A Buddhist Approach to Engineering

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Introduction

Engineering is a vastly pervasive field of study which affects the entire population of the earth. It is important to analyze fields with such a large scale effect from a variety of perspectives; specifically, perspectives that are known to be designed for the sole purpose of bringing good to all forms of life (Loy, 2003). Furthermore, since the vast majority of engineering ethics approaches were formed in the Western world, it is crucial to offer up a more global, Eastern perspective (Clancy & Zhu, 2021). That being said, what can be learned from Buddhist practices and principles within the field of engineering and engineering ethics?

Buddhism at its core is driven by a pure desire to promote universal well-being. This desire is cultivated through a variety of practices and adherence to principles such as following the eightfold path, abstaining from the five precepts, and acknowledging the four noble truths.[1] Without iterating each of these and the variety of their interpretations, the general message is to recognize the impermanence of one's own life experiences, and to abstain from harming all life forms — sentient, or non-sentient. Generally, Buddhism is advertised as something that one must "come and see". In other words, a lot of the ideas must be discovered on one's own account, and understood for what they are, otherwise you are just blindly following a dogma (Rahula, 1974).

Seeing as engineering is a field that has caused a great deal of harm to a variety of life on earth, it is crucial to look at approaches to this study that could impede, and ideally, cease, the harm done by engineers (Schultz-Bergin, 2021). As Buddhism does such a good job at cultivating goodness, and exists more as a framework through which to approach a variety of problems rather than an actual religion, it has great potential for successful application in the

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[1] These concepts will be explained later in the Background section of the report.

realm of engineering (Santiago, 2013). Furthermore, the various offshoots of Buddhism, such as Zen Buddhism, could have great applicability in this discussion (Pirsig, 2006).

As it stands, the current approaches to engineering ethics are almost entirely manufactured by the western world, and fail to encapsulate the true nature and implications of engineering design. While they often cover many of the bases in terms of the customers/users of certain engineered devices, and the potential negative implications of these devices on these groups, engineers oftentimes lack the intention necessary to explore the implications beyond a small subset of populations. Here, I suggest that the ancient teachings of Siddhārtha Gautama, commonly known as the Shakyamuni Buddha, could be of great use in instructing engineers to be more intentional, caring, and loving in their contributions to this society.

Background

Thousands of years ago, a man by the name of Siddhārtha Gautama was born to a wealthy family in Asia. Throughout the beginning of his life, he was confined to a realm controlled by his father, a prevalent ruler of the time. Siddhārtha's father intentionally manufactured this realm to be full of only good things, and this is all Siddhārtha knew for a considerable portion of his life. After some time, Siddhārtha came to realize the synthetic nature of his surroundings, and thus decided to leave the safety of his homelands, and explore the world for what it really was. Here, the man who is now colloquially known as "the Buddha", learned the true nature of the world — suffering. In his explorations, he decided he would make it his life's purpose to rid the world of suffering, and in his many years of asceticism and meditation, he prescribed a set of guidelines to do just that (Rahula, 1974).

I will get into the details of Siddhārtha's suggestions for ridding the world of suffering later, but now is as good a time as any to address a prevalent misconception about Buddhism — Buddhism is not necessarily a religion. While it practiced as a religion in some specific cases, what the Buddha originally taught aligns more with more of a social science, or a framework of thought (Loy, 2003). Rather than being a list of rituals, holidays, etc., the Buddha simply suggested a few rules and regulations with which humans should consider in their daily lives. While there are the more religious components of Buddhism which pertain to enlightenment, life after death, and reincarnation, the Buddha tended to stray away from discussions and questions regarding these topics (Rahula, 1974). Mainly, what the Buddha was trying to teach was a framework through which humans should approach living their lives — a framework which he and many others insisted would maximize the good they do in the world, and their attitude towards the world.

