Using Moral Theories to Evaluate Engineering Codes of Conduct

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Abstract

In this paper we will use several moral theories to analyze the legitimacy of engineering codes of conduct. We believe this is an issue that has been neglected in many engineering ethics studies.

Traditionally, one of several approaches to engineering ethics is used in practical decision making. One approach to engineering ethics concentrates on case studies. Case studies may be useful, but are not sufficient to provide a questioning engineer with help in making decisions. Even if the engineer has a library of many case studies, it is likely that a given situation will be enough different so that a direct transfer from the case study cannot be made. A second approach to engineering ethics examines major issues an engineer might face. This approach has some usefulness, but it can often be so general its results cannot be easily applied. A third approach to engineering ethics examines decision making skills. While such skills can be very helpful, there is a limit to their usefulness. For example, when using a technique such as line drawing, there are still issues of who gets to draw the line of acceptable behavior, and what is the basis for drawing the line at a given point.

All decisions within the engineering ethics domain fundamentally appeal to an authoritative source. One common authority is the engineering code of conduct. The various professional societies have all adapted codes of conduct. So have the state boards of registration. The state boards have the power of government behind their rules and their rules need to be treated with respect. However, we believe we need to ask the question of whether these codes of conduct are sufficient in themselves to be used as a basis for engineering ethics decision making.

In this paper we analyze the legitimacy of these codes of conduct. Are they really a sufficient basis upon which to build an engineering career? We will analyze a generic code of conduct (the one developed by the National Society of Professional Engineers). We will use four different types of moral theories to make this analysis.

1. Utilitarian theories.
2. Duty theories.
3. Rights theories.

4. Virtue theories.

From this analysis we will make conclusions about the legitimacy of the codes of conduct.

I. Approaches to Engineering Ethics Education

There are several different approaches that can be taken to engineering ethics education. 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 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[4,5]. 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 to engineering ethics education is to examine the various issues that engineers might face in actual practice. This is also done in Harris' book described above. This issues approach is taken in Deborah Johnson's book *Ethical Issues in Engineering*[6]. Her book is a collection of essays about various issues that engineers face in practice. Some of them are quite enlightening. However, an awareness of issues does not always lead to an ability to make good decisions. This information is useful, but may not be sufficient.

A third approach emphasizes the making of good decisions. Harris' book[1] discusses various decision making methods. One way someone can make good decisions is to have a firm perspective on the world that allows herself 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 will use their categorization of moral theories as a starting point for our discussion.

II. Engineering Codes of Conduct

There are a variety of engineering codes of conduct. Most professional societies have their own codes. An example of this is the A.S.M.E. code of conduct[9]. Similarly the various state boards of registration have their own standards. Professional engineers in Louisiana are bound to this code in their engineering practice. The Louisiana code is shown on the state board site[10].

Some societies have very detailed codes of conduct, while other societies are very general. Considerable overlap exists between state board codes and society codes. For example, many passages in the ASME code are identical to those in the Louisiana state code. One big difference in the society codes and the state board codes is in the effect upon the individual engineer who violates it. A violation of a society code can result in the society dismissing an engineer as a member and publicizing such dismissal. A violation of the state board code can result in a loss of license as well as significant penalty fees.

Since they are more binding on the engineer, it would be ideal for us to analyze a registration code of conduct. However, there is no national registration of engineering in the United States. Therefore, in order to be relevant to as many engineers as possible, we will analyze the code of the National Society of Professional Engineers (N.S.P.E.). This organization includes engineers of all disciplines, and is the closest thing we have to a national code of conduct. Their code is listed on their web page[11]. Given the similarity of this code to the Louisiana Code, it is likely that if an engineer violates the NSPE code, she is also violating the code of her state.

III. The Legitimacy of Using Codes of Conduct to evaluate Engineering Practice

Not everyone is convinced that the practice of engineering can be adequately regulated by a written code of behavior. Stephen Unger raises some questions about whether this can be done in his book *Controlling Technology*[12]. Some of these same issues are raised in several articles in Deborah Johnson's book[6]. This is a complicated issue, and we are not going to address it in any detail. For this paper we are going to assume that the concept of written engineering codes of conduct is a legitimate one. What we will examine are the legitimacy of some of the details of the different codes.

IV. Introduction to Moral Theories

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.

