The Whammy Line as a Tool for Fostering Moral Imagination

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A central goal of engineering ethics instruction should be to help students develop their moral imaginations. According to Patricia Werhane, moral imagination refers to the ability of professionals to imagine a variety of outcomes for their decisions. Werhane emphasizes that if one is unable to imagine different scenarios, then one cannot assess the risk or apply a framework for moral reasoning (such as utilitarianism, Kantian duty ethics, Lockean rights ethics, or Aristotelian virtue ethics).[1] However, we have discovered that students find it difficult to grasp the notion of moral imagination and apply it to detailed case studies. While we know that there are several tools (such as stakeholder analysis) that can be used in conjunction with moral imagination, we have devised a new teaching tool to foster moral imagination, which we call the Whammy Line.

In using the Whammy Line to cultivate moral imagination, we have the students read a variety of materials. Because traditional ethics cases (for instance, the Poletown Dilemma) often gloss over the ambiguity surrounding consequences in real life, we use short stories and novels to tease out how individuals may fail to imagine fully the negative consequences of their actions or designs. Complementing the literary approach, we also use several historical cases in order to show students both positive and negative episodes of how real-life technologists dealt with consequences. In this paper, we will describe the Whammy Line and outline some of the texts we are using to develop in the classroom.

1. What is the Whammy Line?

We use the Whammy Line in a course required by all engineering students at the University of Virginia, TCC 402, "The Engineer in Society." In this course, students complete their undergraduate engineering theses and at the same time they receive instruction in engineering ethics.[2]

The idea of the Whammy Line is based on the popular TV series, “The X-Files.” In this program, two FBI agents, Fox Mulder and Dana Scully, investigate cases related to strange conspiracies to overthrow the government, alien abduction, and weird psychic phenomena. One of the show’s strengths is the intellectual tension set up between Mulder and Scully. Scully, the junior female agent, is trained in medicine and science and wants to find rational and factual explanations for the phenomena they encounter. In contrast, Mulder, the senior male agent, is willing to accept supernatural explanations for strange events. (Mulder is more sympathetic to nonrational explanations because in early episodes it is suggested that his sister was abducted by aliens, but the exact details are always left tantalizingly vague.) Because of the difference in their outlooks, Mulder is often hard-pressed to convince Scully to accept his conviction that strange, unexplained forces might be at work in a case they are investigating. Hence, in an

episode entitled "Pusher" from the show's 1995-6 season, Mulder tried to explain to Scully that a particularly cunning criminal, the Pusher, convinced another FBI agent to set himself on fire by putting "the whammy" on the agent. In response, Scully asks "Please explain to me the scientific nature of the whammy." In using the term whammy, Mulder was indicating to Scully that they were operating in a context in which the normal rules do not apply. (Mulder's use of the word whammy reflects other definitions of this slang term; according to the *Oxford English Dictionary,* it was first used by Al Capp in the comic strip "Li'l Abner" in which one character threatened to put a hex or to invoke supernatural powers by putting the "whammy" on another character.) Hence, in talking about the Whammy Line, we want to signal to the students that we are leaving the realm where normal rules apply. Unlike Mulder, we don't invoke supernatural forces, but we do want to students to be aware that things may not be as orderly and sensible as they might wish.

To develop the Whammy Line as a tool for moral imagination, we propose to the students that technologies can have four kinds of consequences: positive and negative, intentional and unintentional. Taking advantage of the students' penchant for diagrams, we graph these consequences along two axes and create four quadrants (Figure 1). In everyday life, engineers earn their keep by maximizing the positive intended consequences of a technological system while minimizing the negative intended consequences (Quadrant I). If a technological system has unintended positive consequences, then these are often seen by society as a bonus, and the engineers are treated quite suitably as heroes or geniuses (Quadrant II). A third situation arises when engineers recognize in advance that there are negative consequences, but proceed--often for a variety of reasons with their designs (Quadrant III). This leaves a fourth scenario, the unintended negative, which few engineers want to acknowledge. To draw student attention to these Quadrants II and IV, we refer to negative consequences as occurring below the Whammy Line. We argue that the ultimate challenge for an engineer is to have the character and courage necessary to imagine what happens if his or her design falls beyond the Whammy Line. To acquire this strength of character, we suggest to our students that it is necessary to look at different scenarios--both real and fictitious--that allow us to see how people anticipate and handle consequences.