The Buddha's rules consisted of: the eightfold path, the five precepts, and the four noble truths. While the scope of this paper may not include the nuances of each of these items, and their deeper meanings and interpretations, it is still important to outline them, for application in future sections and arguments. First and foremost, the Noble Eightfold Path consists of: "right understanding, right thought, right speech, right action, right livelihood, right effort, right mindfulness, and right concentration". Here, the Buddha uses the word "right" to emphasize that the follower of the path needs to have good intentions when following these principles. The five precepts consist of: "abstinence from destroying life, from stealing, from committing adultery, from speaking lies and from taking intoxicants" (Buddharakkhita, 1985). And, lastly, the four noble truths consist of: dukkha (dukkha loosely translates to suffering), the origin of dukkha, the cessation of dukkha, and the path leading to the cessation of dukkha (Rahula, 1974). Out of these

three sets of guidelines, the Noble Truths tend to be the most difficult to grasp in their original meaning; which, for our purposes, don't need to be explored. In general, an incomplete, yet accurate encapsulation of Buddhism is it being a "middle way" — in other words, it offers a reasonable approach that lies between the two commonly taken paths in life, asceticism, and hedonism.

Aside from these guidelines, there is one topic that the Buddha touched on that I want to emphasize: meditation, or, mindfulness. While this is only mentioned once in these guidelines, the Buddha has provided us with countless pieces of advice, wisdom, etc. on the front of mindfulness. That being said, it is crucial to the practice of Buddhism. Simply put, mindfulness is the practice of being aware of one's mental, and physical, actions. While it sounds straightforward, it is not; Buddhist monks will spend their entire lives perfecting and teaching mindfulness, and still not fully grasp it (*The Father of Mindfulness Awaits the End of This Life*, 2019). While this may sound discouraging, it is crucial to recognize that even those who are considered masters in this subject struggle with it.

When looking at Buddhism strictly as a framework, and comparing it to engineering ethics, it is evident that there are vast differences between the two. engineering ethics tends to take a significantly more pragmatic approach. In the following paragraphs, I will be speaking mainly from my own personal experience as an engineering undergraduate. Engineering ethics discusses ethical issues from purely a systems approach. It has engineers look at designs as systems, understand them as systems, and then look at how they affect populations as a system. While this is great, it leaves a lot of room for interpretation and adjustment. Most importantly, this approach allows for engineers to have a lot of oversight in terms of the implications of their engineering designs, and their effects on all life, outside their customer base. Buddhism, on the

other hand, offers a significantly more comprehensive approach to ethical dilemmas, and proposes various allegories through which to approach these issues.

The most important allegory offered by Buddhism — namely, the one that I will utilize as a comparison to engineering ethics frameworks throughout this paper — is titled "Indra's Net". Indra's Net describes an infinitely large "net" of jewels, with each jewel in this net reflecting the light coming from every other jewel. Here, an entirely interconnected system is defined, a system which truly represents the environment we live in, and one which is not often represented within engineering education. There are many important takeaways from this allegory, but none can sum it up better than David Loy: "When I discover that I am you, the ethical problem of how to relate to you is transformed. Loss of self-preoccupation entails the ability to respond to others without an ulterior motive that needs to gain something from that encounter." (Loy, 2003).

While the Shakyamuni Buddha offered his teachings with the intention of people ridding themselves of suffering, they are widely applicable in many specific fields of study; namely, engineering. Here, we can utilize many of Buddha's teachings to learn much more about how we can act in this world as engineers.

Methodology

Throughout my research into the potential applications of Buddhism in engineering ethics, I plan to utilize a variety of approaches. Primarily, I will be using literature review; however, I will also be utilizing Ethnography to assist in my research. Literature reviews will be crucial, as they will allow me to document and summarize common engineering ethics approaches and frameworks, along with Buddhism, and compare these approaches. Furthermore, I will also use the resource ofmy local engineering department at the University of Virginia

(UVa) — specifically, the Electrical and Computer Engineering department — and observe how my peers are conceptualizing issues pertaining to engineering ethics.

Primarily, throughout this paper, I will be utilizing ethnography. As a current student in the engineering program at the University of Virginia, I have a lot of exposure to the current culture and teachings of engineering ethics, and the overall response of students to these ideas. I will be reflecting on my experiences throughout this paper to provide context, proof, and arguments for the various components of the pitfalls of engineering ethics as it stands today. Additionally, I will be utilizing conversations I have had with various faculty members pertaining to topics relating to Buddhism and engineering ethics.

