

AC 2009-1236: ENGINEERING BASED ON LOVE

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An Engineering Based on Love

Abstract

A recent death of a beloved member of one of our immediate families has served as a catalyst for our reflection on not only the nature of our work but also upon our approach to the issue of reforms in engineering and engineering education which are desperately needed. In engineering we often speak of development and now of sustainability. Far too often it seems that the model used in engineering in general and in engineering education specifically is based upon profit making. The ultimate goal is economic growth with little if any interest in peace, social or environmental justice or wealth distribution. Such a model ignores inequalities, has contempt for the arts and literature, promotes group think, needs docile students and de-emphasizes critical thinking. We would like to offer a different paradigm, one which has as its priority the development of not only the human species but also the rest of the natural world. We would like to offer a new paradigm for engineering based upon a new ethic, linked to our capacity to love. Using such a paradigm, each and every being matters, groups are disaggregated into individuals and equal respect exists for each individual. Such an ethic calls upon us to transcend our own particular situations and imagine a global society which is based upon equality, to honor individual dissent and to develop our own individual narrative of moral imagination, that is, to develop the ability to be in another's shoes, to cultivate our inner eye of seeing and knowing and to overcome the blindness that we have all become far too accustomed.

I. Introduction

Morals were too essential to the happiness of man, to be risked on the uncertain combinations of the head. [Nature] laid their foundation, therefore, in sentiment, not in science.

Thomas Jefferson¹

*Love and compassion are necessities, not luxuries.
Without them, humanity cannot survive.*

If the love within your mind is lost and you see other beings as enemies, then no matter how much knowledge or education or material comfort you have, only suffering and confusion will ensue.

Dalai Lama²

What exactly is meant by an engineering based on love? As engineers and engineering educators, some of us have encountered traditional applied ethics theories including Utilitarianism,³ rights-based ethics⁴ and virtue ethics⁵ to name a few. As a starting point for the present work, a brief description of each of these applied ethical theories shall be presented. Utilitarianism is the idea that the moral worth of an action is determined solely

by its contribution to happiness or to pleasure (i.e. utility) summed up for all interested persons. Often adherents describe Utilitarianism by the phrase "the greatest good for the greatest number", though on occasion it is further simplified to simply choosing "the greatest good."

Rights-based approaches also have their roots with ancient philosophers concerned with the concept of justice, as well as natural law philosophers who recognized a potential for certain rights inherent in human nature. Modern notions of natural rights are most closely associated with Locke⁶ and his contention that human beings are entitled to life, liberty and property, which in contemporary theory form the basis of what are referred to as universal human rights.⁷

Virtue ethics "emphasizes the virtues, or moral character, in contrast to the approach which emphasizes duties or rules (deontology) or that which emphasizes the consequences of actions (consequentialism or here, Utilitarianism)."⁸

These traditional approaches have been encapsulated in many of our various engineering codes of ethics. An engineering decision based in Utilitarianism would seek to maximize the good while one taking a rights based approach would focus on preserving the dignity of each individual who is affected by the decisions. Lastly, an engineer whose ethical code is based in a virtue ethics approach would concentrate on the actual character of the decision maker. In our opinion, each of these approaches is isolated from an important aspect of living our lives, that is, the ability to feel emotions and ultimately the ability to love. Crowe recently wrote, "If we could only get out of our heads and into our hearts..."⁹ The thrust of the present work attempts to offer such an approach.

Each ethical approach offers us different ways to respond when confronted with ethical dilemmas. The approach we are proposing in the present work challenges us when confronted with difficult decisions to use an engineering ethic based on love. First we shall explore the definitions of love used in this exploration.

II. An Ethic and Definitions of Love

Theologians, philosophers, and applied ethicists have explored the idea of an ethic of love. Fletcher suggested that what is right in one case might be wrong in another and it is, therefore, up to the individual to decide what is the right thing to do in each situation.¹⁰ He suggests three ethical approaches: legalism, antinomianism and situationism. According to Fletcher, legalism occurs when "one enters into every decision-making situation encumbered with a whole apparatus of prefabricated rules and regulation." Antinomianism, at the other end of the spectrum, rejects all prefabricated rules with each decision seen as an existential dilemma. Somewhere in the middle of these two opposites lies situationism in which both rules and rejecting rules are set aside and the decision for the particular situation is based in our desire to nurture our concept of love.