<table>
<tr><td colspan="3">TABLE I
Ethical theories
(adapted from Martin and Schinzinger[7])</td></tr>
<tr><td colspan="3">Acts are morally right when:</td></tr>
<tr><td>They produce the most good for the most people.</td><td>Act–utilitarianism: Mill</td><td rowspan="2">Utilitarianism</td></tr>
<tr><td>They fall under a rule, which if widely followed, would produce the most good for the most people.</td><td>Rule–utilitarianism: Brandt</td></tr>
<tr><td>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.</td><td>Kant</td><td rowspan="2">Duty Theories</td></tr>
<tr><td>They fall under principles of the prima facie duties which every rational, reflective person would have accepted.</td><td>Ross</td></tr>
<tr><td>They are the best way to respect the human rights of everyone affected.</td><td>Locke and Melden</td><td>Rights Theories</td></tr>
<tr><td>They most fully manifest or support relevant virtues, where virtues are traits of character making possible the achievement of social goods.</td><td>Aristotle and MacIntyre</td><td>Virtue Theories</td></tr>
</table>

<u>Utilitarian theories</u> 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.

<u>Duty theories</u> 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.

V. Using Moral Theories with a Specific Case Study

The above description of ethical theories may seem rather esoteric to the average engineer. We will therefore apply these theories to a real world case. This is a real situation faced by the first author when he worked as a quality control engineer for a medium sized steel company. The case has been previously presented by the author[5]. However, the moral theory based analysis is new to this paper.

The first author was a metallurgical engineer for a steel company. Our customer was one of the five largest companies in the country making consumer appliances. We were selling them sheet steel to be used in the core of the electrical motors of the appliances. Being a large company, the specifications for the steel were written by engineers at a site about 200 miles away from the customer's production facility. We were faced with a problem for if our steel met the specification for hardness, then the steel would not physically work in the customer' s press. If we made a softer steel that could be fabricated in the presses then it will not have met the customer's written specifications. We had several options:

(a) Make steel that meets the written specifications
(b) Make steel that will make the part but fail the specifications.
(c) Stop selling steel to the customer since you cannot at the same time satisfy the specifications and make the part
(d) Attempt to get the parts of the customer company to work together as to what hardness of steel

they really needed.

Our company chose a version of option (d). We first met separately with the specification writers and then the production people. The specification writers assured us that their specification was not arbitrary, but was based on the need to have a certain efficiency in the electrical motors. They believed that if they were to change the specifications, then the motors in the appliances would not run as efficiently. When told that steel that met the minimum hardness standards jammed in the presses of the manufacturing facility, their response was that the people at the manufacturing facility were incompetent. [It should be noted the people they were calling incompetent were people who worked for the same corporation.]

The response of the people at the manufacturing plant was very much different. They said that if we met the official minimum hardness numbers the steel would jam in the presses and be rejected. They also told us that if we made steel that was below the official minimum hardness numbers it would work in their presses and they would not tell the rest of their corporation that the steel was out of specification.

At this point, the decision was no longer in the author’s hands alone. Our company decided to ship to them the soft steel that worked in their presses but was officially out of specification. This was based on the knowledge that the other steel suppliers had all made the same decision (to ship out of specification steel), and we were faced with the possibility of losing a considerably sized customer.

This case study raises all sorts of questions. One of them is: who is my customer? Was my customer the plant that used the steel, the designers who wanted a certain efficiency motor, or the consumer who wanted a reliable appliance? Our company decided our loyalty was to the immediate user of the steel, and if they wanted it out of specification, then that was how we were going to ship it. The author was not happy with this solution, but did not complain very much for there was no easy answer.

We will now examine how this specification based case might be interpreted by the four basic systems we have described. The *utilitarian* perspective could have two opposite conclusions. It could approve this solution, because the two obvious groups of people with the problem (the steel company and the stamping plant) were both satisfied. If a wider view of the problem were analyzed, then a utilitarian might disapprove of this solution because there could be long term problems in the appliances of many customers.

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 probably have criticized our decision. If everyone followed this approach of ignoring written specifications, then much of our society’s complex equipment would no longer work, for there would not be adequate replacement parts available (for the parts might not fit or might not work even if they did fit).