For the literature I plan to review, I will mostly be looking at primary, and some select secondary sources, which discuss the original teachings of the Buddha. Predominantly, the Dhammapada — a collection of original sayings from the Shakyamuni Buddha — will be of great use here as a primary source. In terms of the sources used on the engineering ethics side, I will use a few sources which pertain to existing engineering ethics frameworks.

Lastly, ethical analysis, or ethical assessment, is an extremely useful form of analysis when it comes to looking into how the design of a certain system affects its ethical effect. Since my research is directly critiquing and comparing approaches to engineering ethics, ensuring that I am comparing engineering ethics to Buddhism from purely an ethical standpoint will be helpful.

Literature Review

In order to further explore the application of Buddhism into engineering ethics, a variety of articles and other resources will be explored. Throughout my research, I found little literature

regarding the applications of Buddhism into this field, so the majority of this section will consist of my findings in terms of Buddhism's applications into other fields, as well as current practices into the field of engineering, and engineering ethics. With these pieces of literature, I plan to analyze the current state of engineering ethics, and how a system of thought like Buddhism could help change the field for the better.

In terms of the current state of engineering ethics, I found many articles regarding different, prevalent, approaches to ethical discussion within the field of engineering. One of the main frameworks used in engineering is the Social Construct of Technology (SCOT) framework. This framework, simply put, analyzes the way that society affects technology, and how technology affects society (Pinch & Bijker, 1984). This framework is one among many others that are used to analyze engineered designs, and the societies shaped by/shaping them.

In addition to SCOT, another prevalent tool that engineers use to analyze the ethics of their designs is the analysis of previous engineering designs. Whether it is a design that resulted in a horrible tragedy, or a design that provided great benefit to people around the world, a Harris Jr. proposes that engineers use this historical approach to exploring the implications of their designs (Harris Jr. et al., 1996). Through this method, Harris Jr. proposes that engineers will learn the most about practical applications of engineering ethics, and provide them with real life examples that students can relate to, and then apply, in their future projects and careers.

Despite Harris' original explanation of this approach in 1996, he reexplained these ideas years later. Harris argues that the state of engineering ethics leads engineers to consider what not to do, rather than what to do. Through this approach, engineers tend to fret over situations that are, otherwise, not likely to arise, rather than spending their time contemplating the nature of

their engineered designs. This abstracts away the importance of engineering design and ethics, and leaves only an approach based only upon the fear of replication of the past (Harris, 2008).

Moving into the realm of application of Buddhist ideologies into career fields, David Loy outlines a wonderful explanation of the general sociological theories underlying in Buddhism. Loy utilizes his understanding of Buddhism to conceptualize societal problems from recent history. These problems include topics such as: the US prison system, 9/11 and the Iraq war, genetic engineering, and much more (Loy, 2003). The methodology he uses for investigating these various social issues through a lens of Buddhism can be analyzed, and applied to many other issues, of the social, and technical manner, specifically engineering.

In addition to Loy, Robert Pirsig explores the application of a specific school of Buddhism, Zen Buddhism, to the general field of scientific study. While his book mainly consists of anecdotal tales and personal reflections and musings, it tells a story through persistent application of a Zen Buddhist lens. Rather than the typical explanation of an engineering system as a collection as "actors" and "subjects", he goes into depth about how a motorcycle is a collection of systems, and subsystems (a subsystem being no different from a system, except for the fact that it exists within another system) that each consist of different components that coexist, and operate along with one another. His use of a motorcycle as his object of example is merely a symbol of the ether of engineering, an ether which consists of nothing except for objects, and connections (Pirsig, 2006).

