms of pressure? How does Fred balance safety and reliability with the need to cut costs due to the parent company's recent acquisitions?
- Environmental Regulations–When in Rome...: Should Fred take advantage of less strict environmental regulations in Mexico to save money for Phaust corporation? What are the responsibilities of multinational corporations that operate in countries like Mexico?

4.1.3 What You Need to Know

This section provides general background information useful for this module. It includes information on how to (1) define problems, (2) design and evaluate ethical solutions, and (3)resolve disagreements. These frameworks can be used with the Pre-Test and Gray Matters activities.

Problem Solving Stages (Based on analogy between the problem solving and design processes

1. **Problem Specification or Definition**: This stage consists of defining the problem you face from different standpoints or frames. Carefully defining your problem is an essential step to designing effective and ethical solutions. Defining your problem from multiple frames or vantage points, also helps you to create imaginative and ethical solutions to problems that appear unsolvable under commonplace framings.
2. **Solution Generation**: In this stage, you will try to resolve the problem you defined in the previous stage. In a section below, you will find a list of generic solutions to disagreements between stakeholders.
3. **Solution Testing**: The solutions developed in the second stage must be tested in different ways. The reversibility test encapsulates the ethical theory of deontology; exploring the issue from the standpoint of those on the receiving end of your action outlines the idea of reciprocity which is fundamental to deontology. The harm/benefits test has you weigh benefits against harms and steers you toward that solution that produces the most benefits and the least harms. This provides a reasonable approximation to the theory of Utilitarianism which enjoins us to produce the greatest good for the greatest number. Finally, the publicity test has you attribute the values embedded in the act to the character of the agent. In this way, the publicity test encapsulates virtue ethics.
4. **Solution Implementation**: The chosen solution must be examined in terms of how well it responds to various situational constraints that could impede its implementation. To carry out this stage, imagine a check list of resource, interest, and technical constraints that could give rise to obstacles. Go through the list to see if any of these constraints applies to your solution.

Problems can be defined in different ways. By looking at a problem through different definitional frames, we are able to uncover non-obvious, creative solutions. Technical problems require that we focus on the hardware and software components of the underlying Socio-Technical System.

1. **Technical Puzzle**: If the problem is framed as a technical puzzle, then solutions would revolve around developing designs that optimize both ethical and technical specifications, that is, resolve the technical issues and realize ethical value. For example, Phaust chemists could solve the problems of the leaky batches in the new plant by coming up with a new chemical formulation of the paint stripper that doesn't require high temperature and pressure.
2. **Social Problem**: If the problem is framed as a social problem, then solutions would revolve around changing laws or bringing about systemic reform through political action. This would lead one to focus on the people/groups/roles component (working to social practices) or the legal component of

a socio-technical system. Fred's dilemma on whether to line the holding ponds at the Morales plant could be resolved if international environmental standards were raised to EPA levels.

3. **Stakeholder Conflict**: If the problem is framed as a conflict between different stakeholder interests, then the solution would concentrate on getting stakeholders (both individuals and groups) to agree on integrative or compromise-building solutions. This requires concentrating on the people/group/role component of the STS. (Note: A stakeholder is any group or individual with a vital interest at play in the situation.) Fred is hard pressed to satisfy Wally's One Rule, the French company's mandated budget cuts, concerns about environmental contamination (expressed by his wife, an EPA litigator), and the Mexican government's concern about worker and plant safety.
4. **Management Problem**: Finally, if the problem is framed as a management problem, then the solution would revolve around changing an organization's procedures. Along these lines, it would address the organization's (1) fundamental goals, (2) decision recognition procedures, (3) organizational roles, and/or (4) decision-making hierarchy. These four components comprise the organization's **CID** (corporate internal decision) structure. Fred would not have to deal with the moral concerns about passing off problems to the operations division of Phaust if there were company regulations against this or if Phaust did not present an organizational system that pits plant designers against operations.

Ethics Tests

1. **Reversibility**: Would this solution alternative be acceptable to those who stand to be most affected by it? To answer this question, change places with those who are targeted by the action and ask, from this new perspective, whether the action is still acceptable?
2. **Harm/Benefits**: What are the harms your solution is likely to produce? What are its benefits? Does this solution produce the least harms and the most benefits when compared to the available alternatives?
3. **Publicity**: Would you want to be publicly associated or identified with this action? In other words, assume that you will be judged as a person by others in terms of the moral values expressed in the action under consideration. Does this accord with how you would aspire to be judged?

One of the most difficult stages in problem solving is to jump start the process of brainstorming solutions. If you are stuck then here are some generic options guaranteed to get you "unstuck."

1. **Gather Information**: Many disagreements can be resolved by gathering more information. Because this is the easiest and least painful way of reaching consensus, it is almost always best to start here. Gathering information may not be possible because of different constraints: there may not be enough time, the facts may be too expensive to gather, or the information required goes beyond scientific or technical knowledge. Sometimes gathering more information does not solve the problem but allows for a new, more fruitful formulation of the problem. Harris, Pritchard, and Rabins in Engineering Ethics: Concepts and Cases show how solving a factual disagreement allows a more profound conceptual disagreement to emerge.
2. **Nolo Contendere**. Nolo Contendere is latin for not opposing or contending. Your interests may conflict with your supervisor but he or she may be too powerful to reason with or oppose. So your only choice here is to give in to his or her interests. The problem with nolo contendere is that non-opposition is often taken as agreement. You may need to document (e.g., through memos) that your choosing not to oppose does not indicate agreement.
3. **Negotiate**. Good communication and diplomatic skills may make it possible to negotiate a solution that respects the different interests. Value integrative solutions are designed to integrate conflicting values. Compromises allow for partial realization of the conflicting interests. (See the module, The Ethics of Team Work, for compromise strategies such as logrolling or bridging.) Sometimes it may be necessary to set aside one's interests for the present with the understanding that these will be taken care of at a later time. This requires trust.

4. **Oppose**. If nolo contendere and negotiation are not possible, then opposition may be necessary. Opposition requires marshalling evidence to document one's position persuasively and impartially. It makes use of strategies such as leading an "organizational charge" or "blowing the whistle." For more on whistle-blowing consult the discussion of whistle blowing in the Hughes case that can be found at computing cases.
5. **Exit**. Opposition may not be possible if one lacks organizational power or documented evidence. Nolo contendere will not suffice if non-opposition implicates one in wrongdoing. Negotiation will not succeed without a necessary basis of trust or a serious value integrative solution. As a last resort, one may have to exit from the situation by asking for reassignment or resigning.

Prepare a socio-technical analysis of Morales, Mexico. Your analysis will examine the insertion of the Phaust chemical plant into the Morales context. Can you identify any potential value conflicts in the Incident at Morales STS? Look at values like safety, equity/justice, intellectual property, confidentiality, responsibility, reasonableness. Compare moral values, moral and nonmoral values, and even nonmoral with nonmoral values to spot potential conflicts.

General Information on Socio-Technical Systems

1. Socio-Technical Systems are systems, that is, complex structures in which simpler components are related and interact. Common STS components are hardware, software, physical surroundings, stakeholders (people, groups, roles), procedures, laws, and information systems.
2. STSs embody values. These values, often moral, can come into conflict with one another. This is an important source of ethical and social problems.
3. STSs change; the path of this change is their trajectory. Value mismatches between the values embedded in the STS provide internal sources of change. Broader external forces such as political and economic power structures can produce change in STSs from without. What is important in professional ethics is learning how to direct this change toward ethical ends.

Preparing a STS Table

- Study the two templates in the module, "Socio Technical Systems in Professional Decision Making." See which one applies best to the Incident at Morales case.
- Redo the headings of the table substituting relevant items for those in the templates that are not relevant. For example, in preparing a STS table for a computer system, you may wish to change rate and rate structures into something like data and data structures.
- Fill in the relevant columns in your newly revised table. For example, in the Incident at Morales, the description of the physical surroundings would be based on the brief video segment where Fred is consulting with Wally and Manuel. What is the geographical area like? (It looks like a dry climate given the DVD.) What is the plant like? (It is, at the very least, small.) Attention to detail–even trivial detail–is important for these columns of the STS.
- For the second table, take the short value list and (1) look for new value mismatches, (2) identify existing value conflicts, and (3) describe any harmful long term consequences. In Incident at Morales, you may want to concentrate on justice (equity), responsibility for safety, respect, property, and free speech.
- Keep your tables simple and direct. Remember, this is a device to help you visualize value conflicts hidden in technologies and socio technical systems.

Socio-Technical System

Hardware	Software	Physical Surroundings	People, Groups, Roles	Procedures	Laws, Statutes, Regulations	Data and Data Structures

Table 4.1

STS and Values

	Hardware/Software	Physical Surroundings	People, Groups, Roles	Procedures	Laws, Statutes, Regulations	Data and Data Structures
Justice (Equity and Access)	Responsibility					
Responsibility						
Respect (Privacy and Due Process)						
Property						
Free Speech						

Table 4.2

4.1.4 III. What you are going to do

You will be assigned one of the topics described above. Discuss this topic with your group. Answer the questions. The prepare a brief summary of your answers to share with the rest of the class. The topics, again, are confidentiality, Wally's "One Rule", Lutz and Lutz Controls, the quality and integrity of the couplings, and the difference in environmental regulations. Throughout your reflections look for opportunities open to Fred to demonstrate ethical leadership. What obstacles stand in his way? What can he do to overcome them?

Scenario 1: "Tell me this is like what you built!"

- **WALLY**: Chuick is going to have a project kick-off meeting this afternoon. Your plant design will be on the agenda. It'll be at three. We don't waste time around here. We're fast at Phaust. corporate tag line.
- (Walley hands the preliminary plant plans to Fred.)
- **WALLEY**: You might want to look at this. (Hopeful) Tell me if this is like what you were building at your last job.
- **You are Fred. Respond to Wally's question. Try to balance respect to your former employer, Chemitoil, with your current employer, Phaust. Use the ethics tests and the feasibility test to evaluate and justify your solution.**

Scenario 2: Lutz and Lutz Controls?

- You are Fred. After you point out to Wally that Lutz and Lutz controls are expensive, he advises you to "pick your fights when you can win them." (Chuck's brother-in-law is the customer representative for Lutz and Lutz.)
- You think about taking Wally's advice. The cheaper controls should work well except for situations of high temperature and pressure. This is not a problem with the formulation first put forth by Phaust chemists.
- **Evaluate the following option using the ethics and feasibility tests. Can you think of a better option? Use the ethics and feasibility tests to show that your solution is better.**
- **Take Wally's advice and recommend purchasing the more expensive Lutz and Lutz controls. Find some other budget item for cutting expenses.**

Scenario 3: Why do you think we are building it in Mexico?

```
    Fred tells Chuck about his environmental concerns.  He feels that toxic wastes will leach
into the groundwater unless the holding ponds in Morales are lined.

Evaluate the following options using the ethics and feasibility tests:

1. Let Chuck go ahead and call a meeting and bring in the environmental expert.
2. Consult Wally first before allowing Chuck to call the meeting.
3. Keep your environmental concerns to yourself and discuss them later with Wally
```

Scenario 4: Responding to the Chemical Reformulation

- After viewing the new paint stripper from chemitoil, Phaust decides to redo their own formula. they will use a higher temperature/pressure process. This cuts deeply into the margin of safety on the couplings, flanges, and cheaper controls.
- **You are Fred. What should you recommend? Evaluate the following using the ethics and feasibility tests:**
- 1. Go along with the new chemical formulation. The safety margins are close but still adequate. You can also pass off problems and costs to operations.
- 2. Argue that using the new formulation requires retrofitting the couplings, flanges, and controls. It is expensive in the short run but cheaper in the long run.

