Using Moral Theories to Help Engineers Make Ethical Decisions

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Abstract

There are a variety of ways engineering ethics can be taught in the university. One common approach is to use case studies. Engineers like to think of themselves as practical people, and examining actual situations appeals to many engineers.

In their popular book, *Engineering Ethics: Concepts and Cases*[1], Harris, Pritchard, and Rabins use many real world case studies to illustrate the issues that are faced by engineers. Texas A & M University has created an extensive engineering ethics web page with many useful case studies[2]. In order to make the cases more interesting to the average engineer, a number of cases with significant numerical components have been created and posted on Texas A & M University's Engineering Ethics web page[3]. Two of them are by the first author of this paper[4,5]. Another example of the case studies approach is in the first author's paper at the 2002 Regional GSW ASEE meeting[6]. While case studies can be quite useful, and we have been involved in creating some of them, they may not be sufficient to give guidance in all situations.

A second approach emphasizes the making of good decisions. Harris' book[1] discusses various decision making methods. One way an engineer can make good decisions is to have a firm perspective on the world that helps her to evaluate each case that comes to her. This leads to the issue of using moral theories to help make ethical decisions. Martin and Schinzinger's books[7,8] provide more information to the engineer about what moral theories are and how they can be used. Their first book[7] describes moral theories in more detail and we have used them to evaluate the legitimacy of the various engineering codes of conduct[9].

One problem with both the case studies approach and the good decision making approach is the question of what should be used as the basis upon which to decide. Many authors have used the engineering codes of conduct as their basis. However, as we have previously pointed out[9,10], these codes are not perfect, and will not cover all the possible issues that the engineer might face. We believe that teaching about basic moral theories can give the engineer a good moral basis upon which to make decisions. In this paper we will introduce several of the basic moral theories that have been discussed by Martin and Schinzinger[7]. Among the theories we will use are:
1.   Utilitarian theories.
2.   Duty theories.

3.   Rights theories.
4.   Virtue theories.

We will apply these to actual case studies that have been faced by engineers. The difference between this paper and the traditional case studies approach is that we will use moral theories to evaluate the cases, rather than just using engineering codes of conduct as our standard. We will discuss how we have used this approach in the engineering classroom.

Moral Theories

Before an engineer can evaluate the legitimacy of a given choice, he must first have a basis upon which to make the judgment. This means that he should have some moral theory to use as his basis.

There are many different moral theories that can be used to evaluate engineering codes of conduct. We will examine four of them. The following table is a summary of four positions described in Martin and Schinzinger's book[7]. The authors are not professional ethicists and all are engineers (though the first author also has a seminary degree). We are seeking to evaluate moral theories in a way that engineers can appreciate and use. Much of this description of moral theories was first presented by the authors in 2002[9].

TABLE I Ethical theories (adapted from Martin and Schinzinger[7])		
Acts are morally right when:		
They produce the most good for the most people.	Act–utilitarianism: Mill	Utilitarianism
They fall under a rule, which if widely followed, would produce the most good for the most people.	Rule–utilitarianism: Brandt	
They fall under principles of duty which respect the autonomy and rationality of persons, and which can be willed universally to apply to all people.	Kant	Duty Theories
They fall under principles of the *prima facie duties* which every rational, reflective person would have accepted.	Ross	
They are the best way to respect the human rights of everyone affected	Locke and Melden	Rights Theories

TABLE I Ethical theories (adapted from Martin and Schinzinger[7])		
Acts are morally right when:		
They most fully manifest or support relevant virtues, where virtues are traits of character making possible the achievement of social goods.	Aristotle and MacIntyre	Virtue Theories

Utilitarian theories state that something is the right thing to do when it produces the most good for the most people. This is a very common approach to ethics in our society. Many engineering decisions are clearly based on a utilitarian approach, for most engineers assume that if an analysis method works in a given situation, then it is the proper choice.

The utilitarian position is really composed of two subsidiary positions: *act–utilitarianism* and *rule–utilitarianism*. *Act–utilitarianism* says an act is bad if it results in bad consequences. One problem with this view is that no one can definitely say there will be bad results until after the action in question has already been committed. This means that someone who wishes to do good by following act–utilitarianism will have to predict the future before he makes any significant choice. One way to get around this problem without abandoning the utilitarian position is to adopt what is called *rule–utilitarianism*. This perspective states that an act is wrong if it violates a rule, which if widely followed, would produce good for most people. In this manner, some rules can be adopted (based on past observations). When these rules are obeyed, then someone is acting ethically. This removes the need for the person to be able to accurately predict the future before making a choice.

