A Virtue Ethics Analysis of the MIT Media Lab Open Agriculture Food Computer Project

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

In the past twenty years, engineers and scientists have been working to push the benefits of computers into many different industries. Though the agriculture industry had already seen significant growth due to the digital revolution, the MIT Media Lab Open Agriculture (OpenAg) Initiative was founded in 2015 with the goal of accelerating digital agricultural innovation. The primary project for the OpenAg Initiative was a series of personal food computers, which were intended to be climate-controlled devices to which a specific set of features would be applied, including light, temperature, moisture, and others. All of the code would be open-source so that "nerd farmers" around the world could share "recipes" for their most successful plants (Cohen, 2019). The program was shut down in October 2019 after the food computers failed to successfully complete a full growing season, yet the OpenAg Initiative's director, Caleb Harper, still raised $4 million for a startup based on the product and made a number of erroneous claims during this process.

A number of scholars have addressed misrepresentation in business, in particular when entrepreneurs are pitching to investors, however this ethics approach has yet to be applied to the OpenAg case, due to its recency. Although a number of media sources have reported on this case, few have looked at the actions of the project team members through the lens of an ethical framework. While it is important for media sources to present the facts of the case, it is critical to consider all of the ethical factors involved as well. By failing to consider this case from an ethical perspective, scholars lose the opportunity to consider the ethical decisions involved in being an entrepreneur and, most importantly, what it means to be an ethical entrepreneur.

Examining the OpenAg case through a virtue ethics framework will provide clarity and structure regarding the morality of the OpenAg project team as a whole unit. In particular, I will

use this virtue ethics framework to demonstrate that the OpenAg project team took a number of actions (and inactions) that were inconsistent with the moral virtues expected of professional engineers. For this virtue ethics analysis, the three virtues of professional engineers that will be considered are safety, openness, and honesty.

Background

When the OpenAg Initiative began in 2015, lab director Caleb Harper quickly began giving public talks describing the personal food computers as the fourth agricultural revolution. Early in the development of these food computers, the OpenAg team would demonstrate progress to investors and the media by showing healthy, fresh plants inside of their computers. Unfortunately, these plants were almost always purchased by an employee from a local farmer's market or grocery store, cleaned of the soil, and placed inside the device for the demonstration (Gluckman, 2019).

The first large project for the OpenAg Initiative was a joint venture with the World Food Programme (WFP) that involved bringing these food computers to Syrian refugee camps in Jordan. As a step in the process, the Jordanian National Center for Agricultural Research and Extension (NCARE) did research on the food computers at their labs an hour away from the refugee camp. The first set of food computers were delivered to NCARE in January 2017, along with members of the OpenAg spin-off startup, Fenome, who helped set up the devices. Fenome planned to communicate regularly with the NCARE team to stay up to date about the state of the research, but unfortunately some significant roadblocks were hit early on. The climate in Jordan, with very high heat and dry weather, and the lack of development in the area, led to frequent

power failures and unreliable Wi-Fi. Additionally, each time the power went down, the food computers had to be rebooted, which could not be done locally, but only via Wi-Fi.

As such, the Fenome team returned a month after the initial deployment to modify the boxes and to allow the machines to be rebooted locally, but other issues persisted. Algae began to grow inside of the computers, likely because of the clear acrylic access doors that allowed light to enter, and because of the low-quality water at the NCARE site. The last of four visits was completed in May 2017 without a single grow cycle having been successfully completed and without the food computers ever making it to the refugee camp (Goldstein, 2019).

In April 2018, an OpenAg researcher working on a food server in a shipping container in Middleton, Massachusetts contacted the MIT Environment, Health, and Safety office to report that OpenAg was discharging nutrient solutions beyond state-permitted limits. The researcher also informed the Director of the MIT Media Lab of the issue, however proper steps to remedy the issue were not taken until months later (Song & Larkin, 2019).

Caleb Harper, the founder of the OpenAg Initiative, was promoted in November 2018 to a Principal Research Scientist role in the MIT Media Lab, and was officially made Director of the OpenAg Initiative at the same time. Despite the OpenAg Initiative being shut down in September 2019, Caleb Harper continues to be a Principal Research Scientist in the MIT Media Lab.

Literature Review

Although to this point, there are no scholarly reviews of this specific case, we can look to other cases of product misrepresentation to develop an understanding of the ethical factors that are critical to consider in similar situations. Generally, these articles look at the external factors

involved that lead organizations to tend toward these misrepresentations, however they fail to recognize the ethics of decisions internal to the organization that directly led to the misrepresentation. Simply focusing on external factors and incentives neglects the power of the individual in the situation.