2. Quadrant I (Positive, Intentional)

We begin our discussion by considering the most familiar scenario, the positive intentional. Engineers, we argue, earn their keep by being able to predict the behavior of their designs and that they try to maximize the positive consequences while minimizing the negative impacts. To illustrate this, we have the students read about a classic technological hero, Thomas Edison, and how he developed his incandescent lighting system from 1878 to 1882. In this case study, we consider how Edison assessed the commercial demand for a substitute for gas lighting and how he used this assessment to develop a revolutionary and highly successful product.[4] We emphasize how Edison was a methodical inventor, and that an orderly method is what engineers rely on in their efforts to impose order on an unpredictable and chaotic world.[5] This emphasis on method sets up later discussions of the hazards of placing faith in method alone.

3. Quadrant II (Positive, Unintentional)

Having established the realm in which most engineers like to work, we turn briefly to discussing the next scenario, the positive unintentional. This quadrant offers students the attractive opportunity to envision the positive ramifications of engineering. Any innovation that falls in this quadrant has un-dreamed-of socially and technologically redeeming qualities that outweigh any negative side effects. Here we take up a popular example with most students, the impact of the automobile on American culture in the first half of the twentieth century. Here the readings suggest that Americans readily embraced the automobile because cars seemed to solve a wide range of problems. In the cities, the automobile eliminated pollution caused by horse droppings and horses dropping dead on the street. Equally, the car permitted people to have a wider choice of where they lived (urban centers as well as suburbs) and a greater job security. With a car, people could seek work throughout a city or region.[6] Hence it is not surprising that the Lynds reported that even in the Great Depression, the residents of Middletown reported that the last possession they would give up was their car.[7]

In rural America, the automobile--particularly the Model T--had several profound positive consequences for farmers and their families. First, it made it much easier for farmers to deliver their goods to markets or the railroads. Second, cars were often used to power various farm-processing machines; by connecting a belt to the rear axle of a Model T, a farmer could run for instance a butter churn. And third, it cut down on rural isolation by permitting families to come to town every week to do business and socialize.[8]

Equally, the car complemented a growing sense of individualism in American culture in early decades of the twentieth century. As American men and women imagined themselves to unfettered by social structures and traditions, so they often turned to their cars--in both real life and in stories and movies--to implement their dreams and wishes. Because automobiles seemed to allow them to fulfill their destiny economically, socially, and culturally, Americans gladly embraced the automobile with little consideration for the problems it caused in terms of pollution, congestion, and alienation.

Using the automobile as a case study for Quadrant II, we want the students to see how the appeal of many technologies is that they promise to provide a steady stream of positive impacts. As Americans, we readily assume that most technologies will be benign and that any negative impacts will be minimal. We tend to assume that forces in the marketplace will drive out those products with negative impacts. With the automobile, we want the students to see how the fit between a technology and its cultural niche can often be so strong that it becomes hard to even imagine any negative consequences.

4. Quadrant III (Negative Intentional)

We next cross below the Whammy Line to look at the ways in which technologies can have negative consequences and how engineers handle them. We have found that traditional case studies, while helpful in providing real-life examples of decision making, often skim over the psychology of the people making the decisions. Because hindsight is 20/20, it is therefore too easy for the students to judge the decisions based on their consequences.

Historical and literary narrative, however, reveal why and how characters make such decisions. They delineate the character qualities and the thinking processes behind decisions, which helps

students see how to assume the mantle of professional responsibility—or how to shirk it. Indeed, these texts help students move beyond thinking of ethical behavior as a system or method with rules to implement; it instead demands moral imagination

In taking up Quadrant III, we make an important point about intentionality versus foresight. We suggest to the students that we don't think that engineers intentionally pursue or hide negative consequences. We assume that engineers, like medical doctors, generally follow a variation of the Hippocratic oath of "First, do no harm." However, in certain situations engineers may be aware of negative risks and inadvertently downplay or mishandle them. In particular, we suspect that too much faith in an orderly methodology can lead technologists to blindly believe that they can "beat the odds" and overcome any negative consequences. Indeed, foresight is not enough to overcome negative consequences; engineers and others must assume the duty of professional responsibility to combat predicted risks. That professional responsibility requires not only the courage to act but also the courage to imagine stepping outside method in order to acknowledge risk in the first place.