Duty theories state that we each have some duties to other people. While this concept may be widely accepted in general, the difficulty lies in coming up with details of what these duties ought to be. Kant's perspective is that something can only be considered a duty if it could be willed for all people to do. The question arises does society benefit if everyone will do the duty? Ross tries to get around this problem by creating what he calls *prima facie duties*. He says these are the duties that every rational, reflective person would accept. If you do not accept his list, then perhaps you have not thought and reflected enough.

Rights theories state that an action is acceptable if it respects the human rights of everyone involved. Our culture is certainly more accepting of this approach than it used to be. There is still the problem of how to decide what to do when the rights of two or more people come into conflict. One non-engineering example of this is the issue of noise pollution. What do we do when our right to peace and quiet in our automobile is violated by someone in an adjacent lane exercising his right to play music very loudly (because that is the way he likes to hear it)?

Virtue theories are somewhat different from the previous three theories mentioned above. The previous approaches are based on developing some type of decision making skills. Virtue ethics

is based on the premise that good people make good decisions. Rather than concentrating on decision making skills, concentrate on developing good character virtues. The more of these virtues you exhibit, the better your decisions will be.

The author's have previously used moral theories to evaluate engineering codes of conduct[9]. We have also used codes of conduct to evaluate some representative case studies[6]. In this paper we will skip the middleman of codes of conduct and use moral theories directly to evaluate some representative case studies.

The above description of ethical theories may seem rather esoteric to the average engineer. We will therefore apply these theories to real world cases.

We believe that every engineer (and every person) should have a well developed personal ethical system. We are all called upon to make choices in life that have moral implications. We need to have a basis upon which to build when we are faced with such choices. You will have to live with the choices you make. It is our belief that you should think out what you believe so that the choices you make will be ones that you can live with (and still feel good about yourself).

Everyone already has such a system. However, it may not be very well developed. This can cause problems when facing a new situation. The purpose of this section of the paper is to encourage each engineer to develop her own system in more detail. This may involve thinking through some potential issues before she actually has to make a decision relating to them. This will increase her chances of making a decision she will be satisfied with after the event or issue is finished.

In dealing with issues that have moral implications, a person who has firm moral convictions is usually able to better deal with the difficulties surrounding that decision. A historical example might prove useful. Early in 1961 a group of Cuban rebels, trained and financed by the United States, invaded Cuba in an attempt to overthrow the Castro government. That event turned into what has been called the Bay of Pigs disaster as the invaders were quickly beaten by Cuban government forces. President Kennedy was severely criticized by both supporters and opponents of the invasion. Invasion opponents claimed he never should have allowed the invasion to go forward (the training of the group had begun during the Eisenhower administration). Invasion supporters claimed the invasion would have worked if the United States had provided adequate air cover to the invaders. Since President Kennedy chose a course that was not in complete support or complete opposition to the event, both sides criticized him. This criticism extended even to those within his administration. The Undersecretary of State, Chester Bowles was to write in his diary a perceptive comment which we think applies to anyone who has been forced to make a decision with moral implications. Bowles wrote[11]:

> The genuine question which concerns me most about this new Administration is whether it lacks a genuine sense of conviction about what is right and what is wrong. I realize in posing the question that I am raising an extremely serious point. Nevertheless I feel it must be faced.

Anyone in public life who has strong convictions about the rights and wrongs of public morality, both domestic and international, has a very great advantage in times of strain, since his instincts on what to do are clear and immediate. Lacking such a framework of moral conviction or sense of what is right and what is wrong, he is forced to lean almost entirely upon his mental processes; he adds up the pluses and minuses of any question and comes up with a conclusion. Under normal conditions, when he is not tired or frustrated, this pragmatic approach should successfully bring him out on the right side of the question.

What worries me are the conclusions that such an individual may reach when he is tired, angry, frustrated, or emotionally affected. The Cuban fiasco demonstrates how far astray a man as brilliant and well intentioned as Kennedy can go who lacks a basic moral reference point.

The remarkable aspect of the above quote is that it was not done by a Kennedy opponent, but by a high presidential appointee (the number two person in the Kennedy's State Department). Our point in using this example is that some problems can be avoided if an engineer has a well developed personal ethical perspective that can rather automatically be applied to new situations.