In *Misrepresentation and expectations of misrepresentation in an ethical dilemma: the role of incentives and temptation,* Ann E. Tenbrunsel examines the tobacco industry and conducts a study to determine how often people misrepresent estimates based on a number of external factors. Based on the results of the study, which also considered how opponent's perceptions of one another factor into their ethical behavior, Tenbrunsel concludes "the effect of incentive on misrepresentation that was found lends support to the notion that people's reactions to ethical dilemmas may be driven not only by their moral codes of conduct, but also by situational factors." She further describes the study's results for situations when one party is aware that another party may be acting unethically as can often be the case when a company incentivizes its employees to report strong numbers. Lastly, she acknowledges individual motivations by stating that incentives can be perceived differently based on the needs of the individual, and thus incentives are mediated into temptations by each person's own situation (Tenbrunsel, 1998). Despite this acknowledgement that environmental factors influence each individual differently, Tenbrunsel provides no analysis of the specific ethics of the decisions being made when misrepresenting values in business scenarios.

Rutherford, Buller, and Stebbins (2009) look at a similar phenomenon in a slightly different scenario by examining why and how entrepreneurs lie to investors in order to establish legitimacy as a company. They note that many entrepreneurs find themselves in a difficult situation because they require funding in order to develop their product, however a product (or at

least proof-of-concept) is generally required before receiving funding from an investor. They assess this scenario by using the ethical frameworks of utilitarianism and deontology. Based on these frameworks, the authors conclude that in deontology, the misrepresentation of facts to investors is always unethical due to the deontological claim that some actions are intrinsically morally right or wrong. The utilitarianism framework, however, offers a more nuanced view of the situation and says that if intentional misrepresentation of facts has a positive consequence for the investors then it is an ethical act, since utilitarianism strives to create the most good outcomes for the most people. Although this is an important analysis of a common situation, Rutherford, Buller, and Stebbins view this scenario in the generic case, which fails to account for the nuances of the decisions made in each individual case.

There is a depth of literature written about misrepresentation of facts in business scenarios, including both ethical analyses and experimental studies, as represented in the two articles here. Through the work done by other scholars, we can form a basis for an ethical discussion of the MIT Media Lab Food Computer Case. This paper will not only provide a description of the external factors involved in the case, but will also use a virtue ethics framework to compose a judgment of the decisions made by the team that worked on this project.

Conceptual Framework

The morality of the actions the team on the MIT Media Lab Food Computer Project can be analyzed using a virtue ethics framework. Virtue ethics was developed by Aristotle and it hinges on an evaluation of the character of the moral actor. By focusing on the individual, this framework considers the virtues that ethical people should hold, rather than considering the

morality of each particular action as is the case with utilitarianism and deontology (van de Poel & Royakkers, 2011).

Virtue ethics further argues that humans are rational by nature and thus they should be able to reason out how to live morally. This framework defines a virtue as a state or quality toward which all people should work and that falls at the median between an undesirable deficit of the quality and an undesirable surplus of the quality. For example, risk-taking is an important virtue for successful entrepreneurs that lies in between the qualities of timidity and recklessness. Intelligently taking risks is a critical skill for entrepreneurs and this skill clearly falls in between taking no risks no matter the situation (timidity), and taking too many risks without considering the consequences (recklessness).

Based on William Jordan's *A Virtue Ethics Approach to Engineering Ethics* (2006), we can develop virtues of morally responsible engineers using his analysis of the National Society of Professional Engineers (NSPE) Codes of Conduct. In Jordan's analysis of three sections of the NSPE Codes of Conduct, he identifies three distinct virtues that are promoted by the NSPE: safety, openness, and honesty. In the context of this analysis, safety will refer primarily to "the safety, health, and welfare of the public." Openness, based on the NSPE Codes of Conduct, can be described as "endeavor[ing] to extend public knowledge and appreciation of engineering and its achievements." Lastly, honesty is simply described as avoiding deceptive acts. While the Codes of Conduct includes other sections, it can be assumed that these three virtues are necessary for an individual to conduct oneself as a moral, professional engineer.

In the work that follows, I will examine the case of the MIT Media Lab Open Agriculture Food Computers through the framework of virtue ethics. Initially, I establish the validity of the Integration Thesis in this case. Following this connection, this paper analyzes the decisions made

by the team members working on this project with respect to the three virtues outlined in the NSPE Codes of Conduct: safety, openness, and honesty. In this paper, it will be assumed that the OpenAg team holds a particular virtue if the decisions of members of the project team are consistent with that virtue, and that the OpenAg team lacks a particular virtue if its decisions are inconsistent with that virtue.