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[13]. 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, for preserving human life is a higher duty than that of telling the truth. From Ross' perspective, the actions of our company may be right, for it resulted in both companies continuing to profitably do business together. However, if we were to look at the larger perspective (that included our customers consumer customers), this solution is apparently wrong.

Rights theories would probably criticize this solution because we did not consider the rights and needs of the ultimate customers, and only examined the needs of our immediate industrial customer.

Virtue theories concentrate not on the wrong actions, but the wrong character that produced those actions. This approach would clearly criticize this solution, for the solution involves the deliberate ignoring of written standards (specifications) with which we had contractually agreed to abide.

In summary this case study solution would be approved by many utilitarians and some duty theorists. It would probably be criticized by followers of the other approaches. This makes the point that we should not necessarily only use one moral theory to analyze a problem, but consider several different theories and approaches. While the utilitarian theory works well in many situations, it may well have given bad advice in this specific case.

VI. The use of Moral Theories to Evaluate Engineering Codes of Conduct

There are many aspects of the codes we could examine. To illustrate our perspective we will look at four different parts of the NSPE code.

Section II.1.a
Engineers shall hold paramount the safety, health, and welfare of the public. If engineers' judgement is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.[11]

This section is at the heart of the concept of a code of conduct. Engineers should primarily be concerned with the safety and welfare of the public. This is a policy that the *duty ethics* approach would endorse, probably as the prime duty of the engineer. If engineers have any duty to society as a whole, and the authors would argue that we do, then protecting them by our decisions should be one of our prime duties. A problem could develop when a project might hurt a few people, but help many more. An example might be a major dam project in the southwestern United States. Is our prime duty to the few who might be displaced, or the many who might be helped by readily available water and cheaper electricity?

A *utilitarian approach* might approve of this policy as being consistent with meeting the needs of the greatest number of people in a given situation. However, it might also criticize this part of the code by saying it is inconsistent with the best interests of the immediate engineer and the firm she works for.

A *virtue ethics* approach would clearly approve of this part of the code. A person of good character would obviously want to make engineering decisions that will help people and not hurt them.

A *rights ethics* perspective would also endorse this part of the code, as it clearly states that people other than our immediate employers are also important. However, the application of this part of the code still has the problem mentioned above, what if the rights of a few are hurt in order to provide for the rights of the many? How a rights ethicist comes to a conclusion on this issue may well depend on which rights are being helped or hurt. For example, consider the benefits that many people see from the use of nuclear power. This power may be cheaper than the coal fired alternatives. In the United States, more people suffer from the health risks of the coal industry than do from health risks from nuclear power. While the risk of a nuclear power plant accident is small, the severity of such an accident would be great. There is also the problem of how to dispose of nuclear waste material. Therefore is such power good, because more people would benefit (with cheap, consistent power costs) than would likely be hurt? Or is the severity of a potential accident big enough to overcome the concept of the most good for the most people?

Using the same nuclear power example, a rights perspective would probably say the rights of the people living near the plant are more important than the much larger group of people who might benefit from the power being produced.

This policy in the code would be supported by the virtue ethics approach. Depending on how it is interpreted, it may be supported by or criticized by the other approaches.

Section II.2.c

Engineers shall endeavor to extend public knowledge and appreciation of engineering and its achievements.[11]

This policy appears to be one that is concerned with promoting the image of the profession as much as promoting safety of the public. One *virtue ethics* person might approve this as being the natural outgrowth of what a good engineer should do, share his work with others. Another virtue ethics person might see this policy as a self serving one, promoting arrogance in our profession rather than anything useful. We believe that this part of the code might be used to prevent public criticism by engineers of major projects, just because another engineer is involved in it.

A *utilitarian approach* to this would probably endorse this policy. The better the public perceives engineering, the more the engineers can do to improve our society. A *duty ethics* person would probably have mixed feelings about this policy. While we have a duty to do good engineering, do we really have a duty to make others appreciate what we do?

A *rights approach* would most likely criticize this part of the code. The rights of the public to hear an honest discussion of a major engineering project is probably more important that having good public relations for the engineering firm in question.

This part of the code would be approved by some virtue ethics people, but criticized by other virtue ethics people, as well as by most people who follow the other moral theories.

