Prospectus

Raising Deforestation Awareness Through Online Education
(Technical Topic)

The Effect of Farming Technology Innovations on Animal Cruelty
(STS Topic)

By

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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

The Amazon Rainforest, located in South America, is a beautiful, massive forest full of luscious trees, unique animals, and indigenous tribes. With issues of climate change being brought to the forefront of politics, deforestation is certainly a hot topic, and it should be when it comes to the Amazon Rainforest. The Amazon stores 1/6 of the world's carbon, captures 20% of all carbon emissions annually, and yet humans are razing 78 million acres of it every year. The burning of forests across the globe accounts for more carbon emissions than cars, trains, and planes combined (Amazon Aid 2019). For all of these reasons, my capstone team is working with Amazon Aid, a nonprofit spreading awareness of the importance of the Amazon Rainforest. The goal is to build upon an online educational module on their website that teaches young students in the United States (US) about the value of the Amazon. We will be adding important functionality that aids in class registrations, progress tracking, and entertainment.

One of the many reasons for burning the Amazon is to make space for large farms. In countries like the United States, people prevent this by using smaller spaces for mass meat production. While this is efficient, the technology can have controversial impacts on the treatment of the farm animals involved. Throughout this paper, I will reference "animal cruelty," which can be described in many different ways. For the sake of common understanding, I will use this phrase to refer to the unnecessary suffering of animals caused by humans. The reason for this definition is because a survey of 1,012 adults concluded that 93% of adults believe "that animal pain and suffering should be reduced as much as possible even though the animals are going to be slaughtered anyway" (Spira 1996). Technology used today that brings this into question is used in factory farming. A factory farm is defined by the ASPCA (2019) as "an industrial facility that raises large numbers of farm animals such as pigs, chickens or cows in

intensive confinement where their movements are extremely inhibited." This farming industry has a larger impact on us than we tend to expect. In fact, 99% of all farm animals are currently living on factory farms (Reese 2019), so when someone bites into a chicken sandwich, it makes sense for them to understand where that is coming from, and the ethics behind the making of that meal. Saulius Šimčikas (2019) has evidence showing that the number of vegetarians within the US has been on the rise since 2013, and that currently the population is somewhere between 2 and 6 percent vegetarian. Later, I will analyze current technology used in factory farms, and offer a couple of technological solutions that could prevent poor treatment of animals in the future.

Technical Topic

DuPont and the rest of Amazon Aid aims to put pressure on politically and economically powerful organizations because many continue to operate without any environmental accountability. E. Pereira, Ferreira, Ribeiro, Carvalho, and H. Pereira, experts in resource conservation and computational modeling, recorded the series of anti-environmentalist policies enacted by Brazilian politicians linked to the country's agribusiness since 2016. President Michel Temer eliminated multiple construction licenses previously required for companies cutting down the rainforest, and enacted other policies reducing the public's ability to oversee those construction projects. After deforestation rates increased in 2016, Temer's administration cut the Brazilian Ministry of Environment's budget in half, then froze the budget at that level for a twenty-year period beginning in 2018. His successor Jair Bolsonaro promised to continue increasing access to the Amazon's resources (p. 8, 2019). Though not elected, consumer facing companies depend equally on their buyers' sentiments, and in some cases their buyer's ignorance toward irresponsible environmental practices. Because illegal gold mining motivates much of the

Amazon's deforestation, New Yorker writer Stephanie Boyd wrote that members of the jewelry industry created the Responsible Jewelry Council in 2012, promising to trace gold from its customers to its original origins. Within a year, Peruvian reporters caught a council member buying illegal Peruvian gold. Yet, with no punishments set in place by the voluntary council, that company, PAMP, continued its business and still successfully operates today (para. 20, 2012).