Analysis

The actions of the team members of the MIT Media Lab Open Agriculture (OpenAg) Initiative are notably inconsistent with the actions expected of a morally responsible professional based on three main virtues that are critical for an ethical professional engineer to uphold. Based on the NSPE Codes of Conduct, these virtues are safety, openness, and honesty. Since these virtues are critical for a morally responsible professional engineer, any deficiency with respect to these virtues will allow us to consider an individual, based on their actions, to have acted unethically. Using a virtue ethics framework, the team members would not be considered virtuous agents, so their actions are morally irresponsible. The following paragraphs consider each of these virtues individually and establish either a consistent or inconsistent connection between each of the team's actions and the three virtues.

Safety

Since the definition of the safety virtue, for the purposes of this paper, is based on the organization's consideration for the safety and welfare of the public, the OpenAg team's actions will be considered in that respect. Based on this definition, I will show that the OpenAg team's actions were inconsistent with the virtue of safety expected of all engineers in their work.

The first critical oversight by the OpenAg team that affected the public safety was the clear acrylic front pane and the lack of an additional proper water filtration system on the device, since these are the two design points speculated to have led to the algae growth inside the food computer (Goldstein, 2019). According to the Environmental Protection Agency, some algal blooms can produce toxins which would certainly make any food unsafe to eat, based on its general recommendation that humans stay away from algal blooms (Harmful Algal Blooms, 2019).

Additionally, the algal blooms are indicative of a larger issue with the food computers which is that their "controlled environment," a selling point of the devices and a necessary component of their operations, was never successfully maintained, as Dr. Babakinejad mentioned later. Since the project hinged on manipulating features in new ways to maximize growth and flavor, this lack of control of the system can be considered a safety issue since it could have led to unexpected responses from the plants. Further, since algae was able to grow inside the food computers, that indicates that other bacteria and particles were able to enter the systems, which could have led to other, unplanned and unaccounted for, bacterial growth. This is a dangerous outcome for a product that prided itself on its ability to maintain a controlled environment and to be able to replicate results given the same inputs. The lack of care exemplified by this event, given the potentially harmful effects for the public, is inconsistent with the expected actions of a team that holds public safety as a virtue (Goldstein, 2019).

Another oversight by the OpenAg team involved the discharge of nutrient solutions from its food servers. In April 2018, Dr. Babakinejad informed the MIT Environment, Health, and Safety Office that OpenAg was discharging nutrient solutions beyond state-permitted limits for nutrient concentrations. A story published by ProPublica asserted that documents provided by a

former Media Lab employee showed that Nitrogen levels from the lab's wastewater were more than 20 times the legal limit. The story goes on to detail that water with large amounts of nitrogen can kill fish and deprive infants of oxygen. Further, the story indicates that the Massachusetts Department of Environmental Protection began inquiring into the situation in the beginning of 2019, but the MIT Environment, Health, and Safety Office failed to provide the requisite water quality reports in a timely manner (Song & Larkin, 2019). This is an example of the OpenAg team displaying flagrant inconsistency with the public safety virtue expected of professional engineers. Although one could claim that Dr. Babakinejad reported the issue to the MIT Environment, Health, and Safety Office, who failed to execute its role in the process, it is a critical aspect of the engineering process to understand and follow the safety regulations relevant to a given project. By failing to develop a system that produced wastewater within the legal limits, the OpenAg team showed a lack of respect for public safety.

These two instances in particular display inconsistency with the virtue of safety as described by the NSPE Codes of Conduct, by which we can assert that the OpenAg team does not possess this virtue.

Openness

As with the virtue of safety, openness can be described by an organization's relationship with the public, and its efforts to inform the public of the science and engineering advancements being made. In this case there is strong interplay between the virtues of openness and honesty, however, to simplify this section of the analysis, we will consider that the OpenAg team believed all the information they shared with the public to be true. Based on this outlook, I will

demonstrate that the OpenAg team had a number of successes with respect to the virtue of openness.

Throughout the life of the food computer project, Caleb Harper, the OpenAg Director, was extremely vocal in promoting the product through a series of talks, including a TED Talk that was later removed for failing to meet TED's standards (Cohen, 2019). By considering only the fact that these talks were made, it appears that Caleb Harper and the OpenAg team had a strong motivation to share their project with the public and to inform the public of the engineering progress they were making. This motivation and the subsequent actions are certainly consistent with the virtue of openness.

Another success of the OpenAg team to this end was its willingness to use its product as an educational tool. Early on in the development of the food computers, the team sent a number of computers to a Boston-area school so that the students could learn both about agricultural science and engineering, as well as the technology involved in the food computer itself. The OpenAg team also sent computers to a Washington school and worked with the teacher to set them up and give talks to the students and the community about the product and the future of agriculture (Brodwin, 2019). The educational aspect of the OpenAg project represents an exceedingly important component of the openness virtue.