Using Moral Theories with Engineering Case Studies

All of the following case studies are true. In only the first case are the actual names of the individuals involved used. In the other cases, pseudonyms are used in order not to embarrass any of the people involved.

The case of a corrupt public official

We will now examine a real world situation in which engineers performed poorly, and then evaluate that position by a number of different ethical systems. The one chosen involved two engineers in Maryland and their engineering consulting/construction firm. Their story is taken from a book by Richard Cohen and Jules Witcover[11]. We are indebted to Martin and Schinzinger's book[7], which first alerted us to this example. The conclusions in this discussion are our own.

> *Lester Matz and John Childs met during the 1950s when they both worked as municipal engineers for Baltimore. They formed their own firm in 1955... Matz, a gregarious fellow, went out to seek clients. He found them in Baltimore County, to which thousands of Baltimoreans were then fleeing. All over the county, fortunes were being built as farms made way for housing tracts and sewers and roads constructed–a heady sight, a Comstock Lode of opportunities for an engineer. One of the major developers was Bud Hammerman... Another was Wolff, then an engineer in private practice. Before long, the three–Matz, Hammerman, and Wolff–established a business relationship.*

The firm of Matz, Childs began to prosper. As a new and politically unconnected firm, however, it received none of the county's public–works contracts. Despite repeated attempts to break into the favored circle of firms that did, Matz, Childs and Associates remained outsiders, watching with mounting chagrin as the contracts flowed to their better–connected rivals. Still Matz was not idle. By 1960, he had befriended the chairman of the county zoning board of appeals–Spiro Agnew. (Within two years, Matz and Agnew became involved in certain transactions with a man who will be referred to in this book as The Close Associate.) When Agnew announced that he would run for county executive, Matz and Childs threw in with him, donating $500 to what appeared then to be a doomed cause. The two engineers genuinely admired Agnew and of course also hoped that his victory would bring them the contracts they believe they deserved.

Shortly after Agnew's election, The Close Associate told Matz that the two of them figured to make a lot of money...Not long after, The Close Associate asked Matz to prepare a chart listing how much money the engineers receiving county contracts could be expected to kick back. Matz calculated the likely profits on certain jobs, concluded that a 5–percent kickback was not unreasonable, gave a copy of the chart to The Close Associate, and took the original to Agnew. The county executive thanked him for his work.

The chart then became a manual by which kickbacks in Baltimore County and to Spiro Agnew were determined...Whenever Matz learned which contracts the county was about to let, he would contact The Close Associate in his office, handing him a plain white envelope containing the cash. He paid in installments, generally, making each payment when the county sent him an installment for the work performed. And when the size of the cash payments increased and Matz and Childs found themselves in a cash bind, they began to generate cash by having key employees kick back bonuses...

It was no surprise, then, that in 1966, Matz and Childs were enthusiastic supporters of Agnew's gubernatorial campaign. Their faith in the man's abilities–and his financial value to them–was undiminished. With Jerry Wolff as chairman of the state roads commission and Agnew in the governor's mansion, Matz, Childs and Associates soon began to enjoy a steady flow of state contracts. By then, however, circumstances had made Matz reluctant to continue paying through The Close Associate, for he suspected that the intermediary was skimming money off the top and taking all the credit for the cash he handed over. Matz went to Annapolis for a face–to–face talk with the new governor...Matz had a proposition. Instead of paying through The Close Associate, why not deliver the cash to Agnew directly?..

All through 1967, Matz, Childs and Associates continued to share in the largess

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of the Agnew administration. So large were the contracts that Matz and Childs had to defer their payments to Agnew until they received their fees from the state...The firm however, was in a fix. Matz and Childs felt they could not safely generate $30,000 in cash. So Matz turned to a former client who generally dealt in large sums of cash and arranged a "loan."..The friend was able to generate almost $20,000 of the total almost immediately. Matz showed the cash to Childs, then he stuffed it in a manila envelope and drove to the State House in Annapolis...There, Matz handed the envelope to Agnew, thanked him for the state contracts, and left...