A somewhat similar ethic to an ethic based on love, that is, one based on care, has been

offered by Dudley.¹¹ An ethic of care and responsibility develops from an individual's feeling of interconnectedness with others. It is contextual and arises from experience. It is characterized by nurturance and an emphasis on responsibilities to others. An ethic of justice, on the other hand, is an expression of autonomy. It is formulated in terms of universal, abstract principles and is characterized by rationality and an emphasis on individual rights. Some describe an ethic of caring as a "female" approach to morality and an ethic of rights and justice as a "male" approach.

Before offering a new engineering ethic of love, let us consider the concept of love in more detail. Countless sages, scholars, poets, philosophers, theologians and others have tried to define love throughout the ages. We would like to use the following description of three aspects of love, which may impact the manner in which we reach decisions.¹²

- *Agape*: love that promotes overall well-being when confronted by that which generates ill-feeling (i.e., returning good for ill). It is an unconditional love directed towards one's neighbor which is not dependent on any lovable qualities that the object of love possesses. *Agape* is the love that brings forth caring regardless of circumstance. In a Christian context, Lewis metaphorically compares love with a garden, charity with the gardening utensils, the lover as the gardener, and God as the elements of nature. God's love and guidance act on our natural love (that cannot remain what it is by itself) as the sun and rain act on a garden: without either, the object (metaphorically the garden; realistically love itself) would cease to be beautiful or worthy.¹³
- *Eros*: love that promotes overall well-being by affirming the valuable or beautiful. According to some interpretations of Plato, although *eros* is initially felt for a person, with contemplation it becomes an appreciation of the beauty within that person, or even becomes appreciation of beauty itself.¹⁴ Plato also said *eros* helps the soul recall knowledge of beauty, and contributes to an understanding of spiritual truth.
- *Philia*: love that promotes overall well-being when cooperating with others. In his *The Rhetoric*, Aristotle defines the activity involved in *philia* as: "wanting for someone what one thinks good, for his sake and not for one's own, and being inclined, so far as one can, to do such things for him."¹⁵ Cooper argues that this indicates: "that the central idea of *philia* is that of doing well by someone for his own sake, out of concern for *him* (and not, or not merely, out of concern for oneself).¹⁶ Aristotle takes *philia* to be both necessary as a means to happiness ("no one would choose to live without friends even if he had all the other goods" and noble in itself.

Putting the three ideas together, we have the basic framework for reaching ethical decisions. Our work then must promote the overall well-being of all, including our perceptions of friends, and foes. It challenges us to reflect on the words found in nearly all universal wisdom traditions. One example is given below:

But I say to you that hear, love your enemies, do good to those who hate you, bless those who curse you, pray for those who abuse you. To those who strike you on the cheek offer the other also, and from those who take away your cloak, do not withhold your coat as well. Give to everyone who

begs from you, and of those who take away your goods, do not ask them again. And as you wish that others would do to you, do so to them. (Luke 6, ESV Bible 2008)

It calls for moving beyond that false dualism, false as who is to say what actually is good and what is ill? Can we ever really know with certainty? Making decisions, using a sports metaphor, ought not to be equivalent to cheering for one side over another whether it is American football or that variety of football they play in every other corner of the world.

Secondly, how can we affirm the beautiful and the valuable? Perhaps the first step is to examine that which we view as beautiful and that which we view as valuable. The subjective experience of "beauty" often involves the interpretation of some entity as being in balance and harmony with nature which may lead to feelings of attraction and emotional well-being. In its most profound sense, beauty may engender a significant or important experience of positive reflection about the meaning of one's own existence. An "object of beauty" is anything that reveals or resonates with personal meaning. Inner beauty is a concept used to describe the positive aspects of something that is not physically observable. Qualities including kindness, sensitivity, tenderness or compassion, creativity and intelligence have been said to be desirable since antiquity. In turn, let us consider what each of these qualities is asking from us.