As previously mentioned, the OpenAg team sent a number of their computers to schools in the Boston area so that students could learn about the technology behind the computers and conduct their own growing tests. One alternate viewpoint to this discussion is that the OpenAg team was simply interested in using these schools to collect more data about the operation of the food computers. While this could be a reasonable outlook based on the OpenAg team's other actions, it is an important additional piece of evidence that the OpenAg team sent team members

to the schools to help with the food computer's setup and operation and took multiple trips to the school to ensure that the processes were operating well. This seems to be a significant amount more work than is necessary in order for the OpenAg team to simply collect data, so we can safely assume that the OpenAg team genuinely wanted to grow its brand and rapport with the local community while educating students and community members about engineering and agricultural advancements (Brodwin, 2019).

Overall, the actions of the OpenAg team are consistent with the virtue of openness. Its efforts to inform the public about the product both through public talks and educational opportunities show that the team was excited about the work they were doing and valued spreading its ideas.

Honesty

In analysis of the OpenAg team with respect to the virtue of honesty, it is important to recall that honesty is considered to simply be avoiding deceptive acts. In the case of the OpenAg team, a number of pertinent events show that the team actively deceived the public regarding both the success and the implementation details of the product and failed to uphold the virtue of honesty expected of all engineers.

One major series of events related to this virtue involve the OpenAg venture with the World Food Programme (WFP) that consisted of research into the function of the computers with the Jordanian National Center for Agricultural Research and Extension (NCARE). The OpenAg team, and Harper in particular, repeatedly claimed that the food computers were being used to aid Syrian refugees in Azraq, Jordan, where 35,000 refugees were being housed. In reality, the

computers were deployed for testing and observation at a facility run by NCARE in Mafraq, which is an hour from Azraq.

Nina Schroeder, who is the Head of Scale Up Enablement at the WFP Innovation Accelerator, and was in charge of the OpenAg food computer project, said that "for the early research phase, it wouldn't have made sense to deploy it inside the refugee camp." The OpenAg team, however, consistently claimed that refugees were benefiting directly from the food computers and that the food computers allowed them to enjoy growing foods from their home region. Schroeder's explanation, however, indicates that the food computers would be fully tested at the NCARE facility before reaching the refugee camps, and a number of software and hardware bugs led to the OpenAg team visiting the NCARE facility for the last time in May 2017, without having completed a single grow cycle successfully (Goldstein, 2019).

This consistent assertion that the food computers were deployed in the Azraq refugee camp represents inconsistency with the virtue of honesty. By failing to make public the actual timeline for the food computer's development, the OpenAg team was deceiving the public and any investors into thinking that the project had experienced significantly more success than was it had.

This deceit regarding the WFP venture was not the only step the OpenAg team took to lure investors toward its new company. In many cases, when investors and reporters would visit the MIT Media Lab and the Fenome offices, employees desired to display successful plants that had grown inside the computers, however, the plants inside the computers had usually not grown properly. In an effort to make it appear that the food computers were working properly, OpenAg employees would buy plants from another hydroponics system, and place them inside the devices. Additionally, in public talks Harper would describe additional functionality of the food

computers that members of the team, and almost certainly Harper himself, knew had no basis in reality. In an email sent from Dr. Babakinejad to the MIT Media Lab Director, he says Harper was claiming "implementations of image processing, microbiome dosing, creating different climates and collecting credible data from bots across the world that are not true." This quote is exemplary of the lack of honesty that Harper and the team held as they gave the media many buzzwords to enhance the excitement around their product. Despite Dr. Babakinejad's best efforts, the context of this quote also show that the issues with the OpenAg team went deep into the organization (Gluckman, 2019).

The act of using impostor plants in these devices for promotional purposes in order to motivate people to invest money in the project is notably inconsistent with the ideals of honesty. It can be argued that the team needed to give the appearance of success in order to raise money to improve the product further, however the MIT Media Lab was funding the OpenAg team, so development should have been able to continue without extra investment. Additionally, openly lying to investors and the public about the state of the project is a clear failure to uphold the honesty that is expected of professional engineers.

Conclusion

By considering the decisions made by the OpenAg project team with respect to three necessary virtues for ethical professional engineers, we can pass judgement regarding the morality of the OpenAg team as a whole. These decisions represent significant inconsistency with the virtues of safety and honesty, despite the team's efforts to share its work with the public. Based on this virtue ethics analysis, the actions of this team are considered to be immoral because they fail to possess virtues that are necessary for an ethical professional engineer.

Although entrepreneurs are often faced with a dilemma between generating excitement for their new product, and requiring more funding in order to continue to develop their product, by viewing a specific case of this through an ethical framework, we can provide a solution to this dilemma. While there are different approaches to this situation, and different ethical frameworks may lead to these different approaches, it is important to humanize these entrepreneurs with respect to their virtues. Consistently considering the human side of all interactions, and the characteristics expected of those people, will give guidance toward making the correct decisions even as our modern relationship with technology gets more complex.

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