Lastly, a paper released in 2021 explores the influence that religion had on a group of undergraduate engineers in Malaysia. Through looking at the undergraduates of this college's engineering ethics program, Balakrishnan helps provide a new perspective of engineering ethics. While engineering ethics typically comes from a Western perspective, his study is focused on a

sample group that is an Eastern society, having been exposed to predominantly Eastern norms. This unique perspective offers a perspective that is relatively new in the sphere of engineering ethics (Balakrishnan et al., 2021). Additionally, the importance of integration of cultural values into engineering ethics and philosophy is discussed.

Discussion/Results

After looking at engineering ethics today, and at Buddhism as an approach to engineering, I ask: what can be learned from Buddhist practices and principles within the field of engineering and engineering ethics? Engineering ethics is clearly in need of a change in pace when it comes to how engineers implement and approach it. When looking at my peers in my undergraduate engineering major program, most, if not all of them will be working for a company contracted by the Department of Defense (DoD) after we graduate. Why do they decide to do this work when they know the implications of their careers?

Throughout all of our respective exposures to engineering ethics, we have been taught a variety of the aforementioned engineering ethics frameworks, and other unmentioned, yet similar, ones. We have analyzed previous catastrophic engineering failures, and we have looked into successes in engineering. Furthermore, we have looked at how engineered designs have an effect on their stakeholders, and on certain groups/actors in society. These approaches that we have learned have supplied us with all the tools we need to be great ethicists, but they lack one thing: cohesion.

We know how to spot a characteristic of a design which could marginalize a certain demographic group, or an error in a line of code that could result in deaths, yet we fail to question the overall implications of our designs. Furthermore, we do not see ourselves as an

active participant in the overall motives of the design we are working on, the company we work for, or the country we live in. Certainly, most people would not want to intentionally design something that would harm someone; however, what do we do when our employers obscure this from us?

Oftentimes, in these DoD contracted companies, engineers are provided a small piece of a larger puzzle to work on; take, for example, a radar system. An engineer will do their best work on this system, knowing only the vaguest details on the inputs and outputs of this system, and create something that, on its own, has no inherent ill will. Despite this, their carefully constructed radar system will go on to be used in a hostile missile control system that will be sold to a warring country on the other side of the world.

With this, I mean to stipulate that engineers have not been given the tools to analyze their engineered designs applications in any scope outside the one provided to them. In other words, we often fail to ask the question "Engineering for what?" Why are we designing this radar system? Why would my company need a radar system that takes x inputs and provides y outputs? Why do I work for a company that manufactures weapons used in war? The answers to these questions are not easily found in common engineering ethics, and here is where I believe Buddhism needs to be applied.

Buddhism provides a framework which is structured for the sole purpose of doing good in one's life, and this is accomplished through many means, but most importantly, this is accomplished through mindfulness. As a Buddhist, you are mindful of your every action, you are constantly aware of the five precepts, and of the Noble Eightfold Path — both of which greatly stress the importance of being intentional in your life, and reducing your harm as an individual in a shared ecosystem. Through Buddhism, one sees themselves in all other things, and sees all

other things in themselves. And, if one truly has this perspective, it is hard to actively choose to work for any company which does not aim to protect life.

To further apply Buddhist principles to the common engineer and their career, there are many factors that come into play when an engineer ends up working for a DoD contracted company. First and foremost, there is a blatant concern for one's starting salary out of college. I have spoken with a few of my classmates who have gone from securing a job with the government organization, or another company, that is doing great work in this world, to working for a defense contractor. In these cases, without fail, the main reason is the salary. One started at six figures, while the other started at 60-80 thousand dollars. Here I want to reintroduce one of the five precepts: the abstinence from intoxicants.

It can be easy to conflate a statement such as "abstain from intoxicants" with something along the lines of "don't do drugs". While this is, in a sense, what the Buddha is arguing, he also meant more than the substances commonly seen as intoxicants. Here, the Buddha also means any other material, or ethereal, substance, such as money. It is easy to lose sight of what one needs in life beyond our essential needs; however, Buddhism forces us to ask ourselves, how much do we really need? Why do I need a $100k salary?

To take this one step further, the general principle of no-self, or, anatta, is necessary in the field of engineering. A quick disclaimer, this is one of the most complex, and important, aspects of Buddhism, no explanation by anyone will yield any understanding deep enough to begin practicing these principles, they must be practiced, noticed, and understood.