Scenario 5: Leaks After Thirty Batches

```
    You notice that significant leaks are occurring during the plant's testing and start-up
phases.  These leaks are probably caused by the cheaper controls, inferior couplings, and
the inexperience of the plant operating team including Manuel.  What should you do?

1. Have Manuel baby sit the batches timing them and constantly checking their temperature.

2. Argue that it is necessary to immediately retrofit the plant with Lutz and Lutz
controls.

3. Argue that it is necessary to retrofit the plant with Lutz and Lutz controls but this
should be done after the plant has been turned over to operations.  Let them pay for it.

Compare and rank these solution alternatives using the ethics and feasibility tests.
```

Scenario 6: Should you let those plant jockeys make New Stripper?

```
    Wally: Well, this is what we're going to give to operations when we hand over the plant.  Is everybo
CHUCK: Fred's the guy who's got to put his name on it, Fred's got to be alright with it...
Fred: Well, the couplings still leak when the pressure is up.
Wally: And we've alerted operations and given them specific instructions on how to maintain the connecti
CHUCK: We've got Jen working on a lower temperature formula.  That may make all of this moot.
Fred: We haven't worked out the bugs on the last step of the automation...
WaLLY: And next year, we'll retrofit the entire plant with L and L controls.
CHUCK: This is how it works.  We design it.  We build it, we hand it over.  They run it.
We've done the best we can.  No plant, no process, no system is ever completely perfect.
WALLY: You built a plant that's efficient.  You've got your upgrades to the wastewater
treatment.
Fred: Yeah, you're right.  Um, for now Manuel or one of his guys can use the manual
release valve.
CHUCK: Okay.  Time to let those plant jockeys make New Stripper.


You are Fred.  Should you sign off on the documents?
Use the ethics and feasibility tests to test this solution
```

The following table is designed to help you brainstorm and refine solutions to the problem(s) raised by your scenario.

Refined Solution Table

Decision Alternative	Description	Justification: problem fit, ethics, feasibility
Solution 1		
Solution 2		

Table 4.3

The following table, a Solution Evaluation Matrix, will help you to evaluate and rank solutions in terms of their ethics and feasibility.

Solution Evaluation Matrix

Solution / Test	Reversibility	Harm / Benefits	Publicity	Feasibility (Global)
Solution 1				
Solution 2				

Table 4.4

For Feasibility Table, see m14789.

4.1.5 Conclusion: What did you learn?

Some Closing Exercises

1. How does the STS in Morales, Mexico differ from that of Puerto Rico. (A suggested PR STS can be found on the last slide of the presentation appended just below.

2. In what ways (if any) should the CIAPR code of ethics be changed to respond to the problems that arise in "Incident at Morales"? Is it necessary to add more specific principles of professional conduct? Should more aspirational, value-based provisions be added.
3. Obviously, it is best to direct changes in our STSs to avoid problems like those arising in "Incident at Morales." What kind of changes should we make in the stakeholder columns? Can professional societies like the CIAPR play a role in preventing these problems? Is this primarily a compliance role or can other roles be identified?

4.1.6 CIAPR/OEG/CEP Presentation in Professional Ethics

The following resources were invaluable in preparing this module

1. Elena Lugo, **Etica Profesional Para La Ingeniera,** , Mayaguez, PR: Liberia Universal, Inc., 1985. The first book on engineering ethics written in Spanish, it deserves the excellent review it received in Business and Professional Ethics in 1995.
2. Wilfredo Munoz-Roman, **Etica en la Practica Profesional de la Ingenieria: Aspectos Filosoficos, Historicos y Procesales,** San Juan, PR: Universidad Politecnica de Puerto Rico, 1998. This book sponsored by the CIAPR forms the basis of the slides outlining the institutionalization of engineering in Puerto Rico by the Colegio de Intenieros de Puerto Rico.
3. Carl Mitcham and Marcos Garcia de la Huerta, **La Etica En La Profesion De Ingeniero**, Universidad de Chile: Departamento de Estudios Humanisticos, Facultad de Ciencias Fisicas y Matematicas, 2001.
4. Stephen H. Unger, **Controlling Technology: Ethics and the Responsible Engineer, 2nd Edition**, New York: John Wiley and Sons, INC., 1994, 220-239. Unger discusses the positive role professional societies can play in supporting ethical engineers. Chapter 7 (220-239) provides helpful hints to those who would ethically dissent. This advice can also be found at onlineethics.org.
5. Charles Harris, Michael Pritchard, and Michael Rabins, **Engineering Ethics: Concepts and Cases, 3rd Edition**, US: Thompson, 2005. An excellent and widely used textbook in engineering. It's cases have been developed and refined through several NSF-funded case developing initiatives.
6. Michael Davis, **Thinking Like an Engineer: Studies in the Ethics of a Profession**, UK: Oxford University Press, 1998. In addition to providing an excellent historical background to engineering ethics, this book contains invaluable discussions of codes of ethics, wrongdoing in engineering, and a summary of a study looking at the organizational contexts in which engineerins practice.
7. Jimmy Smith and Patricia Harper, editors, **Engineering Ethics: Concepts, Viewpoints, Cases and Codes**, Texas Tech University and Murdough Center for engineering Professionalism: National Institute for Engineering Ethics, 2004. This excellent resource, written by and for engineers, contains the NSPE BER decisions on key cases.
8. Samuel C. Florman, **The Existential Pleasures of Engineering**, New York: St Martin's Press, 1976. Florman defends engineering against the "antitechnologists." But he also writes from the experience of a practicing engineer on joys brought about by the the pursuit of excellence in engineering. Florman is engineering's most eloquent spokesperson.

For invaluable information on codes of ethics, their functions, and the results they bring about, consult the following:

1. Kenneth Kipnis, "Engineers Who Kill: Professional Ethics and the Paramountcy of Public Safety," in **Business and Professional Ethics**, 1(1), Fall 1981: 77-91.
2. John Kultgen, "The Ideological Use of Professiuonal Codes," in **Business and Professional Ethics**>, 1(3): 53-69. Kultgen reveals a disparity between the meanings professional codes convey to membership versus those conveyed to outsiders. He identifies four myths that codes can fall into: independence, altruism, peer review, and wisdom. Must reading for those who would identify pitfalls of professionalism and professional codes.

3. Lynn Sharp Paine, "Managing for Organizational Integrity" in **Harvard Business Review**, March-April 1994: 106-117. This seminal article contrasts integrity-based and compliance strategies for implementing ethical management. The focus is business ethics but her argument is highly relevant for engineers and surveyors working in organizational contexts.
4. Gary Weaver and Linda Klebe Trevino, "Compliance and Values Oriented Ethics Programs: Influences on Employees' Attitudes and Behavior," in **Business Ethics Quarterly**, 9(2): 315-335.
5. John Ladd, "The Quest for a Code of Professional Ethics: An Intellectual and Moral Confusion," in **Ethical Issues in Engineering,** edited by Deborah G. Johnson, Englewood Cliffs, NJ: Prentice Hall, 1991: 130-136.

- This presentation was given before the CIAPR, OEG, and the UPRM CEP organizations on November 15, 2007.

CIAPR Presentation on Professional Ethics

This media object is a downloadable file. Please view or download it at
<EEPR_Nov_07_V2.ppt>

Figure 4.1: This presentation on Professional Ethics has been developed for the Puerto State Society of Professional Engineers and Surveyors. The PR Office of Governmental Ethics and the University of Puerto Rico, Mayaguez Campus Center for Professional Enhancement allowed participants credit for the November 15, 2007 activity.

Evaluations for Mayaguez Workshop

This media object is a downloadable file. Please view or download it at
<OEG_CIAPR_Evals.pdf>

Figure 4.2: This media file has been added for those referred here by the Frontiers in Education Work in Progress that details this activity. Clicking on the link provided will open workshop assessment results generated November 15, 2007 by the Puerto Rican Office of Government Ethics. Although these results are in Spanish, they can give English readers a rough idea of how participants viewed the content, pedagogical style, and presenters. More complete assessment will follow upon future instantiations of this workshop.

Frontiers in Education Presentation 2008

Teaching Engineering Ethics in Puerto Rico

This media object is a downloadable file. Please view or download it at
<TeachEE_V1.pptx>

Figure 4.3: Clicking on this media file will open the presentation delivered by William Frey and Efrain O'Neill at Frontiers in Education, October 24, 2008. This presentation summarizes a workshop developed for engineering practitioners in Puerto Rico in engineering ethics.

Intermediate Moral Concepts

This media object is a downloadable file. Please view or download it at
<IMC_V2_97-2.doc>

Figure 4.4: This figure provides a table summary of intermediate moral concepts used in decision making in the business and professional areas.

Basic Moral Concepts

This media object is a downloadable file. Please view or download it at
<BME_V2_97-1.doc>

Figure 4.5: This figure offers a table summary of basic moral concepts used in decision making in the business and professional areas.

Partial Exam Rubric
[Media Object][2]
Jeopardy on Incident at Morales
[Media Object][3]

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<Jeopardy_IM.pptx>

4.2 Theory Building Activities: "Responsibility and Incident at Morales"[4]

4.2.1 Module Introduction

4.2.1.1 Getting Started...

Manuel, plant manager at the Phaust chemical plant in Morales, Mexico, has just died. While he was babysitting the process of manufacturing Phaust's new paint remover (monitoring on site temperature and pressure conditions) an explosion occurred that killed him instantly. The Mexican government has formed an independent commission to investigate this industrial accident.

This commission (headed by your instructor) has ordered key participants to testify on their role in the accident in a public hearing. Your job is to present before this commission from a stakeholder point of view. You will be divided into groups to role play the following stakeholder perspectives:

- Fred, the chief engineer involved in designing the plant,
- plant workers,
- officials from Mexican government regulatory agencies,
- Phaust management,
- representatives from the parent French company,
- officials presiding over an engineering professional society.

You will be assigned roles and given class time to prepare presentations for the commission. Then the class will enact the public hearing by having each group give a presentation from the perspective of its assigned role. Following these presentations, groups will answer questions from the investigating commission. Finally, you will work through debriefing activities to help solidify your practical understanding of the module's chief concepts. Background materials designed to help you with your presentations include sketches of moral responsibility, links to the "Incident at Morales" Case, tasks to help structure your role-playing, and activities to debrief on this exercise. This module is designed to help you learn about moral responsibility by using responsibility frameworks to make day-to-day decisions in a realistic, dynamic, business context.

4.2.1.1.1 Before You Come to Class...

1. Visit the link to the National Institute for Engineering Ethics. Look at the study guide and download the script for the video, "Incident at Morales." You want to have some idea of what happens in the video before you watch it.
2. Read the module. Pay special attention to the section on "What you need to know." Here you will read summaries of three senses of moral responsibility: blame responsibility, sharing responsibility, and responsibility as a virtue. Your goal here is not to understand everything you read but to have a general sense of the nature of moral responsibility, the structure of the responsibility frameworks you will be using in this module, and the difference between moral and legal responsibility. Having this background will get you ready to learn about moral responsibility by actually practicing it.
3. Come to class ready to watch the video and start preparing for your part in the public hearing. It is essential that you attend all four of these classes. Missing out on a class will create a significant gap in your knowledge about and understanding of moral responsibility.

4.2.2 What you need to know...

"Responsibility" is used in several distinct ways that fall under two broad categories, the reactive and the proactive. Reactive uses of responsibility refer back to the past and respond to what has already occurred. (Who can be praised or blamed for what has occurred?) Proactive uses emerge through the effort to extend

[4]This content is available online at <http://cnx.org/content/m15627/1.7/>.

control over what happens in the future. An important part of extending control, knowledge, and power over the future is learning from the past, especially from past mistakes. But proactive responsibility also moves beyond prevention to bringing about the exemplary. How do occupational and professional specialists uncover and exploit opportunities to realize value in their work? Proactive responsibility (responsibility as a virtue) explores the skills, sensitivities, motives, and attitudes that come together to bring about excellence.

4.2.2.1 Different meanings of Responsibility

Reactive Senses

1. **Causal Responsibility** refers to prior events (called causes) which produce or prevent subsequent events (called effects). Cheap, inacurate sensors (cause) required that Manual be present on the scene (effect) to monitor the high temperatures and pressures required to correctly prepare Phaust's paint stripper.
2. **Role Responsibility** delineates the obligations individuals create when they commit to a social or professional role. When Fred became an engineer he committed to holding paramount the health, safety and welfare of the public. (See NSPE code of ethics)
3. **Capacity Responsibility** sets forth those conditions under which someone can be praised or blamed for their actions. Praise and blame associate an agent with an action. Excuses are based on means for separating or disassociating an agent from their actions. Capacity responsibility helps us determine whether there are any legitimate excuses available for those who would disassociate themselves from untoward, harm-causing actions.
4. **Blame Responsibility** determines when we can legitimately praise or blame individuals for their actions.