With an improved design, Amazon Aid's learning modules could begin educating the next generation of environmentalists to boycott politicians and companies who choose to ignore the deforestation problem. In the two-semester capstone course led by Computer Science professor Ahmed Ibrahim, undergraduate Computer Scientists Trevor Bedsaul, Henry Clabby, Ryan Coulter, Sam Hecht, Dylan Peters, Rob Wallace, and Teddy Vallar will work with Amazon Aid Communications Specialist Ben Eppard to make the website's necessary changes. Within the first semester, the capstone team will solve the accessibility and navigational problems. Though targeted toward middle school classrooms, the learning modules currently require a password protected account to track progress between logins. Public middle school teachers require special administrative permission to use any sites which require student passwords. To eliminate this barrier to entry, the capstone team will restructure the student login process to use a classwide code, distributed by the teacher, followed by a personalized four digit code so that each student may track their progress without the need for a password. Once inside the site, users currently have no way of returning to previously completed "levels" within the learning progression, shown in Figure 1 as different strata of each tree, making classwide discussion about specific aspects of the curriculum unnecessarily difficult. Simply making those previous levels clickable will allow intuitive backwards navigation for students and teachers, and this user experience will be tested with real students to ensure ease of use.

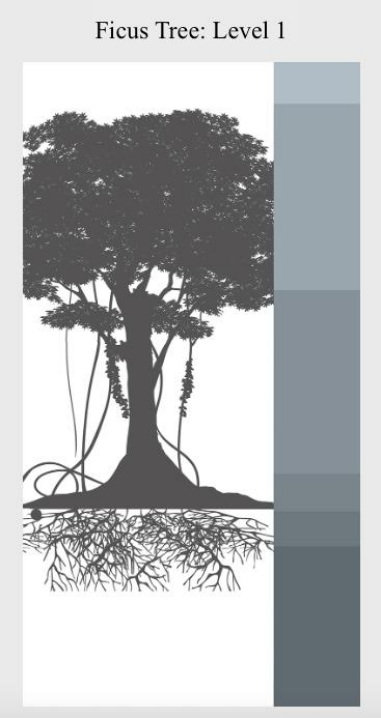

Figure 1. The silhouette of a Ficus Tree shows the progress of a particular learning module in the Amazon Aid site, but features no navigation functionality, and fails to make clear the user's current level. (Image Source: Amazon Aid 2019)

In the second semester of the course, the capstone team will make the learning activities more engaging through improved gamification of the material. While the site currently features small games throughout the curriculum, an example of which is shown in Figure 2, they display multiple common pitfalls of serious games, games designed for something other than pure entertainment, explained by Wim Westera, an expert in learning media. Emphasis on rote memorization without contextual framing, such as a crossword with eight discrete questions and answers, aid in knowledge reproduction but fail to support deeper comprehension and general content understanding. Apparently, games employing only extrinsic motivators like rewards or certificates suffer the same disadvantage when compared to games using intrinsic motivators,

such as enjoyment of the game itself (pp. 61-64, 2019). Though moderately enjoyable, the crossword shown in Figure 2 simply uses the password to the following level as an incentive.

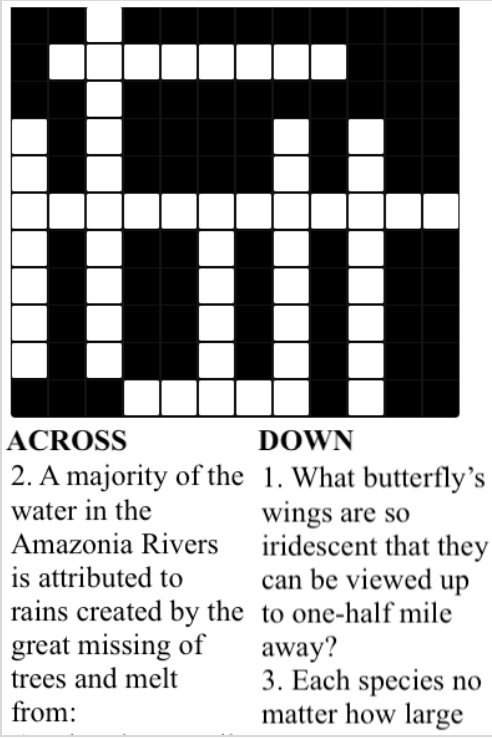

Figure 2. One mini game embedded in the learning modules features an eight question crossword puzzle. (Image Source: Amazon Aid 2019)