- Kindness: the act or the state of charitable behavior to other people.
- Sensitivity: the quality or condition of being sensitive, that is, the capacity to respond to stimulation.
- Tenderness: the quality or state of being considerate or protective
- Compassion: the human feeling of pity over another's sorrows, along with the desire to help others in their situations.
- Creativity: the ability to see something in a new way, to see and solve problems no one else may know exists, and to engage in mental and physical experiences that are new, unique, or different.
- Intelligence: a property of mind that encompasses many related mental abilities, such as the capacities to reason, plan, solve problems, think abstractly, comprehend ideas and language, and learn.

Affirming what we view as valuable at the outset requires that we clarify what we mean when we say we value someone or some idea. In essence what we are doing is clarifying what we value, and why we value it. A process describing the guidelines of the values clarification approach was formulated by Simon et al.¹⁷

Values change over time in response to changing life experiences. Recognizing these changes and understanding how they affect one's actions and behaviors is the goal of the values clarification process. Values clarification will not tell you what your values should be, it simply provides the means to discover what your values are. For the purpose of values clarification, Steele and Harmin¹⁸ and Simon, Walker and Hawkins¹⁹ identified seven criteria that must be met if a value is to be considered a full value. These criteria

can be divided into three categories: choosing, prizing and acting. To be a full value, the value must be chosen freely from a list of alternatives, only after thoughtful consideration has been given to the consequences of each alternative. The value must be cherished and made known to other people. The value must also be translated into behaviors that are consistent with the chosen value and integrated into the life style.

Accordingly if some concept is to be considered valued then: (1) It was chosen from alternatives; (2) It was chosen freely; (3) It is prized; (4) It is affirmed; (5)It is acted upon; and (6) It is acted upon repeatedly, over time.

The last category of love, *philia*, challenges us to see the world in a different way, in the words of Thomas Berry²⁰ as a *collection of subjects*. Berry’s most famous quotation is:
The Universe and thus the Earth is a communion of subjects, not a collection of objects.

By communion, Berry was referring to intimacy or a feeling of emotional closeness, a connection, especially one in which something is communicated or shared. The shift from object to subject is also profound. An object is something visible or tangible; something that can be seen or touched, a focus of somebody's attention or emotion; or a goal or purpose. By subject, the reference is to the essential nature or substance of something as distinguished from its attributes. In other words, borrowing from Buddhism, the essential nature, the Buddha nature, is taught to be a truly real, but internally hidden, eternal potency or immortal element within the purest depths of the mind, present in all sentient beings.

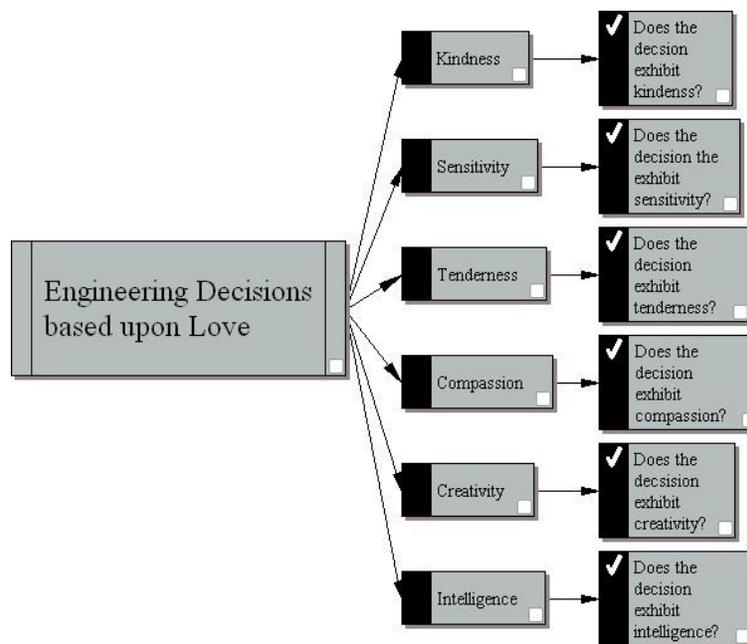


Figure 1 Seven Elements of an Engineering Ethics based upon Love

NSPE suggests the following first canon in its code of ethics:

*Engineers, in the fulfillment of their professional duties, shall hold paramount the safety, health, and welfare of the public.*²¹

We offer the following recasting of the first canon:

Engineers, in the fulfillment of their professional duties, shall promote through love the overall well-being of the communion of subjects which make up the Earth, its diversity of species and ecosystems as well as the powerful and powerless members of society.