Proactive Senses

1. **Sharing Responsibility** extends the sphere of responsibility to include those to whom one stands in internal relations or relations of solidarity. Shared responsibility includes answering for the actions of others within one's group. It also includes coming to the moral aid of those within one's group who have gone morally astray; this involves bringing to their attention morally risky actions and standing with them when they are pressured for trying to uphold group values. While sharing responsibility entails answering for what members of one's group have done, it does not extend to taking the blame for the untoward actions of colleagues. Sharing responsibility does not commit what H.D. Lewis calls the "barbarism of collective responsibility" which consists of blaming and punishing innocent persons for the guilty actions of those with whom they are associated.
2. **Preventive Responsibility**: By using knowledge of the past, one can avoid errors or repeat successes in the future. Peter French calls this the "Principle of Responsive Adjustment." (One adjusts future actions in response to what one has learned from the past.) According to French, responsive adjustment is a moral imperative. If one fails to responsively adjust to avoid the repetition of past untoward results, this loops back into the past and causes a revaluation of the initial unintentional action. The benefit of the doubt is withdrawn and the individual who fails to responsively adjust is now held responsible for the original past action. This is because the failure to adjust inserts the initial action into a larger context of negligence, bad intentions, recklessness, and carelessness. Failure to responsively adjust triggers a retroactive attribution of blame.
3. **Responsibility as a Virtue**: Here one develops skills, acquires professional knowledge, cultivitates sensitivies and emotions, and develops habits of execution that consistently bring about value realization and excellence. One way of getting at responsibility as an excellence it to reinterpret the conditions of imputability of blame responsibility. An agent escapes blame by restricting the scope of role responsibility, claiming ignorance, and citing lack of power and control. In responsibility as a virtue, one goes beyond blame by extending the range of role responsibilities, seeking situation-relevant knowledge, and working to skillfully extending power and control.

4.2.2.2 Blame Responsibility

To hold Fred responsible for the accident at Morales, we need to...

1. Specify his role responsibilities and determine whether he carried them out
2. Identify situation-based factors that limited his ability to execute his role responsibilities (These are factors that **compel** our actions or contribute to our **ignorance** of crucial features of the situation.)
3. Determine if there is any moral fault present in the situation. For example, did Fred act on the basis of **wrongful intention** (Did he intend to harm Manuel by sabotaging the plant?), fail to exercise **due care**, exhibit **negligence or recklessness**?
4. If Fred (a) failed to carry out any of his role responsibilities, (b) this failure contributed to the accident, and (c) Fred can offer no morally legitimate excuse to get himself off the hook, then Fred is blameworthy.

Fred, and other Incident at Morales stakeholders, can escape or minimize blame by establishing morally legitimate excuses. The following table associates common excuses with the formal conditions of imputability of blame responsibility. (Conditions of imputability are those conditions that allow us to associate an action with an agent for purposes of moral evaluation.)

Excuse Table

Excuse Source (Capacity Responsibility)	**Excuse Statement**
Conflicts within a **role responsibility** and between different role responsibilities	I cannot, at the same time, carry out all my conflicting role responsibilities
Hostile Organizational Environment which routinely subordinates ethical to financial considerations.	The environment in which I work makes it impossible to act responsibly. My supervisor routinely overrules my professional judgment, and I can do nothing about it.
Overly determining situational constraints: financial and time	I lack the time and money to carry out my responsibility.
Overly determining situational constraints: technical and manufacturing	Carrying out my responsibility goes beyond technical or manufacturing limits.
Overly determining situational constraints: personal, social, legal, and political.	Personal, social, legal or political obstacles prevent me from carrying out my responsibilities.
Knowledge Limitations	Crucial facts about the situation were kept from me or could not be uncovered given even a reasonable effort.

Table 4.5

4.2.2.3 Proactive Responsibility

Preventive Responsibility: Responsive Adjustment

- Responsibility to adjust future actions in response to what has been learned from the past
- **Scenario One**: Past actions that have led to untoward results. Failure here to adjust future actions to avoid repetition of untoward results leads to reassessing the original action and retrospectively blaming the agent.
- **Scenario Two**: Past actions have unintentionally and accidentally led to positive, value-realizing results. Here the agent responsively adjusts by being prepared to take advantage of being lucky. The agent adjusts future actions to repeat past successes. In this way, the agent captures past actions (past luck) and inserts them into the scope of praise.

- **Nota Bene**: The principle of responsible adjustment sets the foundation for responsibility in the sense of prevention of the untoward.

Responsibility as a Virtue or Excellence

1. Virtues are excellences of the character which are revealed by our actions, perceptions, beliefs, and attitudes. Along these lines, responsibility as a virtue requires that we reformulate responsibility from its reactive, minimalist sense (where it derives much of its content from legal responsibility) to responsibility as an excellence of character.
2. Aristotle situates virtues as means between extremes of excess and defect. Can you think of examples of too much responsibility? (Does Fred try to take on too much responsibility in certain situations?) Can you think of anyone who exhibits too little responsibility. (Does Fred take on too little responsibility or shift responsibility to others?) For Aristotle, we can have too much or too little of a good thing. From the "too much" we derive vices of excess. from the"too little" we derive the vices of defect.
3. Virtues are more than just modes of reasoning and thinking. They also consist of emotions that clue us into aspects of the situation before us that are morally salient and, therefore, worthy of our notice and response. Two emotions important for responsibility are care and compassion. Care clues us into aspects of our situation that could harm those who depend on our actions and vigilance. Do Wally and Fred pay sufficient attention to the early batch leakages in the Morales plant? If not, does this stem from a lack of care ("Let operations handle it") and a lack of compassion ("Manuel can take care of himself")? Care and compassion help to sensitize us to what is morally salient in the situation at hand. They also motivate us to act responsibility on the basis of this sensitivity.
4. Responsibility as a virtue manifests itself in a willingness to pick up where others have left off. After the Bhopal disaster, a worker was asked why, when he saw a cut-off valve open, he didn't immediately close it as safety procedures required. His response was that shutting off the value was not a part of his job but, instead, the job of those working the next shift. This restriction of responsibility to what is one's job creates responsibility gaps through which accidents and other harms rise to the surface. The worker's lack of action may not constitute moral fault but it surely signifies lack of responsibility as a virtue because it indicates a deficiency of care and compassion. Those who practice responsibility as a virtue or excellence move quickly to fill responsibility gaps left by others even if these tasks are not a part of their own role responsibilities strictly defined. Escaping blame requires narrowing the range of one's role responsibilities while practicing responsibility as a virtue often requires effectively expanding it.
5. Finally, responsibility as an excellence requires extending the range of knowledge and control that one exercises in a situation. Preventing accidents requires collecting knowledge about a system even after it has left the design and manufacturing stages and entered its operational life. Responsibility requires that we search out and correct conditions that could, under the right circumstances, produce harmful accidents. Moreover, responsibility is a function of power and control. Extending these and directing them toward good results are clear signs of responsibility as a virtue.

Reponsibility as Virtue

- The Incident at Morales provides us with a look into a fictionalized disaster. But, if it is examined more carefully, it also shows opportunities for the exercise of responsibility as a virtue. The following table will help you to identify these "responsibility opportunities" and allow you to imagine counbterfactuals where had individuals acted otherwise the "incident" could have been avoided and moral value could have been realized.
- Think of virtuous or even heroic interventions that could have prevented the accident. These represents, from the standpoint of the film, lost opportunities for realizing responsibility and other virtues.

Responsibility as a Virtue: Recovering Lost Opportunities

Characteristic	Relevance to Incident at Morales
Change goal from avoiding blame to pursuing professional excellence.	Could this have led participants to look for more creative responses to EPA environmental regulations?
Develop a flexible conception of your role responsibilities and move quickly to extend it to fill responsibility gaps left by others.	Could this have structured differently the relation between those responsible for plant design/construction and those responsible for its operation?
Extend the scope and depth of your situational knowledge, especially regarding accumulating information on the operational history of newly implemented technologies.	Would this have led to further follow-up on the early signs of leakage of the couplings?
Extend control and power. This includes finding ways of more effectively communicating and advocating ethical and professional standards in the context of group-based decision-making.	Could Fred have handled more proactively the last minute change in the chemical formulation of the paint remover?

Table 4.6

Section Conclusion
Integrate the retroactive and proactive senses of responsibility into your group's presentation for the public hearing. Don't just work on the reactive approach, i.e., try to avoid blame and cast it on the other stakeholder groups. Think proactively on how to prevent future problems, respond to this accident, and turn the events into positive opportunities to realize value.

Questions to Get Started

- Is Fred (blame) responsible for the accident and even Manuel's death? (Use the conditions of imputability and the excuse table to get started on this question.)
- Did Wally and Chuck evade their responsibility by delegating key problems and decisions to those, like plant manager Manuel, in charge of operations? (Start the answer to this question by determining the different role responsibilities of the stakeholders in this situation.)
- What kind of responsibility does the parent French company bear for shifting funds away from Phaust's new plant to finance further acquisitions and mergers? (Looking at the modules on corporate social responsibility and corporate governance will help you to frame this in terms of corporate responsibility.)
- Do engineering professional societies share responsibility with Fred? (The CIAPR and NSPE codes of ethics will help here. Try benchmarking corporate codes of ethics to see if they provide anything relevant.
- Look at the positive, proactive moral responsibilities of professional societies. What can they do to provide moral support for engineers facing problems similar to those Fred faces? Think less in terms of blame and more in terms of prevention and value realization.

4.2.3 Presentation on Moral Responsibility

[Media Object][5]

4.2.4 What you are going to do...

In this module, you will...

[5]This media object is a downloadable file. Please view or download it at <Moral Responsibility.pptx>

1. apply and integrate the concept of moral repsonsibility (blame responsibility, sharing responsibility, responsibility as a virtue) to situations that arise in the video, "Incident at Morales."
2. learn the basic facts, character profiles, and decision-situations portrayed in the video, "Incident at Morales." You will see the video in class and examine the script and Study Guide at the NIEE website.
3. work in groups to develop and play a stakeholder role in a fictional public hearing. Your group's specific tasks are outlined below in one of the group profiles provided. In general, you will prepare a statement advancing your group's interests and points of view. The responsibility frameworks will help you anticipate questions, prepare responses, and defend your role against those in other roles who may try to shift the blame your way. But most important, this module provides tools to help you go beyond the reactive, blame standpoint.
4. participate in a mock public hearing by playing out your group's assigned role.
5. work with the other groups to debrief on this activity. The public hearing will generate a lot of information, ideas, and positions. Debriefing will help you to structure and summarize this material. The objective here is to learn by doing. But to truly learn from what you have done, you need to reflect carefully.

4.2.4.1 Stakeholder Roles

Mexican Government Regulatory Agencies

- Look at OSHA regulations on safety. Do any of these apply to the incident at morales. Pay particular attendion to responsibilities for providing safe working conditions and to mandated procedures for accident prevention. How as a government agency can you encourage companies to take active and positive measures to increase workplace safety and prevent accidents?
- Look at EPA or JCA for ideas on environmental issues. What are Phaust's responsibilities regarding local environmental conditions? (Should the Mexican government require lining waste water ponds?)
- As an official representing Mexican government regulatory agencies, how do you balance the safety and environmental needs of Mexican citizens and workers with the need to attract foreign companies and investors to Mexico to promote economic development. Should safety and environmental values ever be traded off to promote economic development?

Workers at Morales Plant

- Manuel, your plant manager, has just died. You and your co-workers are concerned about the safety of this new plant. Can you think of any other issues that may be of concern here?
- Develop a statement that summarizes your interests, concerns, and rights. Are these being addressed by those at Phaust and the parent company in France?
- The Mexican Commission established to investigate this "incident" will ask you questions to help determine what cause it and who is to blame. What do you think some of these questions will be? How should you respond to them? Who do you think is to blame for the incident and what should be done in response?