By installing games that require deeper understanding, such as designing hypothetical ecosystems of plants and animals, the capstone team will make the learning modules more effective as well as engaging. These improvements to the system are summarized as follows:

MINIMUM REQUIREMENTS

- As a USER I should be able to go back to previously completed levels within each "tree" when using the online learning platform.
- As a USER I should be able to enter the learning platform through a single teacher login.
- As a USER I should be able to enter the learning platform using a teacher's login information as well as a personal avatar, so that each student doesn't have to create an account.

DESIRED REQUIREMENTS

- As an ADMIN I should be able to add images that are persisted in a database, so that content can be added and served reliably.
- As a USER I should be able to bypass the integrated minigames in order to move onto more content.

OPTIONAL REQUIREMENTS

- As a USER I should be able to access and play a variety of minigames which are native to the web app while progressing through learning content.

The new and improved learning modules on Amazon Aid's website will be publicly released for use in middle schools and for independent learners who come across it online. Along with the site gaining popularity, Amazon Aid's ideals will begin spreading throughout the world, promoting concern for the Amazon and encouraging citizens and consumers to pressure politicians and businesses to adopt practices protecting the rainforest. Since one of the main purposes of deforestation is to make space for farmland, a way to slow it would be something like Factory Farming. However, this can lead to other concerns with the treatment of animals on those farms, which we will dive into in the next section.

Factory Farming and Animal Cruelty:

First off, I will explain the basic technologies used in factory farms that are at least questionable in the way they are used with farm animals. The most well-known of these is the gestation crate. A gestation crate is used to house adult female pigs, also known as sows. They are normally 2-2.5 feet wide, 7 feet long, and 3 feet tall. A diagram of how this relates to the size of an average farm pig can be seen in Figure 3. Sows will spend nearly their entire lives in a crate, unable to turn around, lay down, or even see their tail, though it gets cut off anyway. In most of these farms, they stand on hard concrete with no natural lighting, with their legs giving out from underneath them, and their feces piling up at their feet. 95% of the pork consumed in

the United States comes from pigs living in these conditions (Bardroff 2015).