By 1969, Agnew had been promoted by Richard Nixon and by the American people out of Maryland and down the Baltimore–Washington Parkway to the seat of national power....Nevertheless, Matz felt that he owed Agnew money for Maryland contracts received under the old Agnew administration. On a piece of yellow paper, he calculated the sum he thought was due Agnew and called the Vice President's office for an appointment. Matz took the yellow paper and an envelope containing $10,000 in cash and went to see Agnew in his office in the basement of the White House. The engineer showed Agnew his calculations, reviewed them with him, and handed the Vice President the envelope. Agnew took it and put in a desk drawer.

On his return to Towson, Matz told Childs about his White House transaction with Agnew. This was no longer something he could be casual about, and he admitted to Childs that he was shaken. He had just paid off the Vice President of the United States in the White House...

From there on, Matz's common sense conflicted with his sense of obligation. Since Agnew was no longer in a position to award contracts, the pace of payments diminished, though Matz did make one to him for $2,500 in return for a federal contract awarded in 1971 to a subsidiary of Matz, Childs. They about a year later, in the spring of 1972, Matz was contacted by The Close Associate, who pressed hard for a $10,000 contribution. Matz complained to Agnew himself. "Say you gave at the office," the Vice President told him.[11]

This scandal had far reaching impacts for many people. Matz and Childs had their engineering careers ended. Spiro Agnew was forced to resign from the Vice-Presidency.

We will now examine how the case of Matz and Childs might be interpreted by the four basic systems we have described. The *utilitarian* perspective would have said they were wrong because of the bad results of their actions. They, Spiro Agnew, and the people of the United States were all hurt by the ensuing scandal. Since the results were bad, then the acts would also have to be bad.

There are a variety of duty theories. *Kant's version of a duty theory* states that someone is acting ethically when he chooses to do something that respects the autonomy and rationality of others. The only duties that are allowable are those that would help society if everyone always performed them. This perspective would also have criticized Matz and Childs actions. Even if you grant that everyone has a duty to provide for his family, these two engineers did it by deceiving others and corrupting government officials. If everyone practiced this deceit and corruption, any society would collapse into chaos–an anarchical "every man for himself". Therefore, what those two engineers did was wrong.

Another version of a duty theory has been developed by W.D. Ross. Ross was concerned that perhaps sometimes one or more duty theories might become in conflict. He thus developed what he called prima-facie duties. An example might be when Corrie Ten Boom lied to the Nazis about whether she was hiding Jews in her home in Holland[12]. Most duty theorists would state that the following statements are both duties: "Do not lie", and "Protect human life". In this case, these two duties appeared to conflict, and Corrie Ten Boom lied to protect human life. Ross would approve of such actions. From Ross' perspective, the actions of Matz and Childs were wrong, for no–one could possibly claim that anyone had a prima–facie duty to lie and deceive.

Rights theories would state that Matz and Childs were wrong because their actions did not respect the rights of the other engineering firms to have a fair chance at obtaining engineering contracts. Their actions also did not respect the rights of the people of Maryland to have honest government, and to have government contracts fulfilled by the most competent engineers, not the most politically correct ones.

Virtue theories concentrate not on the wrong actions, but the wrong character that produced those actions. Matz, Childs, and Agnew were greedy. This character flaw of greediness motivated them to do things that were wrong in the greedy pursuit of material wealth.

The case of a poor young professor

This case involves a young assistant professor named Smith, and an older, more senior professor named Brown. Smith had obtained a research grant with Brown. Both of them were officially co-principal investigators, but Smith was the prime mover behind getting the grant.

The grant had gone on for more than one year, and was about to end at the end of the summer. As he was reviewing the budget that spring, Professor Smith noticed that Brown did not claim all of his summer support the previous year (as Smith had done). Smith was facing a financially bleak summer without any income. He know that Brown was the type of person who did not pay attention to such details (and apparently did not need to the money anyway). Smith faced two choices:
- tell Brown that he has money coming and that he should fill out the forms to get paid

- during the summer
- don't tell anyone about this and claim all of the money for his own needs. After all Smith was the prime mover behind getting the grant, and he had a greater apparent need for the money.

People who believe in a *utilitarian theory* could argue for either decision. Smith should take the money for he has a greater need for it and he is the main person on the project. Alternatively, Smith should not take the money for if he was exposed it would hurt his career. A potentially ruined career is not worth a month of salary support.

Duty theories could also argue the point either way. Some would say that Smith has a duty to provide for his family. Others would argue that Smith has a greater duty to be honest with Brown and tell him about the salary support.

People who believe in *rights theories* would probably criticize a choice by Smith to keep the money for himself. This is because Brown has a right to get the money that was in the original research project budget.