III. Application of the Proposed New Engineering Ethic

We shall conclude with a case study. After the case is described, some possible suggestive questions will be provided as a means for you to begin your own, personal reflection on the various cases and your responses as an engineering professional and an engineering educator.

Case: The Next Generation Landmine

Part I.

Ms. Jane Enaj is a project manager at a multinational corporation which has just been awarded a contract to develop and produce the next generation land mine. She is also a member of the Design Review Committee. The committee's responsibilities include reviewing and approving design changes, procedural changes and submitting performance reports to various U.S. Department of Defense agencies with recommendations.

Today Jane finds herself in a difficult situation. DRC is meeting to finalize recommendation concerning the new land mine. It offers significant improvements for the U.S. military as it will self-detonate in a set period of time thereby reducing the risk of having unexploded ordinance remain on the battlefield long after the actual conflict has ended. This new design should reduce the number of injuries and deaths to innocent civilians by a large amount and is set for deployment in the Middle East. Yet innocent citizens including children and the elderly will still be maimed and/or die. In addition, unsuspecting pets, domestic animals and wildlife will also likely suffer.

The unit has returned after a two month trail run in various environments including U.S desert southwest, and island possessions in the Pacific. After extensive engineering analysis by engineers, it has been concluded that the new design falls slightly above the minimum requirement set by the design specifications. The test and analysis results were both promising and disappointing as approximately 50% of the mines self-destructed. This still would represent a significant improvement over the use of the land mines in the present U.S. arsenal.

Seven members of DRC are present, enough for a quorum. Ms. Enaj is the least senior member present. From the outset of the meeting, committee chair Mr. Senior has made it

clear that it is important to act quickly, since any delay will cost the company, and a lot of money. "A redesign," he says, "might take several months. If we don't approve this, we may be facing a multi-million dollar loss in revenues. We have met the design specifications. What do you think?" Mr. Smith and Mr. Jones immediately concur. Mr. Senior then says, "Well, if no one sees any problems here, let's go with it." There is a moment of silence. Suppose you were Ms. Enaj. What would you recommend?

Part II.

Right after the design meeting a breakthrough was made in the design of the actual explosive material used in the mine. For the same amount of explosives material used, the magnitude of the explosion is doubled both in intensity and radius of impact. The DRC calls a second meeting to consider what impact the new explosives material may have on their final recommendations. Again playing the role of Ms. Enaj, what would you recommend and/or do?

Part III.

After the land mine has been put into use by American forces, the Chinese and Pakistani governments submit orders for significantly large numbers of the new devices. China and Pakistan are in turn known to sell similar weapon systems to various regimes throughout the world. Again playing the role of Ms. Enaj, what would you recommend and/or do?

Possible Responses

Reactions to the design case using different engineering ethics based upon different paradigms will next be presented. Again our intent is simply to offer a new approach to reaching decisions when we as engineers are confronted with difficult ethical choices.

Using a Utilitarian approach may suggest the following set of questions:

- What are the available options for Ms. Enaj concerning the design review?
- What are the costs of delaying the introduction of the landmine?
- Who will benefit the most from its introduction?
- What are the costs associated with increased explosive capabilities?
- What decisions maximize the good?
- What are the costs associated with the selling of the weapons system to China and/or Pakistan?

Alternatively, using a rights-of-persons approach, the following set of questions may be suggested:

- What are the effects of the improved landmine on the combatants? On the civilians?
- Would we be willing to serve as soldiers under such an arrangement? As civilians?
- Would we be willing to accept the consequences of the new landmine on ourselves as soldiers? As innocent civilians?

A third set of questions which may arise out of consideration of a virtue-based engineering ethic include the following:

- Are the rights of all involved in the production and use of landmines given their just due?
- Do the design and its implementation demonstrate self-control and/or self-discipline?
- Do the design and use of the new landmine weapon system require moral strength and/or courage?
- Do the design and use of the new system signify a pursuit of the good according to reason?
- Or is it a manifestation of our fears?

