# Many Facets of Imagination: What Really Matters in Engineering Ethics Instruction?

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## 1. Introduction

Engineering educators have used different strategies to incorporate ethics instruction into engineering curricula, often in response to the ABET requirements on students' understanding of professional and ethical responsibility. The mainstream pedagogical approaches predominantly are case studies supplemented with moral theory and professional codes of ethics (Colby and Sullivan, 2008; Haws, 2001; Herkert, 2000; Lynch, 1997/1998; Shuman et al. 2005). Despite a greater emphasis on engineering culture, real-world practices, macroethics, the need for collective responses (Bucciarelli, 2008; Herkert, 2001; Lynch and Kline, 2000), and social justice (Riley and Lambrinidou, 2015) in engineering ethics literature, it is still not surprising to see persistent reliance on presupposed "correct" responses for a given case; an overemphasis on heroic actions and unusual mistakes without contextual considerations; and the overlooking of the importance of society and peer culture in the teaching of ethics. In this paper, we argue that addressing imaginal capacity as a core component in ethics curriculum helps educators move beyond isolated and product-oriented pictures of engineering ethics instruction and we illustrate ways to bridge complexities embedded in how we think and how we relate to one another in society.

Stimulating moral imagination has been recognized as one of the major goals of ethics instruction (Callahan, 1980). In one of the early comprehensive works on engineering ethics instruction, Harris et al. (1996) emphasized the importance of moral imagination in teaching of ethics. More recent studies also addressed the fundamental role of imagination in engineering practice (Coeckelbergh and Wackers, 2007; Pitchard, 2001; Zhu and Jesiek, 2017). However, few efforts have been made to prioritize imagination in practice, explore the concept in depth and make connections with different frameworks and perspectives (Jalali et al. 2019). We believe such attempts are necessary to design and develop pedagogical practices in which imagination plays a central role. The purpose of this paper is to build on conceptual illustrations of imagination and to reflect on how ethics instruction can be modified to incorporate imagination concepts. Examples of modifications to an ethics curriculum that is currently in use for the senior-level engineering class, Design of Steel Structures, in the Department of Civil and Environmental Engineering at the University of Massachusetts Amherst in the United States are presented to initiate discussion.

We invite educators to engage with the questions of moral reasoning and reflect on the role of imaginal capacity in designing and developing pedagogies. Treating imagination in connection with fantasy and images of the impossible downplays the significance of its importance in

reasoning and understanding, as illustrated by the scholars whose works we briefly review in this paper. John Dewey and Mark Johnson, among some other scholars in pragmatism, have explicitly emphasized on the imaginative character of reasoning and understanding. In this paper, we primarily focus our attention to the unique notions of the moral insight, illustrated by idealist and pragmatist scholar Josiah Royce, and the I-Thou and I-It attitudes, described by philosopher Martin Buber. Then, we move to the resources in liberation theory and praxis and build on the notions used by Royce and Buber in connection with broader context. Finally, we reflect on the curriculum in use and present preliminary ideas for converting theoretical perspectives into classroom praxis.

## 2. Theoretical foundations

Josiah Royce illustrates a unique picture of imaginal capacity that plays a central role in moral understanding (Royce, 1885). Royce develops the argument by noting the unease in dealing with opposing ethical aims. In such cases, each aim may be justified by an ethical theory and this can result in moral confusion; as a result, one may face theoretical skepticism. Royce describes a means to overcome this skepticism; a state in which one is able to assume and accept different aims simultaneously and provisionally:

> Act as thou wouldst will to act if all the consequences of thy act for all the aims that are anywhere to be affected by this act, could be realized by thee now and in this one indivisible moment. (Royce, 1885, p. 141)