To illustrate the hubris of method, we first return to Edison and consider one of the major projects of his career. For over a decade in the 1890s, Edison tried to take over the iron industry in the Eastern United States by building a mammoth plant for processing low-grade iron ore. Edison believed that, if he systematically analyzed the problem and developed large-scale machinery, he could produce iron ore that would be cheaper than what was currently shipped to Pennsylvania blast furnaces from Cuba and other parts of the US. Focused on his methodology, Edison downplayed how new iron mines in Michigan and Minnesota altered the industry and he failed to understand how grinding iron ore into a fine powder rendered it useless for existing blast furnaces. For students, Edison's ore separation venture is a lesson in the limits of an orderly methodology and the need to develop a broad imagination about the factors that can shape the success or failure of a technology.[9]

Simply acknowledging the limits of an orderly methodology, however, does not help students in our classes gain an appreciation for why people choose to rely on method. We have found that traditional case studies, while helpful in providing real-life examples of decision making, often skim over the psychology of the people making the decisions. That is, we can look at examples of technology with negative consequences, and we can identify the persons who made the decisions to allow that technology to advance, we can evaluate the method they used to make those decisions, but we cannot always determine the personal forces that influenced those decision makers. Because hindsight is 20/20, it is therefore too easy for the students to judge the decisions based on their consequences.

Many traditional case studies, for example, teach students decision-making strategies, such as the stakeholder analysis. This method enables students to assign weights to each stakeholder in a seemingly fair, objective, and satisfying manner. Introducing a more personal testimonial from one of the stakeholders, however, often changes the weighting of the stakes. For example, “The Poletown Dilemma” cases describe a controversy initiated by General Motors’ decision to build a new automobile assembly plant. The construction of that new plant would require bulldozing Poletown, a section of Detroit, Michigan. Some of the Poletown residents were outraged. As students progress through the case, they learn to consider each stakeholder’s position in turn, with attention to legal rights, financial loss and gain, and contractual fairness. In the end,

students are encouraged to "distinguish process from outcome: [the] Poletown site was the best location for the plant, even given the pain caused to Poletown residents; by involving them in the process, however, they might have found the outcome easier to accept."[10] In other words, the students learn that it is sufficient simply to provide information about a decision that has negative consequences.

When the Poletown case is taught not only with the text but also with a videotape produced by the outraged Poletown residents, however, the weighting of the stakes can change. Some instructors have noted that showing the video after the class has finished its stakeholder analysis does little to alter that analysis.[11] One of us (Welker) has experimented with showing the video after the class has read the case material but before the class performs its stakeholder analysis; those classes were clearly emotionally affected by the videotape and accordingly gave "the pain caused to Poletown residents" far more weight in their analysis. Those classes ended their analysis with a recommendation NOT to build the plant in Poletown, even given the potential profitability for GM. In other words, the students learned that simply acknowledging negative consequences is not sufficient; professional responsibility demands action. What is interesting about this use of the Poletown case is that it fostered empathy for the Poletown residents and that empathy enabled students to step outside the strict stakeholder analysis to consider other issues more seriously. That empathy is arguably a precursor to moral imagination.

Most case studies, however, do not have accompanying videotapes of stakeholder testimony. Consequently, we turn to historical and literary narratives, which hold the advantage of revealing why and how characters make such decisions. These texts reveal not only the external, professional forces acting upon characters, but also the social, familial, and psychological forces. They delineate the character qualities and the thinking processes behind decisions, which helps students empathize with those decisions. Students see that assuming the mantle of professional responsibility—or shirking it—demands much more than simply following a code of ethics: it demands personal fortitude. Indeed, these texts help students move beyond thinking of ethical behavior as a system or method with rules to implement; it instead demands moral imagination

As a second example, we have the students read *The Ice Master*, by Jennifer Niven, which recounts the catastrophic 1913 Artic expedition of the *Karluk.*[12] Niven's narrative, based on diaries of the scientific staff and crew, ascribes the blame overwhelmingly to shirked professional responsibility. The expedition is structured along a hierarchy of professional status levels: expedition leader, ship's captain, scientific staff, ship's crew, native hunters, and sled dogs. Niven's narrative, as charted in Figure 2, can similarly be read to structure a corresponding hierarchy of responsibilities abdicated.