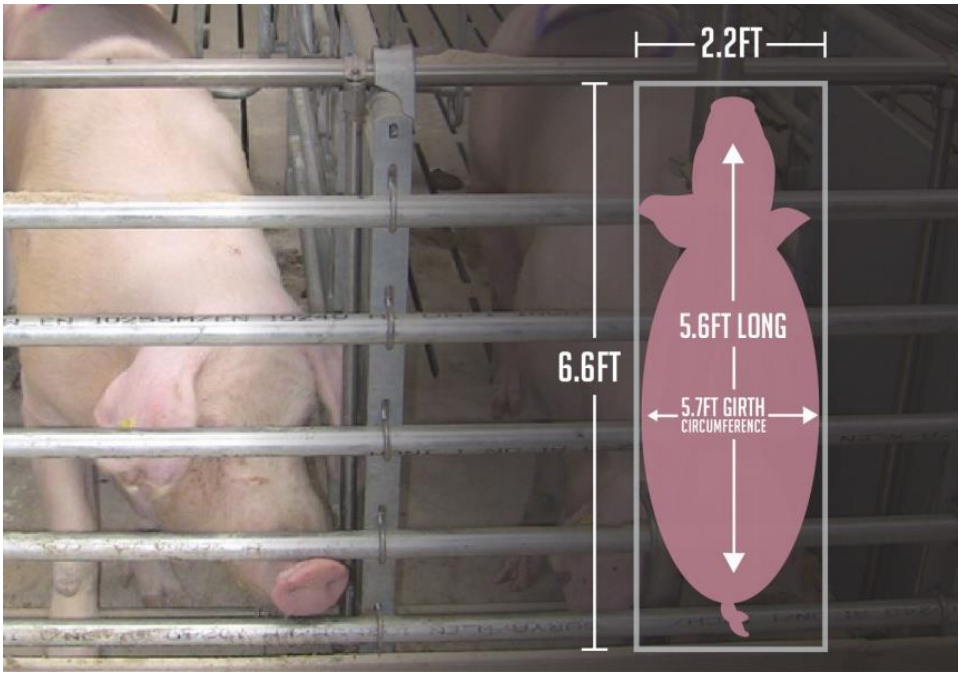

Figure 3. Diagram showing the size of a gestation crate in comparison to the size of the average sow housed there – nearly the same size as the crate itself. (Image Source: Bardroff 2015)

Moving onto chickens, the technology used for their treatment that I will pay attention to is battery cages. Battery cages are sized between 1 and 4 cubic feet, and are incredibly overcrowded, housing between 4 and 9 chickens. These are used to house the laying hens, who's sole purpose in the farm is to reproduce. These chickens are genetically modified to reproduce quicker and live longer, though the death rate is between 10 and 15 percent because of their living conditions (Frank 1979). Living in cages stacked 8 high, these buildings can hold tens of thousands of these laying hens. The efficiency of this reproduction setup leads to chickens being the top slaughtered animal in the U.S., at over 700 million killed a month in comparison to pigs at around 10 million (The Ethical Implications of Factory Farming 2014).

There are many ideas as to how we can move away from these ethical issues. For example, the introduction of meatless meats, like the impossible burger. Some people who go vegetarian because of animal welfare may still want the delicious taste of meat, and this is one of the only options they currently have to do that. Claire Robinson (2018) digs into the use of the impossible burger and how valuable it currently is. When it comes to environmental and health concerns, it is "at best questionable and at worst highly misleading." Some of the evidence to support this is from the FDA, which ended up deciding they could not approve the safety of eating the Impossible Burger, because of the unpredictable effect the unique proteins used in the burger could have on humans.

Evelyn Pluhar offers up another solution, known as in-vitro meat. Creating in-vitro meat is an incredibly complicated process, but to simplify it into a sentence, it involves taking an individual muscle cell from the animal, and then uses complex processes to replicate it and create actual meat from that animal. The demand for these food options is growing. In fact, "People for the Ethical Treatment of Animals (PETA) has offered $1 million to the first scientist who can produce affordable chicken nuggets that can pass a blind taste-test" (Pluhar 2009).

To better understand the issue, it is important to understand the different stakeholders and actors involved. Every consumer is a stakeholder, or at least those interested in animal products. The average consumer will need to make a choice between what level of care they think a farm animal deserves versus how much they are willing to pay for the products. Grocery stores, restaurants, and the farms themselves are all making more money than ever before due to the efficiency of these methods. The actors are the various technologies in these farms. For example, the gestation crates for pigs, battery cages for chickens, and the tools used to remove the tails from pigs and beaks from chickens. Lastly, the intangible actors could be anything from the idea

of animal cruelty and what people consider to be cruel, to the current research into in-vitro meat and the idea of how we can create beef from a single muscle cell of a cow.