The moral insight is the quality one acquires in the process of "realization" --- to act with taking into account different aims, Royce argues. Royce uses the conflict between selfishness and unselfishness as analogous to a conflict of ethical aims and argues that is easier for us to imagine our future selves than the present self of our neighbors. In other words, it would be easier to have insight into my own future, desires, hopes, and states; what I experience then becomes more significant than someone else's present experience. Royce describes how this conflict will lead to an imperfect realization of others, where their inner aspects and personal experiences can be ignored. Thomas Nagel in his remarkable work *What Is It Like to Be a Bat?* (Nagel, 1974) emphasizes on the subjective nature of experiences with relation to the mind-body problem, and argues that in order to understand someone else, one needs to move beyond predicting behaviors through simulation; and imagination is the only thing she can rely on to think about the subjective character of experience; "At present we are completely unequipped to think about the subjective character of experience without relying on the imagination–without taking up the point of view of the experiential subject" (Nagel, 1974, p. 449). Royce describes moral insight as an imaginative quality that one needs to achieve for a thorough realization of her neighbor. Importantly, sympathy is not enough to get to the moment of insight:

The emotion of sympathy does indeed often tend to make me realize the other and more completely internal aspect of my neighbor's reality; but sympathy does this in the halting and uncertain way described in a previous chapter. And at all events, whatever sympathy leads to, it is not by itself the insight. (Royce, 1885, p. 153)

This relational emphasis is also evident in the works of other scholars, in particular Martin Buber. Buber argues if "I" take one or few characteristics out of a person and make them as labels stand in front of her; her whole being then will be reduced to those attributes. Buber calls this attitude "I-It". On the other hand, if I think and imagine of another as a whole that is beyond the sum of her attributes then my attitude is "I-Thou" (Buber, 1958). There is a complex dynamic within our relationships; to live in liminal space where we are neither oppressor nor oppressed, where we live in "relation" depends partly on how we see and imagine one another. Buber's distinction between I-Thou and I-It can be applied to all forms of dominance (Roberts, 1997). Depending on one's attitude, another person can become a particular characteristic (or sum of characteristics), or can be seen and imagined as a whole; "Although it is possible to list numerous attributes each of us has, even an infinite list would not say who we are. In our wholeness, we are each greater than the sum of our parts" (Roberts, 1997, p. 46). This appreciation of the whole, the "acknowledgment of the actual being", Buber argues, is integrated with people's experience of inclusion (Buber, 1947). In such a state, having become closer to the other, we might be able to imagine the other's positions --- thinking, feeling, etc. --- from the other's view.

To take one step beyond the understanding of the neighbor, we stretch the idea of moral imagination into a bridge between inner state and social transformation. We turn into the resources in liberation theory and practice in which scholars--- in response to institutionalized dominance and systematic oppression--- have developed complex frameworks to urge attention and to illustrate pathways towards challenging authority and diminishing systematic patterns of human suffering. Embedded as a constituent of liberatory struggle, liberation scholars repeatedly highlighted the importance of imaginal capacity in the understanding and transformation of reality (Anzaldúa, 2015; Freire, 2005; Marcuse, 1969; Scarry, 1985). Similar to the quality illustrated by Royce, imagination here is not a tool for creativity or fantasizing a situation or individual(s). The reason we build on liberatory perspectives as complementary to what discussed by Royce and Buber is that these frameworks urge attention to broad social and political structures that may influence our ethical reasoning and decision-making, in explicit or implicit manners. Such factors may play a significant role at the *institutional level* when we think about the culture of engineering practice and its conventional norms and structures and in general the role each individual plays in relation to others in society. Imagination moves into active quality of reflection and action in transformation of reality. For Paulo Freire, the prominent scholar of critical/liberatory pedagogy, imagination is essential constituent of the dialogical means of transformation, the critical thought process that bridges reflective mental activity with

the action upon the world. Freire (2005) in describing resolving the oppressed-oppressor contradiction elaborates:

> To achieve this goal, the oppressed must confront reality critically, simultaneously objectifying and acting upon that reality. A mere perception of reality not followed by this critical intervention will not lead to a transformation of objective reality- precisely because it is not a true perception. (Freire, 2005, p. 52)

Giroux (2010) illustrates what critical thinking means for Freire:

> Critical thinking for Freire was not an object lesson in test-taking, but a tool for self determination and civic engagement. According to Freire, critical thinking was not about the task of simply reproducing the past and understanding the present. To the contrary, it was about offering a way of thinking beyond the present, soaring beyond the immediate confines of one's experiences, entering into a critical dialogue with history, and imagining a future that would not merely reproduce the present. (Giroux, 2010, p. 716)

The central role of imaginal capacity in thought process has also been addressed by the feminist liberation scholar Gloria Anzaldúa. Deep understanding characterized by Anzaldúa relies heavily on talking with images. Importantly, to act socially and politically, one needs to first engage in imaginal conversation with herself. Unless one doesn't engage in such dialogue, outer work is not possible. This dialogue shifts our perceptions, how we position ourselves in the world and in relation with others. Anzaldúa uses the symbolic and metaphorical illustration of walking/living in "nepantla", and illustrates imagining ourselves walking what she calls "between the world" to arrive at the state in which we can negotiate/interact between borders, where there is not a struggle of "us versus them". In such a state, one does not belong to a particular category of race, gender, sexuality, etc. The concept of identity is not rigid; it is relational:

> To re-image identity in new ways requires that we change the focus of the lens trained on our faces and shift our perceptions. It requires letting go of the old identifications and behaviors. The who-we-are is currently undergoing disintegration and reconstruction, pulled apart, disembodied, then reconstructed–a process I envision symbolized by Coyolxauhqui. (Anzaldúa, 2015, p. 74)

In describing her program, spiritual activism, Anzaldúa is clear that she is in fact engaging in developing an epistemology of the imagination (Anzaldúa, 2015). Imaginative character is essential to thinking, reasoning, and understanding. In contrast to product-oriented and rigid descriptions of thinking, Anzaldúa invites us to engage in reflective dialogue and tolerating ambiguity:

*La mestiza* constantly has to shift out of habitual formations; from convergent thinking, analytical reasoning that tends to use rationality to move toward a single goal (a Western mode), to divergent thinking, characterized by movement away from set patterns and goals and toward a more whole perspective, one that includes rather than excludes. (Anzaldúa, 2012, p. 101)

Analouise Keating, a scholar of Gloria Anzaldúa, in describing Anzaldúa's liberatory conception of spiritual activism, explains:

Spiritual activism begins with the personal yet moves outward, acknowledging our radical interconnectedness. This is spirituality for social change, spatiality that recognizes the many differences among us yet insists on our commonalities and uses these commonalities as catalysts for transformation. What a contrast: while identity politics requires holding onto specific categories of identity, spiritual activism demands that we left them go. (Keating, 2002, p. 18)

One who is on this journey, the process of inner and outer changes, negotiates and navigates between possibilities; what is essential is a faculty of imagination.

## 3. Classroom praxis discussion

The typical methods of teaching ethics in the engineering curriculum are not aligned to the concepts of moral insight, moral imagination and liberation theory. For example, many case studies include a disaster or heroic action/moral exemplar that ignores the skepticism and realization addressed by Royce, at best presenting a variety of perspectives and motives but focusing on a single ethical perspective/solution that is "correct". The use of situations that the student has not yet experienced requires an imaginative leap that is likely beyond their conception, resulting in an abstract decision process where they are intuiting what is expected in the scenario, but not having personal engagement in the process. This inherently promotes ethical teaching to Buber's "I-It" and Anzaldura's "us versus them" perspectives and promoting rigid concepts of identity. A reliance on codes of ethics or legal decisions further promotes the idea of ethics as a decision between "right" and "wrong." Discussing microethics versus macroethics is inherently based in concepts of individual versus societal needs rather than a re-imagination of reality as a reconstructed relationship of the self to the world and active reflection on how personal actions affect I-Thou relationships and how they are likewise perceived by others. Considering that the majority of the engineering curriculum is based on convergent thinking it is not surprising that ethics is often similarly approached in that manner. However, as we have addressed in the theoretical foundations, ethical decisions benefit from divergent thinking that is inclusive of perspectives and often needs to reject presumed patterns (societal, interpersonal and personal). Through this approach one can address micro-meso-macro ethics as a continuum of ethical perspectives rather than opposing objectives.