Designing Engineer: Fred

- Examine Fred's actions and participation from the standpoint of the three responsibilty frameworks mentioned above.
- Develop a two minute position paper summarizing Fred's interests, concerns, and rights.
- Anticipate questions that the Commission might raise about Fred's position and develop proactive and effective responses..
- Be sure to use the three responsibility frameworks. Is Fred to blame for what happened? In what way? What can professional societies do to provide moral support to members in difficult situations? How can interested parties provide moral support? Finally, what opportunities arose in the video practicing moral responsibility as a virtue? (Think about what an exemplary engineer would have done differently.)

Phaust Management: Wally and Chuck

- Chuck and Walley made several decisions reponding to the parent company's budget cuts that placed Fred under tight constraints. Identify these decisions, determine whether there were viable alternatives, and decide whether to justify, excuse,or explain your decisions.
- Develop a two minute position paper that you will present to the commission.
- Anticipate Commission questions into your responsibility and develop effective responses to possible attempts by other groups to shift the blame your way.

Corporate Governance: French Parent Company

- You represent the French owners who have recently required Phaust Chemical. You have recently shifted funds from Phaust operations to finance further mergers and acquisitions for your company.
- What are your supervisory responsibilities in relation to Phaust?
- Develop a preliminary two minute presentation summarizing your position and interests.
- Anticipate likely commission questions along with possible attempts by other groups to shift the blame your way.

Engineering Professional Society

- You represent the professional engineering society to which Fred belongs.
- Develop a two minute presentation that outlines your group's interests and position.
- Anticipate possible Commission questions, develop responses, and anticipate attempts by other groups to shift the blame your way.
- Respond to whether your professional society should extend moral support to engineers in difficult positions like Fred's. Should they clarify code provisions? Provide legal support and counseling? Make available a professional/ethical support hotline?

Investigative Commission
This role will be played by your instructor and other "guests" to the classroom. Try to anticipate the commissions questions. These will be based on the conditions of blame responsibility, the principle of responsive adjustment, and responsibility as a virtue.

4.2.4.2 Module Time Line

- Module Preparation Activities: Read module and visit niee.org to get general orientation to "Incident at Morales"
- **Class One**: Watch Video. Receive group role. Begin preparing your group role.
- **Class Two**: Work within your group on preparing your group's statement, anticipating questions, and developing responses.
- **Class Three**: Participate in the Public Hearing. The group representing the Mexican Commission will convene the public hearing, listen to the group's statements, ask questions, and prepare a brief presentation on the Commission's findings
- **Class four**: Class will debrief on the previous class's public hearing. This will begin with the Commission's findings

4.2.5 Incident at Morales and Jeopardy

Jeopardy and Incident at Morales
[Media Object][6]

[6] This media object is a downloadable file. Please view or download it at <Jeopardy_IM.pptx>

Jeopardy on Socio-Technical Systems in Incident at Morales
[Media Object][7]

4.2.6 What have you learned?

Listen to the findings of the Mexican Government Commision. Write a short essay responding to the following questions. Be prepared to read parts of your essay to your professor and to your classmates.

1. Do you agree with the Commissions findings? Why or why not? Be sure to frame your arguments in terms of the responsibility frameworks provided above.
2. Were there any opportunities to offer Fred moral support by those who shared responsibility with him? What were these opportunities. How, in general, can professional societies support their members when they find themselves in ethically difficult situations?
3. What opportunities arise for exercising resonsibility as an excellence? Which were taken advantage of? Which were lost?
4. Finally, quickly list themes and issues that were left out of the public hearing that should have been included?

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4.3 Value Profile: Responsibility[8]

4.3.1 Introduction: The Root Meaning of Responsibility

The College of Business Administration at the University of Puerto Rico at Mayaguez has recently adopted a Statement of Values. Rather than allowing this document to become static, this community is committed to challenging the Statement of Values. The first challenge, brought about by students, was to translate the Statement of Values into Spanish. (The original was drafted in English in order to be integrated into Business Administration's efforts at AACSB accreditation.) This module forms part of a series of modules that profile in detail each of the constituent values of Business Administration's Statement of Values: justice,

[7] This media object is a downloadable file. Please view or download it at <Jeopardy_SOV_IM.pptx>

[8] This content is available online at <http://cnx.org/content/m44683/1.2/>.

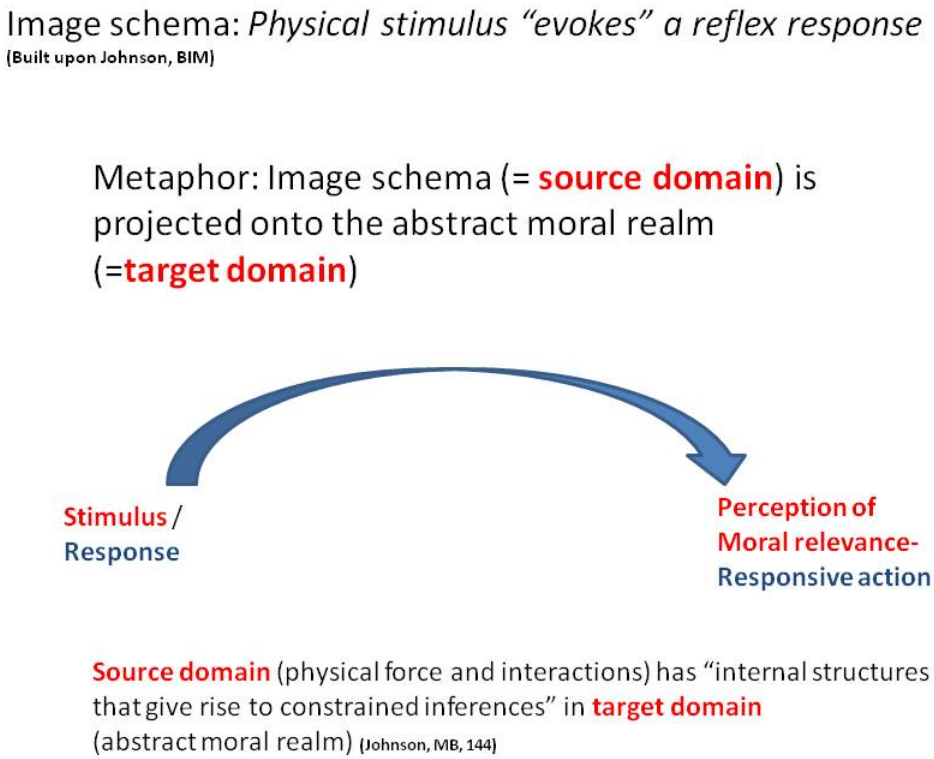
responsibility, respect, trust, and integrity. Its purpose is to provide the basis for a conceptual challenge to the Statement of Values. Different constituents or stakeholders of Business Administration, students and staff, have expressed interest in more sharply distinguishing key values (e.g. trust and responsibility) and in exploring the overlap and distinctions between values (e.g., integrity and responsibility). This module profiles responsibility. Others will profile the remaining values, justice, respect, trust, and integrity. Finally, an introductory module will introduce students to value-based decision making while a concluding module will present a value realization framework taken from software engineering. This module profiles responsibility by providing its root metaphor, key features, kinds and senses, and useful frameworks. It concludes with exercises designed to help students understand responsibility's root metaphor, response to relevance, and how it has been metaphorically projected onto increasingly "higher" moral spaces, moving from the negative to the positive, the minimal to the exemplary, and the reactive to the prospective.

Root Meaning: Response to Relevance

Herbert Fingarette's formula, **"responsiveness to essential relevance"** pulls together two strains used to test for criminal insanity, the cognitive test which lies in the ability to appreciate the moral quality of one's actions and the volitional test which lies in the ability to act on one's perception of moral relevance. This module converts the test for legal competence, "responsiveness to essential relevance," into a the root metaphor for moral responsibility, namely, "(moral) responsiveness to essential (moral) relevance." Moral responsibility brings together two skills. First, the responsible agent has the ability to zero in on the morally relevant aspects of a situation. This comes from cultivated emotional and perceptual sensitivities. (You are sitting on a crowded bus and begin to feel empathically the uncomfortableness of the elderly lady standing in the center.) Second, while keeping the morally relevant aspects in focus, the responsible agent is able to design and execute a morally responsive action that answers to the moral relevance in a situation. (You rise from your seat in the bus and offer it to the elderly lady.) This volitional ability requires cultivating powers of control, skill and knowledge. **The root meaning of responsibility is, thus, (moral) responsiveness to essential (moral) relevance.** See Fingarette, The Meaning of Criminal Insanity, 186-7.

Metaphorical Structure

Responsibility is metaphorically structured. Metaphor, for Johnson and Lakoff, is more than just a figure of speech. It is a projection of meaning and structure from one domain, a familiar experience termed the **source domain**, onto another less familiar domain termed the **target domain**. Seeing the unfamiliar in terms of the familiar or extending existing meaning and experience to cover new regions, represents, for Johnson and Lakoff, a fundamental imaginative activity. So, our experience of physical forces and their interactions is encapsulated into the image schema, stimulus-response. Then this basic structure is projected onto the moral domain: stimulus-response becomes perception of relevance-response to relevance. This projection doesn't merely repeat the original experience; it does not reduce the moral to the physical. Stimulus-response is expanded by the insertion of moral content. Stimulus becomes sensitivity to what is morally salient in a situation; we use perceptual and emotional sensitivities and skills to zero in on the moral aspects of a complex situation. Response, when projected onto the moral domain, is no longer unthinking, automatic; now it becomes the formulation of action that is calibrated to moral salience. This metaphorical structure of responsibility is subject to further elaborations. As you will see in the exercises below, responsibility begins as a punitive response to failure to achieve the minimally moral. We blame an engineer for an accident when it results from her failure to exercise even minimal due care in the design and testing of a product. But, through repeated metaphorical projections, moral repsonsibility is repeatedly elaborated onto higher and higher moral spaces as the pursuit of excellence, not just the avoidance of blame. In short, the metaphorical elaboration of the root meaning of responsibility allows us to see continuity between its negative, reactive, and blame-center forms and more advanced positive, proactive, and supererogatory praise-worthy forms. Just below is a slide that taken from a presentation given by the author on "Teaching Moral Responsibility" at the annual meeting of the Association of Practical and Professional Ethics, March 2012; it shows the elaboration of moral responsibility through the repeated projeections of the image schema stimulus-response or the experience of physical force and its interactions. (This account of responsibilty as a metaphor is taken from Mark Johnson, The Body in the Mind, p. 14. See other Johnson references listed below.)



4.3.2 Positive and Negative Senses of Responsibility

Negative Rsponsibility

The negative sense focuses on assigning blame for the untoward. (Untoward means something negative like harmful or unduely risky, etc.) This sense of responsibility works, primarily, from the threshold of the morally minimum. If you are below this threshold, several things happen: you are subjective to reactive attitudes (resentment, indignation, guilt), blame or approbation, and punishment. It is this sense that Bradley had in mind when he asserted that "repsonsibliity is necessarily connected to punishment." In this domain, the goal is to stay out of trouble which is the same as staying above the minmally moral. Good enough to stay out of trouble but not really good. (Hobbes, in Calvin and Hobbes, tells Santa Clause that he has not committed any murders or robbed any banks this year. Hobbes tells him that this might not be enough; not doing wrong does not fully constitute doing good.)

Positive Responsibility

Positive/proactive responsibility focuses on preventing harm and striving for supererogatory value-realization. You are working on an assembly line and see your coworker unconsciously taking a risk that could, under the right configuration of events, cause an accident. You make him aware of this risky habit and work with him to change it all the while taking care not blame him or attribute it to him as a fault. Your coworker could, and at least initially probably will say, that it is none of your business. But you make it clear that you are doing this because you are concerned and want to work with him to avoid an injury. More and more, companies are working to take injury prevention out of the negative and punitive stance and make it part of an approach that emphasizes non-fault prevention. But even more than prevention, positive responsibility can lie int he pursuit of the supererogatory. Here one takes responsibility even if prior to the act of commitment, it was not not obligatory. One delivers an unexpected good work or even offers a sacrifice

of an important interest in the pursuit of an excellence. Positive responsibility sets behind itself issues of punishment and blame and recasts itself as the pursuit of excellence. In its most positive sense, responsibly becomes a virtue. (Pritchard, Harris, and Rabins discuss positive senses of responsibility in **Engineering Ethics: Concepts and Cases** 99-116. 2nd Edition. See also William F. May, "Professoinal Virtue and Self-Regulation," in ethical Issues in Professional Life, Oxford University Press, 1988. Finally see John Ladd "Bhopal: An Essay on Moral Responsibility and Civic Virtue" in **Journal of Social Philosophy** Vol. 22(1):73-91.)