The expedition leader quickly and ominously abdicates his professional responsibilities. Vilhjalmur Stefansson, a world-renowned Arctic explorer, organizes the expedition in search of new land, amassing the largest scientific staff thus far. Repeatedly, crew and scientific staff note in their diaries that they assumed that Stefansson, as the expedition leader, would take of: to ensure an adequate ship, equipment, supplies and plan. Yet the ship was entirely unseaworthy and ill-suited to Artic exploration; the equipment was sub-par, stored sloppily, and at times dangerous to the crew operating it; the supplies were insufficient for the number of men and the Polar conditions; and the overall plan lacked any contingency alternatives should the ship

become icebound. Indeed, Stefansson abandons the ship and men at the first sign that he could not achieve his goal.

While it would be easy for students—any reader, in fact—to place all blame on Stefansson, his omissions were so glaring that other professionals aboard the *Karluk* ought to have borne the responsibility of stepping outside the fixed hierarchy of command to meet them. Although the *Karluk* is obviously an inappropriate vessel for ice breaking and arctic exploration, no one assumes the responsibility for insisting that Stefansson replace her—no one else assumes the fundamental responsibility of safety because Stefansson ought to. Despite the obviousness of Stefansson's lies as he abandons them, the captain, scientific staff, and crew cannot imagine that he would commit such a moral crime and so they continue to proclaim his eventual return for months, thus losing precious time and resources. Captain Bartlett himself continues to trust in the method of chain of command even after shipwreck and mutiny arise. He leaves a "lazy, duplicitous" man in charge of camp rather than a responsible scientist because he believes that only method and order will ensure survival.

Survival in the tale turns on the few moments when characters step outside of the expected method to try something innovative. When Bartlett encourages the men to construct sleds before the shipwreck, he shows not only the ability to foresee further hardship but also to do something about it. Interestingly, a few of the men write of getting lost in the snow on their ways back into shipwreck camp; snow blind and lost, they rely on hunting dogs and imaginary owls to guide them home.

For students, *The Ice Master* does not simply relate what can go horribly wrong on a dangerous expedition. More importantly, it explores why this particular chain of decisions led to the deaths of 11 men. It illustrates that foresight was not enough. Having a suspicion that the leader isn't fully trustworthy or that the ship isn't safe won't stop the catastrophe from happening. Trusting in the chain of command or the method of expedition won't help either. Assuming the mantle of responsibility that others drop might help, but only if one can imagine the dire consequences of complacency.

5. Quadrant IV (Negative Unintentional)

Discussing the fourth quadrant demands showing students a path into that difficult-to-imagine world. *The Intuitionist*, by Colin Whitehead, illuminates one path.[13] The novel narrates the story of Lila Mae Watson who must solve a mystery despite having three handicaps: she is black woman in a profession dominated by white men, and she is an intuitionist. Intuitionism is a method of elevator inspection developed by Lila Mae's idol, James Fulton, who turns out to be a black man passing for white. Empiricists inspect elevators visually, examining the cables, motors, and hoisting gear. Intuitionists, in contrast, inspect elevators by closing their eyes and experiencing the elevator's machinery with their other senses (hearing and touch) and with their imagination. While the new method may sound crazy, Whitehead claims that Intuitionists are significantly more accurate than Empiricists in assessing elevators. This success, based on sense other than vision in assessing truth, is played out on many levels in the novel, including the truth of Fulton's race.

The trouble begins when an elevator Lila Mae has inspected suffers a complete freefall, crashing to the ground. In order to solve the mystery of what happened to this elevator, Lila Mae sets out in rather empiricist fashion to locate the saboteur. The quest keeps her and the plot firmly located in quadrant III (negative, intentional) as she sifts through potential suspects and motives:

- Was it Pompey, the only other black inspector, seeking to discredit her?
- Was one elevator manufacturing company trying to discredit its major competitor?
- Was it the Empiricist mob seeking to discredit Intuitionists generally?
- Was it the Intuitionist party hoping to trick her into uncovering Fulton's plans for the black box, the perfect elevator?

The ultimate elevator, or the black box, is Fulton's technological dream for transcending racism and other social ills. His description of it is progressively detailed through magnum opus, *Theoretical Elevators*, volumes 1-3. The power of his work lies in the fact that it began as a joke, a spoof on elevator school textbooks, replete with academic riddles like the Dilemma of the Phantom passenger. When his colleagues failed to see the joke, took him seriously, and praised him as the greatest elevator theoretician ever, Fulton despaired of connecting with the human race. Fulton retreated and developed his philosophy of transcendence, disguising it as a textbook concerned with ideal design and invention. Hence, only those readers willing to read between his lines can see beyond the guise of method to explore the philosophy behind invention.