With the objective of addressing the shortcomings in typical ethics instruction, the Fall 2019 senior level Design of Steel Structures Class was modified by the second author to include specific ethical teaching objectives. The initial goal was not to specifically introduce imagination in the ethics curriculum, but rather as complementary instruction to traditional ethical instruction elsewhere in the curriculum. The intent was to introduce subtleties of ethical decisions in the context of opposing ethical positions, acceptance of alternate perspectives and awareness that the student's ethical decisions can be influenced/changed through experiences. The changes implemented were successful and have been re-evaluated in the context of imagination theory, with thoughts on further modifications toward fostering imagination as a full component of ethics instruction.

The curriculum already includes a traditional teaching approach to ethics in the freshmen and senior years, with a class in each year including a two to three week module on ethics based on the introduction of professional (ASCE/NSPE) Codes of Ethics, case studies based on these standards and discussions of different persons affected and mico-macro ethics perspectives that should be considered. Additional ethics instruction may be included in other classes, but not consistently and in an ad-hoc manner at best. The new material was intended to complement rather than replace the current curriculum content. Specific information related to the implementation of the ethics curriculum implemented in Fall 2019 and student survey results are presented elsewhere (Civjan and Tooker, 2020). In the discussion that follows, we revisit the major components incorporated into the design class and reflect on those in connection with imagination.

In order to address ethics meaningfully it is imperative that not only decisions be discussed, but that students understand some concepts of moral decision theories, engage in self-reflection on their own ethical thought process and become aware that others may engage in a different process. It is only through an understanding of the existence of multiple frameworks and theories and how they affect the ethical decision process that a student can move toward acceptance of theoretical skepticism and ethical realization. In other words, those that make a different ethical decision do not need to be identified as "ethical" and "unethical" but may have arrived at opposing decisions through equally ethical processes using different constructions of the world and/or different ethical reasoning. This can be contextualized through examples that include different cultural norms and oppression-liberation concepts. For instance, is an engineer "bending their ethical compass" in adjusting to established business practices in another country that may seem questionable to U.S. practice, or are they promoting an imperialistic perspective in the assumption that the U.S. practice is ethically "correct"? Could an individual be using a different but equally valid ethical decision process to arrive at a competing ethical action? The authors posit that these types of discussions push students beyond upholding assumed ethical standard and provides a context that could enhance students' sensitivity to others' experiences.

Moving ethical thought from I-It to I-Thou can only be accomplished when "us versus them" is replaced with a relational identity thought process. This can be introduced subtly as a reflection on how one perceives everyday decisions and having students identify situations where they have personally altered their perspective, setting up a simple situational imagination exercise that can be built upon to expand the imagination leap that students can make. For instance, an assignment where students reflect on a "marginal" cheating observed in their classes and asking them to provide a justification from the perspective of the person violating an academic policy based on peer, instructor or institutional culture was included. Students generally found it relatable to take the "unethical" position, with some even assigning the ethical lapse on instructors for making it too easy to cheat without being caught, or noting that an instructor statement such as "I know that solutions can be found on the internet, but you are only hurting yourself by using them" is often perceived as allowing unethical behavior so long as the student does not find a harm, in fact a benefit, from searching out solutions to homework problems. The authors posit that it is effective to provide initial ethics discussions of situations where students have had personal experience and can easily see themselves in the alternate role. This imaginative leap, though small, is posited as necessary before a student is expected to accept relational identities that are more removed from their personal experiences.