What then would an engineering ethic based upon love have to offer to our consideration? We would suggest such an ethic may offer the following set of questions:

- Does the new design exhibit any elements of kindness? To those who must use it? To those who will ultimately be maimed or killed?
- Is the new design sensitive to the needs of the combatants? To innocent civilians? To the ecosystems?
- Does the new design foster a sense of protectiveness? For whom?
- As designers, have we demonstrated compassion for those who will be affected by our device? Have we been as creative as we can be in the design, its execution and its implementation?
- Have we been willing to think ‘outside the box’, using our mind to its fullest capabilities?

IV. Concluding Remarks

Our intent in the present work is to offer an alternative to the ways in which we as engineers confront difficult ethical choices that often occur in the practice of our profession. We hope to start conversations among various practitioners and educators. We have been engineers and educators now for over fifty years. Throughout our work both in the profession and as teachers, we have been troubled by many seemingly unintended consequences of our work. We as a profession have brought great benefit to different aspects of society but it seems at least to us that many other elements of society and the environment have been overlooked and as a result have actually suffered at the hands of advancing technology. Rather than stating emphatically that we put up a red light to stop the advancement which would never happen at any rate what we are suggesting, using the traffic light metaphor, is that perhaps we proceed with a bit less haste and a bit more reflection. We are calling for a yellow caution light and a time for advancement but with caution and reflection and ultimately a consideration of love.

There is a passage from *Zen and the Art of Motorcycle Maintenance*²² which seems particularly relevant for the present conversation:

“What’s wrong with technology is that it’s not connected in any real way with matters of the spirit and of the heart. And so it does blind, ugly things quite by accident and gets hated for that. People haven’t paid much attention to this before because the big concern has been food, clothing and shelter for everyone and technology has provided these. But now where

these are assured, the ugliness is being noticed more and more and people are asking if we must suffer spiritually and esthetically in order to satisfy our material needs.”

When we practice our profession of engineering, it is important that we view humanity and the ecosystem as part of an undividable whole. Berry takes this one step farther. According to Berry, our new community is a very special one, that is, it is one in which the various elements are bound together as subjects having interests rather than one in which some have interests while others are simply resources to be utilized. In our view, viewing the universe including both the natural environment and the poor as members of a communion of subjects rather than a collection of objects has important, even revolutionary significance for the engineering profession. It eliminates from the outset that we ever again can remain aloof from the consequences of our projects. Landmines continue to explode long after the end of hostilities in combat zones across the globe. Polar bears are rapidly disappearing from the Arctic regions in part due to the technologies we continue to produce. The poor in New Orleans suffered beyond our understanding in part due to decisions we as engineers and engineering organizations made and continue to routinely make. If we can begin to see the connection we have with the health of the Arctic ecosystem and thus with the well-being of the polar bears, recognizing all that we share, they like the rest of Nature have much greater importance when we are formulating our criteria whereby we make decisions.

Even more importantly, if we can begin to view the poor, whether they live in the 9th Ward of New Orleans or the Pine Ridge Reservation in South Dakota, as connected to us and as possessing an entire spectrum of potentialities and possibilities then too our criteria for decision making as engineers is broadened importantly. Those potentialities and possibilities are as important to the ongoing dynamic process of creation in the Universe as those that reside within us as each of us plays an integral role in the communion of subjects.

As educators, we might ask how can we integrate an engineering ethic based on love into the curriculum? No, we are not calling for a new course or a new section of course that focuses on engineering or professional ethics. Rather, we are suggesting that while modeling engineering problems whether in capstone design or engineering science settings we can directly and explicitly speak to the issues that have been tabbed by the United nations as the most important challenges we face as a society at the start of the 21st century: peace and security, developed and under-developed societies and health and deterioration of the Earth's eco-systems. We would further suggest that there is no room in the engineering classroom for ignorance or indifference to these profoundly complex and important issues. Our society, and our planet desperately need engineers to be a part of the conversations that far too often have been dominated by one very narrow economic and political ideology. It is our view that the Earth is in the balance.

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