A crucial component of Buddhism is this recognition that life is no more than a collection of five senses; yet, humans have constructed in their minds, on top of these five senses, a sense of self, or, ego. We believe that we are in control of our thoughts, of our surroundings, etc.,

because at one time, we needed to be to survive — it makes perfect sense why we hold these beliefs. However, now that we have developed to a point where we can contemplate these things, we can sit and recognize that we are simply a part of all life, everywhere. The importance of this recognition is that this sets us up to best contribute to our world. If we see ourselves as so important that we need to have a new car, or a new wardrobe, then we will need that six-figure salary, and we will allow ourselves to work for companies that are not contributing to the good of the world.

Conclusion

Engineering, as it stands, does not always provide benefit to society; and, more importantly, all life on earth. In fact, in a lot of cases, it has proven to be quite detrimental for life. This indicates that something is wrong with how we engineer. This shows us, that we need to investigate how we can best approach the further development of our technologies, and their integration into the environment. This all leads us back to the question: what can be learned from Buddhist practices and principles within the field of engineering and engineering ethics?

Our earth is nearing the end of a decade long suffocation, all because humans decided to take more than they give. Will this obsession with our "selves" cause the end of our humanity, as it has already led to the extinction of other life we share this earth with? As engineers, maybe it is time we take a step back from our engineering designs, and utilize the Buddha's teachings on mindfulness to see ourselves as we are, and see that we are, in fact, without self. If we can remove our egos from engineering, remove selfishness from arguably the discipline that designs the world, maybe we can save life from ourselves.

References

Balakrishnan, B., Tochinai, F., Kanemitsu, H., & Altalbe, A. (2021). Engineering ethics education from the cultural and religious perspectives: A study among Malaysian undergraduates. *European Journal of Engineering Education*, *46*(5), 707–717. https://doi.org/10.1080/03043797.2021.1881449

Buddharakkhita, A. (1985). *The Dhammapada*. Buddhist Publication Society. https://www.buddhanet.net/pdf_file/scrndhamma.pdf

Clancy, R., & Zhu, Q. (2021). Global Engineering Ethics: What? Why? How? And When? *2021 ASEE Virtual Annual Conference Content Access Proceedings*, 37227. https://doi.org/10.18260/1-2--37227

Harris, C. E. (2008). The Good Engineer: Giving Virtue its Due in Engineering Ethics. *Science and Engineering Ethics*, *14*(2), 153–164. https://doi.org/10.1007/s11948-008-9068-3

Harris Jr., C. E., Davis, M., Pritchard, M. S., & Rabins, M. J. (1996). Engineering Ethics: What? Why? How? And When? *Journal of Engineering Education*, *85*(2), 93–96. https://doi.org/10.1002/j.2168-9830.1996.tb00216.x

Loy, D. (2003). *The Great Awakening: A Buddhist Social Theory*. Wisdom Publications.

Pinch, T. J., & Bijker, W. E. (1984). The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology might Benefit Each Other. *Social Studies of Science*, *14*(3), 399–441. https://doi.org/10.1177/030631284014003004

Pirsig, R. (2006). *Zen and the Art of Motorcycle Maintenance*. Mass Market Paperback.

Rahula, W. (1974). *What the Buddha Taught*. Grove Press.

Santiago, M. M. (2013). What Can Buddhism Offer to a Socially Just Engineering Education? In J. Lucena (Ed.), *Engineering Education for Social Justice: Critical Explorations and*

Opportunities (pp. 85–109). Springer Netherlands.

https://doi.org/10.1007/978-94-007-6350-0_5

Schultz-Bergin, M. (2021). *Engineering & the Environment*.

https://pressbooks.ulib.csuohio.edu/principles-of-engineering-ethics/chapter/engineering-

the-environment/

The Father of Mindfulness Awaits the End of This Life. (2019, January 24). TIME.

https://time.com/5511729/monk-mindfulness-art-of-dying/