4.3.3 Moral Responsibility and the Law

Moral responsibility cannot be reduced to legal responsibility. Yet, as Fingarette's investigation of criminal insanity shows, the two overlap and frequently compliment one another. Here it is absolutely essential to emphasize one fundamental difference. Legal responsibility focuses on the boundary between what is above the threshold of the minimally moral and what falls below. Moral responsibility begins with this minimal threshold or boundary but then proceeds to outline higher regions of what can be termed exemplary or supererogatory space. Another way of putting this is to hold that while moral responsibility can reflect legal responsibility by laying out the gateway between the blameworthy and the acceptable, it can also be formulated as a virtue or an excellence. Legal responsibility remains necessarily connected with blame and punishment. Moral responsibility at some point leaves these behind as it becomes associated with different morally reactive attitudes such as gratitude, admiration, and pride.

Responsibility under Civil Law

- A Tort is a wrongful injury. To prevail in a tort one must prove negligence, recklessness, or intent.
- Negligence emerges out of the background of the normal or reasonable where due care is exercised. In other words, it arises from the failure to exercise due care.
- Recklessness goes a step further. One consciously risks a harm but does so in pursuit of another intention or goal. So you may drive recklessly through the university but justify–in your own mind–this risk incurred on others because you are late to your job interview.
- Intent is the worst of all three. Here the harm in question forms a central part of the agent's intention. The employee fired from his job intentionally introduces a virus into the workplace computer network shutting it down and producing financial loss. Injury intentionally brought about not only triggers compensation to make the victim whole; it may also trigger punitive damages, an invasion of civil law by criminal law.

An interesting debate has developed in the field of engineering ethics about standards of due care. Larry May sets forth a standard of minimal care which is a threshold below which an engineer cannot fall without incurring negligence. While the law is adept at establishing a minimal level of acceptable care, engineers as professionals should be held to higher standards. Hence, Harris, Pritchard, and Rabins in an influential textbook on engineering ethics, Engineering Ethics: Concepts and Cases, argue for higher standards of care such as normal or reasonable care, good works, and exemplary care. Engineers should be encourage to explore higher levels of care and responsibility; but this is held back by the specter of blame. It is certainly appropriate to hold engineers responsible and blameworthy for failure to live up to minimum standards of care and practice. But above this level, when should blame drop out. Certainly engineers who fall below reasonable or normal standards exhibit moral deficiency. (The term comes from Ladd.) But what about taking on tasks that are above and beyond the call of duty? Suppose an engineer elects not to bring about a good work or make a substantial self-sacrifice to obtain a community good. Certainly such an action cannot be blameworthy since it falls well above the minimum threshold of acceptable practice. Nor does it seem to admit of moral deficiency. Hence, as responsibility is projected into increasingly positive and supererogatory space, what terms should we employ to replace blame, punishment, and moral deficiency? See Martin Curd and Larry May, "Professional Responsibility for Harmful Actions" in **Module Series in Applied Ethics**, Center for the Study of Ethics in the Professions, Illinois Institute of Technology Kendall/Hunt, 1984. See also **Engineering Ethics: Concepts and Cases**, Chapter 5.

Criminal Responsibility

- This area of the law applies to human individuals.
- To prevail in a criminal trial, one must first prove **mens rea** or a guilty mind. This is essentially an intention to break the law, to commit the crime in question.
- It is also necessary to prove that the target of a criminal suit have actually committed the guilty, law-breaking action, termed an **actus reus**.
- Finally, it is necessary to prove that the **mens rea** caused and guided the execution of the **actus reus**

Back to O.J. Simpson

- Reflecting on the trial of O.J. Simpson can help distinguish burden of proof in a civil and criminal law. Burden of proof is what the plaintiff has to prove to prevail against the accused or defendant. In a criminal trial, the burden of proof is set quite high. (Why do you suppose this would be?) The prosecution has to prove the defendant guilty "beyond a reasonable doubt." It is lower in a civil trial where the plaintiff only has to prove the case against the defendant by establishing a "preponderance of evidence." This is largely quantative; if 51% of the evidence falls on the side of the plaintiff, then the case against the defendant stands.
- OJ Simpson was found innocent in the criminal trial. The prosecutors were unable to establish his guilt beyond a reasonable doubt.
- But in the civil trial, his accusers were able to accumulate a preponderance of evidence against him. The difference in burden of proof thus explains why Simpson lost the civil trial but won the criminal trial.

4.3.4 Corporate Responsibility

While this is not the place to discuss this topic in detail, a few things can be said of corporate responsibility in summary. This notion, to say the least, is controversial. Much of this follows from the characteristics of criminal responsibility. To be criminally responsible, one must have a guilty state of mind (**mens rea**), carry out a guilt or law-breaking act (**actus reus**), and there must be a close connection between the two such that the mens rea guided the actus reus in its design and execution. But to attribute moral responsibility to a corporation would be to anthropomorphize it, to attribute to it a personality that would include mental states and body that existed above and apart form the minds and bodies of its members or employees. One ethicist, John Ladd, warns that this stretches to a breaking point, the thin concept of moral personhood; applying this to corporations empties personhood of its content and renders the concept ineffective. Or as John Danley puts it, there is nothing wrong with the anthropomorphic bias (read focus or meaning) of moral concepts such as responsibility, agency, and personhood. See Manuel Velazquez, "Why Corporations are Not Morally Responsible for Anything They Do," **Business and Professional Ethics Journal**, Vol. 2, No. 3: 1-18.

Nevertheless, there are credible arguments for corporate responsibility based on the premise that attributing responsibility to corporations does not preclude holding human individuals responsible. Peter French argues that under certain conditions, the actions of human individuals can be redescribed as corporation actions. The "device" that "licenses" this redescription is called a Corporate Internal Decision Structure or CIDS. (See French, Collective and Corporate Responsibility. Complete reference below.)

Constituents of CIDS

- **Corporate goals**. These are either objectives found in the charter or informal ends that can be uncoveed by becoming immersed in the day to day operations of a corporation.
- **Corporate decision making and recognition procedures**. These compose the grammar of corporate actions. Included would be procedures for soliciting travel funds, standard operating procedures, hiring and firing practices and other procedures that are followed for routinely corporate acts. These are at the center of attributions of corporate responsibility for these procedures are the ways in which

we can see that an action has been authorized by the organization within which and for which it was performed.

- **Corporate roles**. Was the action performed by an individual designed to carry out a corporate role or was this action performed by the individual in some other capacity?
- **Corporate Organizational or Management Systems**. These systems display the relations of the corporate roles and the individuals occupying them. Usually portrayed by the corporate flow chart, these can display any number of kinds or types but two that come to mind. In hierarchically structured organizations power flows down the chain of command while information flows from the bottom-up; in horizontally organized corporations, power is distributed across relatively autonomous interdisciplinary work teams, each of which is designated responsible for the performance of certain tasks.

4.3.5 Kinds of Responsibility

The root metaphor of responsibility is "response to essential relevance" or "response to relevance." But this root metaphor has been used to structure different moral, legal, social, and other practical domains. The result are several different senses of responsibility. This section will help you sort out some of the different senses by providing brief, provisional definitions of causal, capacity, blame, role, and corporate responsibility.

- **Causal Responsibility**: Physical motions or events produce other physical motions or events. The hurricane blew the panel off the roof and caused other damage to the house.
- **Capacity Responsibility**: Conditions for attributing an action to an agent for the purposes of assigning moral praise or blame.
- **Blame Responsibility**: Blaming individuals for their actions, attitudes, or characters that result in untoward or negative consequences
- **Role Responsibility**: To stand committed to realizing the values, goods, or interests around which a social, occupational, or professional role is built or oriented.
- **Corporate Responsibility**: The legal and moral practice of treating corporations as moral agents (not necessarily as persons) and holding them accountable or answerable for their actions. Corporate moral responsibility should not exclude attributing moral responsibility to individuals for their actions. Yet, under special conditions, the actions of individuals can be re-described as corporations or re-description can reveal a corporate dimension or aspect to individual actions.

There are different accounts of types of responsibility in H. L. A. Hart, “Responsibility and Retribution,” in Computers, Ethics and Social Values, Deborah G. Johnson and Helen Nissenbaum, Eds. Upper Saddle River, NJ: Prentice Hall, 1995, pp. 514-525 as well as K. Baier, “Types of Responsibility,” in The Spectrum of Responsibility, Peter A. French, Ed. New York: St. Martin’s, 1991, pp. 117-122.

4.3.6 Useful Responsibility Frameworks

Responsibility has positive and negative senses. In its negative sense, responsibility is the practice of assigning blame and setting the stage for punishment as a means of discouraging modes of action that lead to bad results. But the positive sense–so to speak–pivots off this negative sense and reconstructs the negative and reactive as positive and proactive. (More on this below.) This section presents F.H. Bradley’s conditions of imputibility, requirements that must be in place in order for us to hold one another responsible for our actions and their results. Combining the perspectives of Bradley and Strawson, we could say that one fits into the **participant attitude** if one satisfies the conditions of imputability, that is, self-sameness, moral sense, and ownership. Failing this, one could still be in the participant perspective but, due to special circumstances, be unable (temporarily)to act responsibly. But Strawson’s **objective attitude** is more fundamental and applies to children, the disabled, and the insane. In this case, we are dealing with individuals who are incapable of fulfilling the conditions of imputability, especially self-sameness and moral sense. In this case, the individual falls outside the practice of responsibility, the participant attitude, and into what Strawson terms the objective attitude. We can treat such an individual as "as a possible predictable entity ’to be

managed or handled or cured or trained; and perhaps simply to be avoided.'" (Margaret Urban-Walker in **Moral Repair** quoting–in part–Strawson, "Freedom and Resentment."

Capacity Responsibility (Conditions for Imputing or Assigning Responsibility)

- **Self-sameness** (Identity): The agent caused the action and the agent's identity persists or continues from the moment of act to the moment of accountability. F.H. Bradley: "I must be throughout one identical person. We do not say, 'He is not the same man that he was,' but always in another sense, to signify that the character or disposition of the person is altered." **Ethical Studies**, 5
- **Moral Sense**: The agent has skills pertinent to honing in on moral relevance and collecting thought, emotion, and will into responsive action. As Bradley puts it, "Responsibility implies a moral agent. No one is accountable, who is not capable of knowing (not, who does not know) the moral quality of his acts. Wherever we can not presume upon a capacity for apprehending (not, an actual apprehension of) moral distinctions, in such cases, for example, as those of young children and some madmen, there is, and there can be, no responsibility because there exists no moral will." **Ethical Studies** 7
- **Ownership**: Minimally, this condition requires the absence of ignorance and compulsion. As Bradley puts it, "it [the act] must have belonged to me–it must have been mine....The deed must issue from my will; in Aristotle's language, the arche must be in myself. ["Arche" is the Greek workd for beginning or principle.] Where I am forced, there I do nothing....Not only must the deed be an act, and come from the man without compulsion, but, in the second place, the doer must be supposed intelligent; he must know the particular circumstances of the case;;;;If the man is ignorant, and if it was not his duty to know...then the deed is not his act." **Ethical Studies**, 5-6.
- Ignorance and compulsion are not excusable if the they result from past, negligent actions. For example, if my failure to find crucial information in the past–"I don't want to know..."–caused my present ignorance it is not excusable. If my past actions and choices got me into the present compelling situation, then I am also responsible.
- Bradley's definition of compulsion is, roughly, the production in an individual of a state of mind or body that is contrary to his or her actual will. Holding a loaded gun to my head and telling me to sign the contract, is compulsion because the fear it produces in my mind leads me to an action that, absent the gun, I would not do. Tripping me produces a state of body–falling–that is contrary to my actual will of standing straight.