My STS framework I plan to use is Technological Determinism. Sally Wyatt (2008) describes this framework well and provides examples of it, such as the low-roofed bridges built between New York and Long Island that prevented the busing of poor individuals to the island. Essentially, Technological Determinism is analyzing how new technology can shape a society's future and values. This works against the analytical framework, Social Construction of Technology, which shows how societies have control over what technology is introduced to fit their values. The reason I want to use Technological Determinism for this topic is because from personal experience, when asking someone how the meat got onto their plate, they never want to hear the answer. Instead, usually they acknowledge that it likely isn't a good story, and then change the topic so that they can eat in peace. This is an example of how introducing this technology has caused people to be more content with worse animal treatment on farms. Knowing this from personal experience, I want to research it under a more structured approach and see how fair or unfair it is to make that claim.

This fits the topic well because as explained, there are many new technologies that were incorporated recently in these factory farms. A clear argument can be made that the invention of the gestation crate, with the prime purpose of housing pigs, has led to worse treatment of animals. Information on treatment like this has been widely available since the 90's, and yet meat consumption in the United States has hit an all-time high (Šimčikas 2019). It is a perfect example of how this technology being introduced has led to people being more complacent with poor animal treatment, or at the very least ignoring what is happening. This puts the blame on the invention of these technologies, rather than on the way that farmers use it to make the animals

suffer over time. Along with this, we are seeing new ideas being brought to the forefront, like the in-vitro meat and the impossible burger, which could have a large impact on the social dimensions of farming technology in the near future.

Research Question and Methods

How have innovations in factory farming led to animal cruelty, and can we use technology to fix that? This is what I plan to answer by the end of the school year. Meat consumption is higher than ever, yet the animal rights movement is gaining steam. It is a perfect example of engineering innovation in these farms leading to social controversy over the use of the technology. I will create a survey to administer in mass to students at UVa, with questions asking what they believe to be cruel animal treatment on farms. The survey will include specific practices used in factory farming, and whether or not they think gestation crates, for example, are cruel to animals. Along with this, I'll interview many vegetarians and vegans with questions on why they identify that way, and when they last broke their diet. This will help provide an understanding of the main reasons that college students are increasingly going meatless, and how strongly people tend to stick to these identities. After gathering this information, thematic analysis can be used to understand what proportion of UVa students consider gestation crates, for example, as a form of animal cruelty. Lastly, I plan to contact local chicken and pork farms in Virginia, inquire about a visit, and interview workers at those farms. I can use Technological Determinism to analyze how people accept or reject practices used on their farms based off of the technology they have. These research methods of data collection and analysis, along with more research into the issue, will result in a strong structure to provide potential solutions to the current examples of animal cruelty within the farming industry.

Conclusion

To reiterate, there are two problems I am looking to solve through this research paper. The Amazon Rainforest is a huge asset to our climate, and it is being torn down incredibly fast and much of that land is used for raising cattle and pigs. The web application that my capstone group is working on will help spread awareness to middle school children in the US. Factory farms offer an alternative to razing the Amazon, but there are ethical concerns about that practice. Further, it is something that seems to get pushed aside, since people don't see it with their own eyes. My goal is to clearly explain all of the issues with the current technology used in farming, and offer up many potential solutions to these problems. As for timing, Figure 4 shows a Gantt Chart of when I expect to get my work finished.

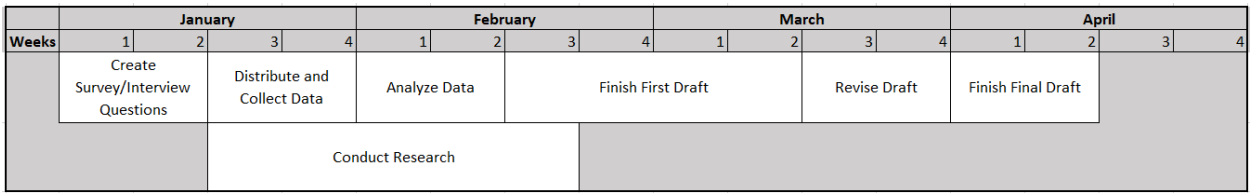

Figure 4. Gantt Chart showing the timeline of research and writing for the final thesis research paper. (Image Source: Bedsaul 2019)

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