Section II.5.a
Engineers shall avoid deceptive acts. Engineers shall not falsify their qualifications or permit misrepresentation of their or their associates' qualifications.[11]

This policy would probably be endorsed by all four perspectives. Being deceptive in getting work, is certainly not a positive character trait that virtue ethics would endorse. An engineer who got work by deceptive means has a great possibility of being incompetent in the area. For otherwise, why would someone use deceptive techniques if their abilities were good enough to legitimately get their work? The incompetent practice of engineering is something that could hurt large numbers of people, which would also violate utilitarian ethics. No one has a right to a given job opportunity, and the use of deceptive practices to get a job would not be the result of any legitimate duty. Such deceptive practices would not be respecting the rights of the people to have the best firm get the job.

Let us examine the note at end of the NSPE code relating to competitive bidding.
"By order of the United States District Court for the District of Columbia, former Section 11(c) of the NSPE Code of Ethics prohibiting competitive bidding, and all policy statements, opinions, rulings or other guidelines interpreting its scope, have been rescinded as unlawfully interfering with the legal right of engineers, protected under the antitrust laws, to provide price information to prospective clients..."
Statement of NSPE Executive committee

In order to correct misunderstandings which have been indicated in some instances since the issuance of the Supreme Court decision and the entry of the Final Judgement, it is noted that in its decision of April 25, 1978, the Supreme Court of the United States declared: "The Sherman Act does not require competitive bidding"

1. *Engineers and firms may individually refuse to bid for engineering services...*
4. *State societies and local chapters are free to actively and aggressively seek legislation for professional selection and negotiation procedures by public agencies.*[11]

NSPE originally had in its code of ethics an explicit ban on using competitive bidding to obtain engineering services. The federal court system has ruled that this is a violation of the antitrust laws of the United States and cannot be enforced. This shows that there is nothing unique to these codes that makes them self authoritative. They must be adapted and changed to correspond to the laws of our society. The further note by NSPE notes that no engineering firm is required to engage in competitive bidding, so if an agency seeks bids on this basis, any (and every) firm is allowed to not respond to such a request for bids. Engineers are even allowed to lobby state legislatures to come up with alternative methods to competitive bidding. This means that while NSPE cannot call an engineer unethical for engaging in competitive bidding, it can still discourage her from doing so.

This former code item is an example of things that were put into the codes of conduct to protect those who are already in the profession more than those who are just entering it. For the people most likely to win by competitive bidding are young engineers (and young firms) that are willing to work for less money to get more work. The firms most likely to lose by this method are older, more established ones who have higher overheads and must charge more for their services.

The *utilitarian approach* would criticize this former policy as one that helped a few (older, more established firms) at the expense of the public who is denied the lowest cost solution to their needs. More people would be helped by having cheaper engineering services provided by the younger firms.

A *virtue approach* would also criticize this former policy. This policy is based on protecting those already in the profession and hurts those who are just starting out. It is promoting the character trait of greed within the established engineering firms.

A *duty approach* would likely criticize this section. A government agency has a duty to get the most benefit from the tax payers money, and competitive bidding might be seen as a way to accomplish this goal.

A *rights approach* would also criticize this part of the code. The people have a right to have their tax money used in the most efficient manner possible. The young engineering firms also have a right to have a fair chance to get governmental contracts. Under the system endorsed by this part of the code, the younger firms would have great difficulty in getting into the governmental contracting business.

This former part of the code will be criticized by some followers of each of the four moral theories described in this paper. Yet the NSPE statement at the end of this code clearly says that the organization prefers that engineers do not engage in competitive bidding. The removal of this part of the code (required by a federal court order) did not change the basic perspective of the society's leadership, for they still prefer the old method. All that is changed is that the NSPE can no longer openly label an engineer who practices competitive bidding as being someone who is practicing in an unethical manner.

VII. Conclusion

Engineering codes of conduct are not absolute standards which cannot be questioned. They have been changed over the years to reflect changes in our culture, our law, and in technology itself. The four different moral theories described in this paper can be used to evaluate different aspects of these codes. As we have seen in this paper, some parts of these codes do not have a strong ethical foundation. We are not saying that engineers should just do whatever they want, and violate the codes as they see fit. Since the codes used by the state boards of registration have the force of law, they must be treated with respect. However, by appropriately using these different moral theories we can see weaknesses in these codes that we should strive to modify.

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