Reflection on how classroom cheating relates to office culture and how similar office culture norms can lead to actions that would be perceived as unethical in a different context (such as at school) can stretch the imagination capacity of a student. Further assignments included professional decisions that would have impacts on different stakeholders or scheduling of construction projects. Finally, brief scenarios were provided of data being given to the student to use in their design (from a different discipline, from a different collaborating company, from another team member within their company). The students were asked whether they would blindly use the data in their analysis, and if that would be affected by how similar the data was to past projects, as well as who they believed would be liable if their design ultimately resulted in a failure due to errors in that data. Through imagination exercises that progress from the immediately relatable and incrementally to the future self an instructor can increase the student awareness of different perspectives, widen the inter-relations of stakeholders being considered and incrementally provide situations that are further removed from the student's personal experience. Students were then asked to interview non-engineers to get feedback on the perception of engineering decisions accounting for end user perspectives. This was followed up with a final assignment in which students reflected on watching portions of an ASEE session panel of activists giving their experiences around specific engineering crisis (Community Engagement Panel, 2019). The voices of stakeholders in these last two assignments are intended to move students toward an I-Thou perspective and shift their relational identity to include the direct impact their decisions make on others. The authors posit that the use of gradually

expanded situational relationships and gradual steps beyond student experiences can gently develop imagination capabilities.

If successfully implemented, this method of instruction is proposed to be a more effective means for students to internalize the impact of their ethical decisions. Over time, the objective is for students to broaden different aspects of ethical behavior including: awareness of their own ethical thought process, incorporating and acknowledging differing perspectives, accepting the validity of other viewpoints, including these stakeholders in the decision process. Placing one's continual reflection on ethical issues in the context of re-imagining relationships as an essential component to ethical learning, with an increasing inclusion of a broader consideration of stakeholders, is in stark contrast to the traditional methods of instruction. Traditional contexts of "right" versus "wrong" scenarios and imaginative leaps that prevent students from internalizing the ethical decision being addressed are not productive to moral growth and may inadvertently promote moral stagnation. This does not mean that traditional methods of teaching ethics should be discarded, but that the scaffolding for discussing these scenarios and the Codes of Ethics must be established first, ideally interspersed throughout the curriculum.

While the changes to the design class did not fully implement imagination theory, assignments were introduced to support student growth in imagination. A discussion of assignments and comparison to the traditional curriculum are presented in Civjan and Tooker (2020). Although the database from that semester is limited, the results indicate that students exposed to a combination of the new curriculum and the traditional ethics curriculum (as compared to students exposed to only one or the other) had higher acceptance of duality in ethical decisions. The students were also more consistent in their responses to ethics scenarios of consulting experience dilemmas, choosing more balanced responses with less tendency to shed responsibility or take whistleblower actions before trying to address the problems directly. Further development of the assignments and inclusion into other classes is the goal over the next few years.

To conclude, additional ethical content is recommended in the engineering curriculum. This should include some background of ethical theory and reflection on how different individuals can have personal ethical processes that are equally valid, discussions on how culture (social or professional) can influence these processes, and imagination exercises that gradually stretch student imaginal capacity. These exercises should start with situations of opposing ethical decisions that are each readily relatable to students. This is in contrast to ethics instruction methods that often presuppose an ethical position (either based on dominant cultures at university or through codes of ethics that are assumed to be "true" and perpetual), are often based on contexts that are far removed from student experiences and are often presented as having a "right" and "wrong" decision. This traditional approach is likely to introduce a separation of students from the ethical decision they are asked to make. It is proposed that

student self-evaluation of their ethical decision process through their engagement with imaginative exercises are critical steps toward ethical development. With these steps implemented on more common situational decisions ethical decisions are more likely in the less common situations often presented in case studies.

4. **Conclusion**

In this paper, we provided theoretical foundations supporting the need for moral imagination and reconstruction of relational identities when making ethical decisions. The disconnect between these concepts and ways that ethics is traditionally addressed in engineering curriculum was noted. We then explained instructional approaches that can be considered in ethics instruction to prepare students for the moral imagination required to make ethical decisions. Examples were provided of assignments that were introduced in a senior level design class in order to complement traditional instruction. In practice these descriptions are intended to promote discussion on how imagination can be included in instruction and integrated throughout the curriculum with direct relation to individual class content and hope that they can provide rich resources for educators in operationalizing imagination in ethics instruction. Re-thinking of the design course assignments in the context of imagination theory has led to curriculum changes and initiated discussion among multiple faculty regarding further implementation.

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