More on Strawson

- **Participant reactive attitudes**: "What I have called the participant reactive attitudes are essentially natural human reactions to the good or ill will or indifferences of others towards us, as displayed in their attitudes and actions" Strawson, "Freedom and Resentment," 10-11. For Strawson, responsibility arises when we hold one another responsible for living up to certain standards and when we respond with "reactive attitudes" when there is a failure to live up to these standards.
- **Objective attitude**: "on the other hand, [the objective attitude] withholds subjecting oneself and others to reactive attitudes. In cases of insanity, childhood, or some other relevant deficiency, the individual does ot fit in the network of relations supported by reactive attitudes." "Freedom and Resentment" 18-19.
- **Examples**: Resentment, Indignation, Shame.
- **Positive Correlates**: Gratitude, Admiration, Pride

Responsibility as a Virtue

Responsibility, when reconstructed in exemplary moral space, becomes a virtue, the pursuit of an excellence. This section pivots from the reactive model set forth by thinkers like Bradley and Strawson to a more prospective model. This positive model that portrays responsibility as a virtue targets three skill sets: Role-taking, transperspectivity, and techno-social sensitivity.

- **Role-Taking**: Projecting into the standpoints of others to assess situations, formulate moral relevance, and outline actions. Requires the ability to explore multpile perspectives (multiple framings) and to move quickly from one to the other.

- **Transperspectivity**:"unravel or trace back the strands by which our constructions weave our world together." Also, the ability to "imagine how thwe world might be constructed differently." Johnson quotes Winter in Johnson 1993, 241. Steven Winter: "Bull Durham and the Uses of Theory" in Standford Law Journal, 42, 639-693.
- **Techno-social Sensitivity**: From Harris, SEE 2008: "Critical awareness of the way technology affects society and the way social forces, in turn, affect the evolution of technology."

4.3.7 Exercises

Identify the Relevance and Response components of the following cases:

- The disciplinary tribunal of the Puerto Rico State Society of Land Surveyors and Professional Engineers has a moral tribunal that investigates violations of the society's code of ethics. Individuals brought before the tribunal and found guilty of code violations are subject to temporary or permanent expulsion from membership of this professional society and from the privileges of attendant upon being a licensed professional engineer. Discuss rule compliance from the standpoint of "response to relevance." What is the relevance component? What is the response component?
- The Puerto Rican government held public hearings to review a private company's petition for permission to build a windmill farm on privately owned land located near a publicly owned nature preserve. (Bosque Seco de Guanica) The public hearings wer held in a distant place, at an expensive and exclusive facility, and at an inconvenient time for many of those opposed to the project. This activity was not well publicized. What aspects of this situation fall under the umbrella of moral salience or moral relevance? What would be morally appropriate responses available to those opposing the project?
- An engineer passes a laminating press room and notices that a fine white powder covers everything in the room, including the operator. The engineer talks with the operator and finds out that he has been working at this position for ten years. The operator says he is not aware of any evidence that this powder is dangerous or hazardous but has not really looked into the matter. He also appears not to be using any safety equipment to avoid exposure to the white powder. What is the moral salience of this situation? What would be some relevantly moral responses to this salience?
- A family is without electricity in the aftermath of a severe hurricane in a tropical country. Neighbors have generators which they run all day and night to keep their houses air conditioned and their appliances continually running. The family without a generator finds that the noise from their neighbors generators prevents them from sleeping at night. They finally give up starying in their house and stay in a hotel for the duration of the time it takes to restore their electricity. What is the moral salience of this situation and what are possible responsive actions that the neighbors with generators could take?
- Nathaniel Borenstein is a pacifist. He is also a computer programmer whose skills are in high demand for those developing military technology. But he has a strong commitment not to collaborate with the military or associated industries. So when NATO contacts him to assist them in building a training program for missile launchers, he politely but firmly refuses their overtures. But when he learns that the training program they have developed so far is embedded, he reconsiders his vow of non-participation. An embedded training program could mistakenly inform trainees that the system was in training mode when it was actually in operational mode. What is the moral salience of this situation and what is it about Borenstein that makes him uniquely qualified to attend to this moral salience? What kind of responsive actions are available to Borenstein? Would continuing his policy of non-participation be considered one of these options?

Responsibility in Dickens' Bleak House
Bleak House is a novel written by Charles Dickens. In it, Dickens creates characters who embody different models of responsibility. Below are these characters and a brief sketch of their approach to responsibility. Read the sketches below. Then answer the following questions.

Character Sketches

- **Esther Summerson**: Esther believes in helping those around her. While she spends almost no time worrying about her own needs, she is entirely focused on those of her surrounding family, guardian, friends, and community. She finds an abstract conception of duty to be both difficult to comprehend and distracting since she is quite busy with helping those in her immediate surroundings.
- **Mrs. Jellyby**: Jellyby is entirely focused on the plight of the natives of the distant country, Borioboola Gha. She works tirelessly writing letters that inform others of their plight. She organizes activities to raise funds to help develop coffee plantations and to provide hungry children with food. While focused on the distant, she is completely unaware of what is going on around her. Her husband has lost his work and is depressed. Her children—we never know how many—run around unsupervised. There are several servants in the household but they drink, argue among one another, and generally do little to carry out their basic duties. When introduced to Jellyby, Esther notes jellyby's peculiar habit of looking through one as if she were focused on the distant plight of those in Borrioboola Gha. Dickens calls Jellyby a "telescopic philanthropist."
- **Harold Skimpole**: Harold Skimpole presents himself as a child. His lot in life is to give others pleasure by helping him. As for his own situation, he has a family that he neglect but somehow finds ways of attaching himself to those who supply him with the finer things in life: good food, drink, and fine clothes. He incurs debts which he foists off on other by pleading that he is incapable of understanding figures. He is but a child and all he asks for is to be able to live and to enjoy life.
- **Richard Carstone**: Richard Carstone is a handsome and talented young man. But he has trouble focusing on a career. He engages in studies in medicine and the law but is unable to focus on them and soon abandons them for a career in the military which he also abandons. He is a minor party to a long and complicated lawsuit. He devotes himself to its resolution placing all his hopes and efforts on coming into a substantial inheritance. His guardian, who was initially the source of his trust and love, is later seen by him as an opponent in the lawsuit. He interprets all his guardian's actions as motivated by the desire to win the lawsuit and to claim the money that properly belongs to him (Richard).
- **Mr. Tulkinghorn**: Tulkinghorn is a highly regarded lawyer, a keeper and discoverer of secrets. He has a very British view of society. A person's duty is to stay loyal to the duties of the station in which he or she was born. Those born aristocratic carry out their station of high fashion and the maintenance of large estates while those who are poor are relegated to working in the drastic employments available to their station. His job is to keep people in their stations and to prevent the rise of those who would usurp the stations of those born higher. In this way, he uses the law to maintain the natural order of society.

Questions:

- Which model of responsibility works best for you, Esther's "circle of duty" model where one starts with one's immediate surroundings or Jellyby's "telescopic" model where one focuses on the distant. Start by considering what would be the strength and weaknesses of each.
- Do you believe Skimpole is sincere in his project of avoiding responsibility. What kind of actions or thinking could Skimpole show that would give the lie to his claim that "I am only a child"?
- Richard places all of his hopes and dreams on the resolution of the lawsuit that encircles all the characters of Bleak House. Do you think this project sustainable? How could such a commitment render one less responsible, that is, less capable of response to relevance?
- Dickens seems to imply by his portrait of Jellyby and Esther that one can either attend to one's immediate surroundings or one can focus, telescopically, on what is distant. Is this "disjunction" necessarily the case? Can you think of anyone who has managed to combine both perspectives? Can you think of anyone else like either Esther or Jellyby? How are they able to balance these poles of responsibility?
- Dickens takes exception to two themes embodied in the lawyer Tulkinghorn. First, Tulkinghorn reduces moral responsibility to legal responsibility? What do you think Dickens finds wrong with this. Second, for Tulkinghorn, the goal of legal responsibility is to maintain social order. Tulkinghorn's conception of social order is, in many respects, Medieval. He finds social order in every person's finding their

station or social position, remaining loyal to that station, and performing its attendant duties. When someone rises above their station, Tulkinghorn feels it his duty to put them back in their place. What do you find wrong with this project? Do you think this problem endemic to responsibility or merely to Tulkinghorn's particular view of responsibility?

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[Media Object][9]

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[9]This media object is a downloadable file. Please view or download it at <Train_Eng_V7.pptx>

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4.4 Three Views of CSR (Corporate Social Responsibility)[10]

Word Version of this Template

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Figure 4.6: This is an example of an embedded link. (Go to "Files" tab to delete this file and replace it with your own files.)

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  - The first two links to this module are to sample corporate social
  responsibility statements put out by McDonalds and Starbucks. These
  will help you to benchmark your own efforts both in the fictional
  Burger Man case and in your efforts to develop CSR reports for real
  companies.

- The other link is a story from reporter, Paul Solomon, that reports on
  the annual Business for Social Responsibility conference.  This story,
  first broadcast on December 23, 2004 reports on outstanding and suc-
  cessful efforts on CSR.  Its title is "Good Business Deeds" and it was
  accessed for this module on August 17, 2008 at the following URL:
  http://www.pbs.org/newshour/bb/business/july-dec04/corporate_12-23.html
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4.4.1 Introduction

This module will introduce you to the theme of corporate social responsibility. Three representative cases will help to pose the central problems and basic issues of CSR. Then you will work on developing a social contract between the business corporation and society to articulate the interests, goods, and rights at stake in CSR. Three different approaches dominate this field: the shareholder approach set forth by Milton Friedman, the stakeholder approach articulated by Evan and Freeman, and Patricia Werhane's alliance model. Finally, you will work on developing a CSR program for the hypothetical corporation, Burger Man. This will be based on a shareholder meeting that consists of six or seven stakeholder presentations. (You will play the role of one of the stakeholders.) Your CSR program will address and integrate the needs and interests of the Burger Man stakeholders.

Three CSR Challenges

Patricia Werhane discusses how six corporate organizations deal with three CSR challenges: (1) carrying out oil drilling in a corrupt political environment, (2) working with suppliers who impose sweatshop conditions on employees, and (3) addressing the HIV/AIDS challenge in Africa. Each challenge elicits two corporate responses, one from a shareholder or stakeholder perspective, the other from an alliance perspective. Shell Oil's response to political corruption in Nigeria will be compared with Exxon/Mobile's response in Chad and Cameroon. Nike's answer to public criticism of the employment practices of its third world suppliers will be compared to Wal Mart's reputedly heavy-handed treatment of its employees and suppliers. Finally, while the pharmaceutical industry has developed an expensive drug cocktail to treat HIV/AIDS in patients in developed nations, the NGO (Non Government Organization), the Female Health Company, has designed

[10] This content is available online at <http://cnx.org/content/m17318/1.6/>.

a program to distribute of condoms to prevent infection in the first place. These paired corporate responses to CSR challenges are not provided in support of the position that the superiority of the alliance approach is a "no-brainer." Instead, they provide you with a menu of CSR strategies that you will evaluate using the CSR framework you will develop out of the social contract that between business and society. These three CSR challenges come from Werhane (2007)

Operating in a Corrupt Environment

- A big challenge facing multinational corporations is how they should respond to local corruption. Both Shell Oil and Exxon/Mobile sought to carry out drilling operations at sites plagued by corrupt local and national governments.
- Shell took a shareholder approach arguing that their primary CSR was to their stockholders and that involvement in corrupt local politics would be tantamount to paternalism.
- Exxon/Mobile, on the other hand, adopted a more active approach. They took expensive measures to mitigate the environmental impact of their operations. They also hired and provided technical training to local residents. Finally, they worked to ensure that the revenues they introduced into the local communities were not lost through political and business corruption.
- What are the CSRs of multinational corporations that operate in corrupt local environments? Are these fashioned around the minimal obligation of creating no additional harm? Or should they expand to preventing harm (if possible) that others are about to inflict? To move even further up the ladder of responsibility, do multinational corporations have positive, supererogatory responsibilities that consist of adding value to the communities they do business in?