People who believe in *virtue theories* would obviously say that Smith should tell Brown about the salary support. One of the prime virtues that should be emphasized is the need to be honest in all of our professional and personal lives. To do anything to keep the money for himself would be to operate from a perspective of greed, which is not a virtue.

The case of an unpleasant professor

This case involved two more senior professors, Jones and Black. Both were successful by the standards of their university. Jones was more aggressive about pursuing research. He found out about an opportunity which involved Black's specialty. He approached Black about working with him on the project. Black agreed to work with him. Preliminary discussions had been made with the sponsoring agency, and it appeared almost certain that the grant would be funded.

However, the more they worked together, Black began to notice some things about the way Jones treated people (including himself). Jones treated subordinates harshly and lashed out at anyone whom he thought might get in their way. Jones also began treating Black, not as a professor of equal rank, but as a flunky who did not have to be treated well.

Black realized that if he was to continue to work with Jones, his own reputation might also be hurt, for others might see them as partners who behaved in an equal fashion. There were several reasons to justify continue working on the project:
- he had already agreed to work on the project
- the project involved work that was interesting to him
- the project held out the probability of three years of summer income

- Black was being considered for a promotion, and any turmoil at this time (caused by withdrawing from the project) could hurt his chances.

Some reasons to justify breaking from Jones and withdrawing from the project
- Jones was treating Black unprofessionally
- Jones was treating other faculty and staff unprofessionally
- continuing to work with Jones might hurt Black's own reputation
- it was not fun working with someone who acted as Jones did

A *utilitarian* might state that Black should stay with the project, for it was professionally and financially rewarding. It also increases the chances that Black might get the promotion.

Duty theorists might argue either side of the situation. They might state that Black had the duty to fulfill his commitment to the project. Other duty theorists might state that Black had a higher duty to act honorably in his professional work, and that continuing to work with Jones might jeopardize that.

Using a *rights perspective*, someone would probably suggest that Black withdraw from the project for he has a right to protect his own reputation of honestly and fairly dealing with others.

Someone who believes in *virtue ethics* would have to balance out two different aspects. The first own is the need to keep our own commitments. The second one is the need to act honorably treat others with respect, avoiding entanglements with those who treat people with contempt. The second aspect would probably win out, and support Black's withdrawal from the project.

The case of a potential job change

In this case engineer Green is faced with a potential change of jobs. He is reasonably successful in his own company, however, his boss is not much older than him, and there is not much chance for advancement. A competitor approaches him and offers him a similar job at a higher salary. While there are no guarantees, it appears that there might more opportunities for advancement in this second company.

After carefully considering the offer, Green decides to go back to his present company and see if they wanted to keep him badly enough to make a counter offer of a pay raise. The present company agrees to match the offer. Green then tells his present company he will stay with them at their higher matched offer. He then begins to wonder if he might be worth more than he had realized. He then goes back to the competitor to see if they will increase their original offer. The competitor then increases their offer, and Green goes to work for them.

The real issue at this time is not the legitimacy of changing jobs, which we assume everyone would say is acceptable. The issue is whether Green acted unethically by leaving his company

after telling them he would stay if they matched the other company's offer. Green said to his company that he would stay if they matched the offer, and he did not stay. There would probably be no ethical issue if Green had only told his company he would consider staying if they matched the offer. We now have the question, has Green acted ethically in this job change?

A *utilitarian* would probably say yes, for Green has acted to increase his salary and upward mobility to as high a level as possible. A *duty theory* person would probably criticize Green for engineers have a duty to treat everyone in an honest fashion and Green did not do so to his original company.

One *rights theory* person might defend Green, for he has the right to work for his own best self interest. Another rights theory person would criticize Green, for no one has the right to treat his own employer the way Green has done.

A *virtue ethics* person would criticize Green for what he has done. Green has acted in a selfish manner. He told his present company he would stay if they matched the offer, and he did not keep his word. From this perspective, it does not really matter which company made the offer of the highest salary. What matters is honesty, and Green needs to keep his promise to his company.

Conclusion

Using appropriate moral theories an engineer can gain insight into which decision to make when faced with a difficult situation. Not all moral theories will give the same answers to these difficult questions. The authors recommend that each engineer carefully determine what his basic ethical approach before he is faced with a difficult problem. Once his basic perspective has been determined, he is more able to make wise decisions when faced with difficult situations.

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