In order to show how Lila Mae crosses over from Quadrant III concerns to Quadrant IV concerns, we draw students' attention to the way Whitehead structures Lila Mae's personal reasons for seeking the black box plans. The four sections of the novel are punctuated with milestones: The first section ends with Lila Mae choosing to abandon her well-structured professional routine in order to seek the Black Box plans because she wants to save her professional reputation; the second section ends with Lila Mae developing an attraction to a black man and for political reasons wanting to discover the Black Box plans for the black race; the third section ends with Lila Mae developing compassion for a black stranger, wanting the discover the Black Box plans for all lonely, alienated people of her race; and the final section ends with Lila Mae assuming Fulton's mantle, finishing his work of philosophy in order to satisfy a basic human need for transcending suffering.

Lila Mae's quest, through numerous adventures, teaches her that appearances are indeed deceiving. She learns that race is no indicator of trustworthiness. More importantly, she learns that the illusion of control fostered by elevator school and inspection method cannot predict or prevent catastrophic freefall. By stripping away the reliability of daily routine, of the inspection method, and of technological control, the quest teaches Lila Mae to instead trust a philosophy that undergirds behavior. Answering the question "How did the elevator fall?" won't help her solve the mystery at all. It will only leave her trying to assign blame. Once she takes the leap to even imagine the possibility of total freefall, she can ask a different question: "Does my work ease the suffering of the human race?"

We deliver students from the uncomfortable land of negative, unintended consequences by returning to Werhane's concept of moral imagination (the ability of professionals to imagine a variety of outcomes for their decisions). The ability to make good professional decisions depends on the willingness to consider not only what you're doing but also why. It requires both a professional and a personal investment, both a method and a philosophy.

This paper has detailed how we currently approach defining and discussing each of the four quadrants. We have focused on the two quadrants that address negative aspects of technological endeavors. One final caveat: we use these books and cases to highlight aspects of each quadrant. Within each text, indeed at any point in a narrative for any character, we can construct the quadrants differently in order to analyze the situation and options at hand. The point is not to set in concrete how to interpret a given text or how to analyze the ramifications of any design. The point is to open a discussion about intention, about responsibility, and about the hazards of abdicating the duty to imagine the consequences of one's work.

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Figure 1. The Whammy Line Diagram

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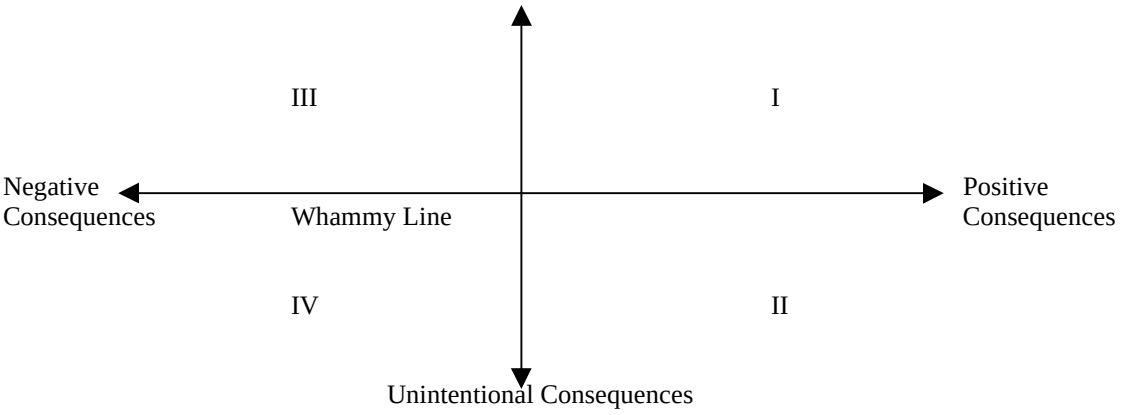

Figure 2. Hierarchy of Responsibility in *The Ice Master*. Note the blocked lines of duty between Stefansson and other characters; these characters expect him to assume a form of professional responsibility but he fails to do so.