Vicarious CSR: Responding to Supplier Sweatshops

- Vicarious responsibility occurs when one agent accepts responsibility for actions executed by another. For example, under agency theory, the principal bears overall moral and legal responsibility for the action since he or she has originated it. Although the agent executes the action, he or she is responsibility only for executing the action faithfully and treating the principal's interests as his or her own.
- In this context, can we hold corporations such as Nike and Wal Mart vicariously responsible for the morally questionable actions of their suppliers? If so, then under what conditions?
- Nike fell under siege when the press found out that its suppliers based in the third world imposed harsh, sweatshop conditions on their employees, including child labor. Nike could have argued that this was beyond the scope of their repsonsibility. How could **they** be held **vicariously responsible** for the actions of another? Their job was to produce shoes at the lowest possible price to deliver an affordable quality product to customers and to maximize shareholder value. But Nike went beyond this minimal responsibility to carefully vet suppliers and to work with them to improve working conditions. Thus, they expanded the scope of their CSR to include improving working conditions for, not only their employees, but also the employees of their suppliers.
- Wal Mart has been identified by Collins and Porras (Built to Last) as a highly successful and visionary company. It has certainly led the way in providing consumers with high quality products at surprisingly low prices. But the savings it provides to customers and the high returns it guarantees investors are purchased at a high price. Wal Mart prevents its employees from joining unions which has lowered their wages and restricted their health and retirement benefits. Wal Mart employees are also expected to work long hours for the company. While it provides cheap, high quality products to its customers, Wal Mart pushes suppliers narrowing their profit margin and placing upon them the responsibility of supplying product just-in-time to meet demand.
- In its earlier days, Wal Mart targeted small towns. Their competitive practices forced less aggressive, local business to leave. While they have brought considerable benefits to these communities, they have also seriously changed established business and social structures.
- Finally, Wal Mart, like Nike initially, exercises minimal supervision over their suppliers many of whom are oversees. Wal Mart suppliers also have been known to impose harsh working conditions on their employees.

Some CSR Questions for Nike and Wal Mart

1. From a broader CSR perspective, is Nike maximizing stakeholder value? Is it redistributing burdens and costs from customers and investors to its suppliers and their employees? Does CSR allow this redistribution of the corporate wealth form the shareholders to other stakeholders? (Think about Friedman's arguments here.
2. If it is necessary to trade off stakeholder stakes as both Wal Mart and Nike do, which trade off is more just? Nike's distribution of its wealth from its stockholders to the needy manifested in its efforts to improve the working conditions and income of the employees of its suppliers? Or Wal Mart's distribution of benefits to its stockholders and its comparatively prosperous customers?
3. Which model would Friedman prefer under the his version of the shareholder view of CSR? Explain and evaluate.
4. Which model would be preferable by Evan and Freeman under the stakeholder view? Who are Nike and Wal Mart's stakeholders? What are their stakes? How should the wealth produced by these two corporations be distributed among their stakeholders?
5. Werhane, in her alliance model, argues for the importance of a CSR model that decentralizes the corporation and facilitates morally imaginative solutions. Why does she argue that Nike's program is than Wal Mart's from this perspective? What could Wal Mart do to improve its CSR on the alliance view?

Facing the AIDS Challenge in Africa

- The widespread and devastating effects of the AIDS epidemic in Africa are well known. But what are the responsibilities of corporations in the face of this terrible CSR challenge? Should they do business as usual and allow others who are perhaps more qualified respond to this pervasive social problem? Or should they recognize a broader responsibility to channel their wealth, knowledge and expertise toward mitigating this social problem?
- Pharmaceutical corporations invest huge amounts of money in research and development. The market place is a good place for both encouraging this necessary risk and for distributing it among several groups and interests. Developing new medicines requires costly research. So Friedman's question is highly pertinent here: does imposing CSR on a corporation do more harm than good because it interferes with the delicate mechanism of the market?
- At any point along the way, the product may not meet expectations, a competitor may beat the pharmaceutical to the market, the regulatory process may delay or even prevent sale, and so on. The rewards from patenting a successful medicine are astoundingly high. But heavy, possibly devastating losses are also possible. Adding CSR to the mixture may be the formula for corporate disaster.
- Pharmaceutical corporations also face daunting challenges from regulatory agencies such as the Food and Drug Administration. New products must be exhaustively and painstakingly tested to avoid problems that have arisen in the past such as the Dalkon Shield and Thalidomide. Again, considerable effort must be expended in exploring the middle and long term consequences accompanying product and drug use, and all of this before the product can be marketed and profits made. Government regulation also raises another problem. Is government prodding necessary to force corporations into a proper CSR posture? Or should corporations be allowed to develop voluntarily their own CSR responses?
- In the case at hand, pharmaceutical companies have invested considerable resources to carry out research into medicines that control HIV infection and prevent it from developing into full-blown AIDS. But these treatments are very expensive and bring with them considerable side effects. An anti-AIDS chemical cocktail can cost patients in developed nations between 15 and 20 thousand dollars per patient per year. This is far beyond the financial resources available to a typical HIV/AIDS patient in Africa. Some NGOs and critics of the pharmaceutical industry accuse the latter of gouging victims and drawing excess profits from the misfortune of others. A spokesperson for "Doctors Without Borders," for example, claims that the AIDS treatment "cocktail" that costs U.S. patients 15 to 20 thousand dollars could be made available to Africans at less than 300 dollars per patient per year.

Pharmaceuticals, according to their critics, need to rethink their CSR, cease operating as for-profit businesses, and make these drugs available to third world sufferers at cost.

- What are the CSRs of multinational pharmaceutical corporations for making HIV/AIDS drugs available to victims in the poverty-stricken nations of Africa? Are they responsible for charging what the market will bear? Assuming they have the right to recoup their heavy investment in research, should governments, recognizing the necessity of compensating drug companies for their research, buy these drugs and redistribute them at little or no cost to those who can't afford them? Or should the pharmaceuticals charge more to those who can pay and less to those who cannot? (This redistributes the burden of cost from the haves to the have nots.)
- Many NGOs have taken the stance that their responsibility lies in pressuring drug companies to do the right thing and donate medicines to patients who cannot pay. This is their corporate social responsibility, and the pharmaceutical industry certainly has enough money to do this.
- But others have tried to reframe this issue using moral imagination. Treating individuals for HIV infection once they have contracted it is expensive no matter how you look at it. But, redefining the problem, can moderate and affordable measures be taken to prevent the spread of the disease?
- This is the imaginative approach taken by the Female Health Company which has initiated a widespread effort to distribute condoms to those at risk for contracting AIDS.
- How does the approach of the FHO exemplify Werhane's alliance model? How should pharmaceutical companies respond to this kind of initiative? Is it necessary to frame the relation between the pharmaceutical industry and NGOs as an adversarial relation or should broader alliances be formed that coordinate the efforts of these groups?

4.4.2 The Social Contract between Business and Society

Every contract is built on the basis of three conditions (1) free and informed consent, (2) a quid pro quo, and (3) the rational self interest of the contracting parties.

- **Free and Informed Consent**: No contract is legitimate that is based on force, fraud or deception. The parties must enter into this agreement freely and without compulsion. They must understand the terms of the contract which excludes deception and fraud. In short, the contract presupposes the uncoerced participation of all the parties. To enter into the contract they must understand all the key issues and consent to the constitutive exchange.
- **Quid Pro Quo**: Quid Pro Quo literally means something in exchange for something. Every contract is built around a mutually beneficial exchange. I give you my baseball cap in exchange your ice cream. Most exchanges are simultaneous. But some are what Hobbes calls "covenants." Here I give you my baseball cap with the understanding that later this afternoon you will pass by your refrigerator, get my ice cream cone and give it to me. I give you my part now and trust you to carry out your part later.
- **Rational Self Interest**: Each of us should know the value of the items to be exchanged. (That is one reason why a contract requires free and informed consent.) This knowledge is determined, in part, by the preference schedules that we have developed as rationally self-interested beings. So a legitimate contract assumes that I have interests, that I am capable of determining what promotes these interests, and that I am rational enough to determine means to promote them and avoid other means that interfere with them.

Social Contracts

A social contract differs from other contracts because it is hypothetical. Business and Society have never sat down in a room and hammered out a contract outlining their relation. But this hypothetical contract provides a good means of making sense out of the relation that has gradually evolved between society and business. Forget for a moment the historical details of the relation between business and society. If this relation is summarized as a contract, what does society give to business? What does business give to society? Do these two institutions trust one another or do they each adopt means to monitor and control the other?

What are these means? Treating the relation between business and society as a contract between two mutually consenting agents or actors does get some of the facts wrong. But it provides a useful "heuristic" device, i.e., a framework that will help us to summarize, structure, and, in a work, make sense of the relation between the two. Moving from the terms of this "contract" you will be able to develop a framework for understanding the social responsibilities of business corporations. This, in turn, will help you to understand the CSR challenges presented above and the CSRs of the fictional but realistic Burger Man corporation.

Exercise 1: In small groups, spell out the social contract between society and business.

- How can the absence of force, deception, and fraud be guaranteed in this contract? How should each side hold the other accountable? (This is especially the case where one side delivers at one time and the other side is trusted to deliver later.)
- What benefits can busines bring to society? How can society benefit business. Develop a table with one column listing what business has to contribute to society and the other what society has to contribute to business. This table is the heart of your social contract.
- Assume that society and business are rationally self interested. How does this effect the formulation of the goods of the exchange? How does this enforce the terms of the contract? Are these self interests divergent? (Then each side must monitor the other to prevent the corruption of the contract.) Are these interests convergent? (Then the contract consists largely in building social capital and trust between the contracting parties.)
- Donaldson, 1993 uses social contract theory to account for the rights and duties of multinational corporations

Exercise 2: CSR and STS
Choose one of the CSR challenges above and construct a socio-technical table around it

STS Table

Component / Embedded Value	**Technology (Hardware)**	**Technology (Software)**	**Physical Surroundings**	**Stakeholders**	**Procedures**	**Laws**	**Information and Information Systems**
Justice							
Free Speech							
Property							
Privacy							
Safety							

Table 4.7

4.4.3 Three CSR Frameworks

Shareholder View
From Milton Friedman, "The Social Responsibility of Business is to Increase Its Profits." "But the doctrine of "social responsibility" taken seriously would extend the scope of the political mechanism to every human activity. It does not differ in philosophy from the most explicitly collectivist doctrine. It differs only by professing to believe that collectivist ends can be attained without collectivist means. That is why, in my book **Capitalism and Freedom**, I have called it a "fundamentally subversive doctrine" in a free society, and have said that in such a society, "there is one and only one social responsibility of business–to use its

resources and engage in activities designed to increase its profits so long as it stays wihtin the rules of the game, which is to say, engages in open and free competition without deception or fraud." 1970 by New York Times Company

Stakeholder View

- A stakeholder must be distinguished from a stockholder. The latter owns a share of the corporation. On the other hand, a stakeholder is any group or individual that has a vital interest in the doings of the corporation. Hence the stockholder is a stakeholder of the corporation whose vital interest at play is the share owned of the corporation and the money invested in this share.
- There are several other stakeholders of the corporation. These include (1) employees, (2) customers, (3) suppliers, (4) local community, (4) surrounding governments, (5) the surrounding human and natural environment, and (6) the corporation's managers. (In some situations there are other stakeholders such as competitors.)
- Stakeholder theory requires that the corporation recognize and respect the vital interests of each of its surrounding stakeholders. This frequently issues in proposing stakeholder rights and assigning to others correlative duties to recognize and respect these rights.
- Stakeholder theory also requires that the corporation integrate interests where possible, mediate or broker conflicts between interests, and only trade off competing interests when absolutely necessary and when more conciliatory efforts have already been made and have failed.
- See Evan and Freeman 1988

Werhane's Alliance Approach

- Werhane's alliance approach is similar to the stakeholder approach in that it recognizes several groups that surround the corporation and have vital interests that depend on the doings of the corporation. These surrounding groups are more or less the same as those in the stakeholder approach: owners, managers, employees, customers, suppliers, local communities, governments, the environment, etc.
- But Werhane makes two significant departures from the stakeholder approach. First, she uses moral imagination to distance the corporation from the problem solving process; the lens of problem solving refocuses on each of the other stakeholders. Whereas for stakeholder theory the corporation is the center of analysis and is visualized as surrounded by its stakeholders, the alliance approach decentralizes the corporation and alternatively visualizes each stakeholder as the center for the purpose of framing problems and generating solutions.
- Second, the alliance approach sees the corporation as a part of a system of interrelated and interdependent parts. Hence, each problem situation presents a system formed of the corporation, owners, managers, employees, suppliers, customers, local communities, and governments. Problems emerge from value conflicts within and between the constituent parts of the system. They are solved through the cooperation of the different constituencies of the alliance.
- While this approach does not lend itself to algorithms or rules, it does promise solutions by highlighting and facilitating moral imagination both in the framing of problems (problems are posed in terms of framings from multiple perspectives) and in terms of the generation of solutions (multiple problem-framings help us to visualize new solution horizons).
- See Werhane, 2007 and 2008.

4.4.4 What you will do ...

Module Activities

1. Examine the CSR challenges presented above. Compare the two responses to each challenge.
2. Learn about three models of corporate social responsibility.
3. Develop a fully articulated social contract between business and society. Use this contract to understand the basic CSRs of business corporations.

4. Prepare a Social Impact Analysis on the fictional firm, Burger Man.
5. Prepare for and participate in a board meeting for Burger Man to examine ethically its practices and develop for it a viable and sustainable program of corporate social responsibility. This requires that you give a short presentation on the interests of a particular Burger Man stakeholder
6. Develop a full blown CSR program for Burger Man that carries out the responsibilities of this company to its stakeholders.

4.4.5 Burger Man Stakeholders

The author became aware of the Burger Man exercise when participating in an Ag-Sat broadcast course in Agricultural Ethics in 1992. The exercise was created by the leader of the course, Dr. Paul Thompson.

Burger Man Profile

Burger Man is a franchise that began by selling the fast food staples of hamburgers, french fries, and milk shakes. As the company has matured and faced other competitors in this market niche, it has, of course, developed a more sophisticated set of products and services. But it has also been challenged on various issues related to corporate social responsibility. Groups representing the rights and interests of animals have criticized the agribusiness methods used by its suppliers. Recently, public interest groups have blamed Burger Man and its competitors for encouraging unhealthy dietary habits among its customers and the public in general. Shareholders, of course, are concerned that the company continue to be profitable and provide them with a good return on investment. Governmental regulatory agencies such as the EPA (Environmental Protection Agency) and OSHA (Occupational Safety and Health Administration) wish to hold Burger Man accountable for conforming to its regulations. In short there are several stakeholder groups surrounding this corporation, each vying for its particular interest. In this exercise, you will play two roles. First you will be assigned a role as one of Burger Man's stakeholders and make a presentation of your group's interest in mock shareholder meeting that will be held in class. Then you will switch to the role of Burger Man management. Here your assignment will be to articulate the different stakeholder interests and integrate them into a coherent CSR plan for your company.

Burger Man Customers

- Burger Man customers are the consumers who go to its restaurant and enjoy its food services. In preparing your board meeting presentation you need to explore Burger Man's social responsibilities to its customers.
- Are these reducible to providing them an enjoyable product at a reasonable price? Or does BM's social responsibilities go beyond this?
- Burger Man has extensive interactions with its suppliers that include meat packing corporations and agri-business concerns. How should Burger Man choose its suppliers? How carefully should it monitor their activities. To what extent is Burger Man responsible for the untoward activities of these groups?
- How responsible is Burger Man for shaping the dietary habits of its customers? Does it bear responsibility for the health problems that its public develops from bad dietary practices?

Burger Man Shareholders

- Burger Man shareholders are investors who have purchased shares of Burger Man's publicly traded stock.
- What are their stakes?
- What are their responsibilities? For example, how closely should shareholders monitor the actions of their agents, i.e., Burger Man's managers? Are shareholders responsible for holding Burger Man to certain standards of corporate social responsibility? What are these standards and how do they stand in relation to the different models of social responsibility?
- Prepare your presentation around these issues. Address shareholder interests (stakes) and responsibilities.

Burger Man Managers

- Burger Man managers are the agents of the shareholders/owners responsible for overseeing the day-to-day operations of the corporation.
- What are the manager's stakes? What role do they play in the different models of social responsibility? (Classical, stakeholder, and alliance views?)
- Agency theory argues that the primary corporate governance problem is overseeing and controlling the actions of managers. How closely should shareholders and their board of directors oversee corporate managers? Are managers self-interested agents or stewards of the corporation?
- What are managerial responsibilities vis a vis corporate social responsibility? Should they uncover illegal actions? Should they implement an audit process that assess the corporation's success in carrying out its social responsibilities? Should these responsibilities go beyond the legal minimum?
- Should managers go beyond the legal minimum in monitoring and carrying out corporate social responsibilities?
- Are corporate managers responsible only to shareholders or do their responsibilities extend to other stakeholders? If the latter, how do they balance conflicting stakes?
- Structure your presentation around outlining managerial stakes and roles. Choose a model of corporate social responsibility and argue for its appropriateness to Burger Man.

Government Regulatory Agencies: OSHA and EPA

- OSHA is in charge of regulating workplace safety. EPA is in charge of setting, monitoring, and enforcing standards concerning the environment. (For example, they establish acceptable air emission and water discharge standards.)
- What are the stakes of government regulatory agencies? What is their role in the context of the Burger Man corporation?
- Write your position paper outlining your group's stakes and roles in the context of establishing Burger Man's corporate social responsibility procedures. What would you recommend? How should you back up or enforce these recommendations?

Animal Rights Activists

- Burger Man serves hamburgers, chicken sandwiches, and dairy products. These involve animals. As animal rights activists, you are concerned with steering Burger Man and its suppliers toward morally acceptable treatment of animals.
- What are your group's stakes in this board meeting? What kind of role should you play?
- State your policy on animal treatment? Is it a position of animal welfare based on utilitarian considerations? (Peter Singer provides such a position.) Is it a deontological position based on the assertion of animal rights that impose correlative duties on humans? (Tom Regan takes this position.) Or should you base your arguments on anthropocentric issues such as human health?
- Write a position paper that responds to these questions for presentation in the Burger Man board meeting.

Town X Committee for Economic Development

- Your town, Town X, has three Burger Man franchises. Representatives from the town council are participating in the board meeting in order to ensure that Burger Man's policies on corporate social responsibility enhance the town's economic welfare and development.
- What are your stakes? What are your roles and responsibilities?
- What kind of services and products do you provide for Burger Man? What benefits do your community draw from Burger Man? How can Burger Man activities and policies promote or demote your town's interests and stakes?
- Develop a position paper for the board meeting that addresses these issues? Pay special attention to the goods and risks that your town exchanges with Burger Man.

Insert paragraph text here.

Exercises in CSR

- Participate in the Burger Man Stakeholder Meeting
- Take your assigned stakeholder group and prepare a short presentation(five minutes maximum) on your stakeholder's interests, rights, needs, and vulnerabilities.
- Listen to the stakeholder presentations from the other groups. Try to avoid a competitive stance. Instead, look for commonalities and shared interests. You may want to form coalitions with one or more of the other groups.
- Switch from the stakeholder role to that of Burger Man management. You are responsible for developing a comprehensive corporate social responsibility program for Burger Man. You job is to integrate the concerns expressed by the stakeholders in their presentation and form your plan around this integration.
- Try to resolve conflicts. If you cannot and are forced to prioritize, then you still must find a way of recognizing and responding to each legitimate stakeholder stake. You may want to refer to the "Ethics of Team Work" module (m13760) to look for time-tested methods for dealing with difficult to reconcile stake. These include setting quotas, negotiating interests, expanding the pie, nonspecific compensation, logrolling, cost-cutting and bridging. You should be able to establish beyond a shadow of a doubt that you have made every attempt to recognize and integrate every legitimate stakeholder stake.

4.4.6 What did you learn?

This module and two others (A Short History of the Corporation and Corporate Governance) are designed to help you understand the corporate context of business. In this section, you should reflect on three questions: (1) What have you learned about the social responsibilities of corporations? (2) What still perplexes you about the social responsibilities of corporations. (3) Do you find one model of CSR better than the others? (4) Can these models of CSR be combined in any way?

4.4.7 Appendix

Rubric for Partial Exam on CSR

This media object is a downloadable file. Please view or download it at
<PE_Rubric_CLSR_F08.docx>

Figure 4.7: This file contains the rubric to be used on the partial exam for Corporate Leadership and Social Responsibility, ADMI 3405, Fall 2008"

Corporate Social Responsibility Frameworks: Seminal Papers

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4.4.8 EAC ToolKit Project

4.4.8.1 This module is a WORK-IN-PROGRESS; the author(s) may update the content as needed. Others are welcome to use this module or create a new derived module. You can COLLABORATE to improve this module by providing suggestions and/or feedback on your experiences with this module.

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Index of Keywords and Terms

Keywords are listed by the section with that keyword (page numbers are in parentheses). Keywords do not necessarily appear in the text of the page. They are merely associated with that section. *Ex.* apples, § 1.1 (1) **Terms** are referenced by the page they appear on. *Ex.* apples, 1

A Appropriate Technology, § 2.2(39)

B Business, § 1.2(10), § 2.1(21), § 4.2(75), § 4.4(93)
Business Ethics, § 2.1(21)

C Capabilities, § 2.2(39)
Computer Ethics, § 1.3(15), § 3.1(53)
Corporate, § 4.4(93)
Corporate governance, § 1.2(10)

D Decision Making, § 3.1(53)
Decision-making, § 1.2(10)
design, § 4.3(82)

E Engineering, § 1.1(1), § 2.1(21), § 4.1(65)
Engineering Ethics, § 1.3(15), § 3.1(53), § 4.1(65)
Ethical Dilemma, § 1.3(15)
Ethical Leadership, § 1.2(10)
Ethical Theory, § 1.3(15)
Ethics, § 1.1(1), § 1.2(10), § 1.3(15), § 2.1(21), § 3.1(53), § 4.1(65), § 4.2(75), § 4.3(82), § 4.4(93)
Ethics Bowl, § 3.1(53)
Ethics of Technology, § 2.2(39)

H Human Development Approach, § 2.2(39)

I Incident at Morales, § 4.2(75)

M Module, § 1.1(1)

P problem-solving, § 4.3(82)
Professional, § 1.1(1), § 4.2(75)
Professional Ethics, § 4.1(65)

R Responsibility, § 4.2(75), § 4.3(82), § 4.4(93)

S Social, § 4.4(93)
Social Impacts, § 2.1(21)
Social Responsibility, § 1.2(10), § 4.1(65)
Socio-technical analysis, § 3.1(53)
Socio-Technical System, § 2.1(21)
Socio-technical systems, § 4.1(65)
Student, § 1.1(1)

T Technical Impacts, § 2.1(21)
Technology, § 2.2(39)
Template, § 1.1(1)
Toolkit, § 1.1(1)

V value, § 4.3(82)

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Module: "Three Views of CSR (Corporate Social Responsibility)"
By: William Frey, Jose A. Cruz-Cruz
URL: http://cnx.org/content/m17318/1.6/
Pages: 93-102
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Based on: EAC Toolkit - Student Module Template
By: Jose A. Cruz-Cruz, William Frey
URL: http://cnx.org/content/m14291/1.9/

Engineering Ethics Modules for Ethics Across the Curriculum

This collection of modules is designed to implement ethics across the curriculum for engineering programs for ABET. It consists of an introductory module, a module that encourages students to consider social and global impacts, a module for developing skills in ethical decision making, and a module exploring exploring responsibility in the context of the NIEE video, "Incident at Morales." In this latest version, modules were added on corporate social responsibility, technological choice, and a value profile of responsibility. This course and its modules are part of the NSF-funded EAC Toolkit, NSF SES 0551779.

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