Prospectus

Design of Communication Based Computer Science Course
(Technical Topic)

Analysis of Communication Issues at Theranos as Cause of Company Failure
(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

Internal company wide communication is integral to a company's success. Without communication between sections of the company, the company cannot work together towards one goal, and it is easier to cover up company failures. According to Peter Muchivsky (1977), the form of communication matters a great deal when it comes to job satisfaction. A gate-keeping style of communicating, withholding information from those who ask, is significantly more likely to decrease job satisfaction. On the other hand, summarizing, or providing key points about work and findings, is more likely to increase job satisfaction. Thus, learning how to communicate well within an organization, and knowing what to expect from an organization in terms of communication, is an important part of working in industry.

Currently, the University of Virginia requires courses for computer science majors with limited focus on widespread communication. Throughout my experience interning at Yext during the summer, internal communication and documentation was key in reducing redundancy within the workplace. The University of Virginia does not currently require any courses on this largescale organizational communication. Current courses include group projects that are limited to 2-4 people, thus providing good insight for technical communication with people of a similar skill level, but not communication with those who have lower levels of technical knowledge. Realistically, within companies as a whole, a team is made up of multiple roles both technical, like software developers, and non-technical, like designers and project managers. Communication across these lines is an important skill to develop as a software engineer. Thus, I am evaluating how actors within a company network interact and communicate with each other. Each employee is a separate actor, but the influence of actors upon others, as well as the methods for communication, are important factors to consider when analyzing the network as a whole.

If computer science students at UVA only develop technical skills, they will have no method of communicating the importance and nuance of these skills to a wider audience. Students need to have the ability to communicate both with other members of their organization, as well as clients. A lack of broad communication skills will limit the productivity and effectiveness of the organization as a whole, because other members of the organization will not have the knowledge necessary to request realistic complex solutions to problems.

Therefore, I have decided to focus on effective internal communication between company employees. For my technical report, I will propose additions to the current CS curriculum that will allow for more the development of effective communication skills between students. For the Socio-Technical component of my project, I will be evaluating a failure in communication within the company Theranos. Actor-network theory is an STS framework that breaks technologies and companies into a heterogeneous network of actors that can be analyzed (Cressman 2009). I will be using actor-network theory to evaluate communication within the heterogeneous networks at the company that I interned for, Yext, and the failure of communication between networks at the company Theranos.

Technical project

During the summer of 2021, I interned at a company called Yext. I was a consulting software engineer that worked with technical engagement managers to address issues that clients had with their Yext Pages. I also worked at Yext to help revamp an internal tool that provided easier access to current information about clients. During my internship, I noticed the importance of company communication and internal resources. There were a lot of helpful resources to make sure that we, as developers, were not reinventing the wheel. For example, I would search the Github repository for examples similar to my current work, and thus be able to learn from others

through their thorough documentation. My intern project also extended this idea of internal records, as it created a source of truth for company information. The internal tool that I worked on began as a directory of current clients, and the products for those clients. I worked with a group of technical engagement manager interns to develop the site into something much more usable, through a refreshed directory, more information on given pages, and an algorithmic search system rather than a keyword search. I learned the importance of internal company communication and documentation through this intern experience.

There were many useful courses at UVA that helped prepare me for this experience. The two most important courses were my Programming Languages for Web Development course and my Advanced Software development course. The Advanced software development course was important in learning how to build from requirements, and how to work and communicate within a team. The syllabus mentions that students act as a "member of a team that has to interact with other teams and customer representatives" (McBurney 2021). A required course for BS computer science majors at UVA, this course teaches an important lesson on communication as a team towards a common goal. Even so, there is little communication with those of a different technical level. Within the course, students gather requirements from non-technical members of the community, but there is no back and forth beyond this.

The other course that helped prepare me for my internship was Programming Languages for Web Development. This course taught me an important number of technical skills that were useful in my internship. I learned Javascript, Html, and CSS, which are relevant programming languages, as well as how to interact with a database from a website. The course also had an element of communication, as the course gathered students into pairs to complete the project, and pairs needed to demonstrate their project (Praphamontripong 2021). The same issue arose as with

the previous course, in that the communication within the course was mainly technical communication. Thus, I propose the solution of creating a new CS class that is based around a project where there are technical and non-technical members that must communicate to develop the project.

The current courses at the University of Virginia do not stress the importance of non-technical communication. Through my work at Yext, I needed to be able to communicate with technical engagement managers, who would speak with clients about requirements. Many technical engagement managers would not have the same level of technical knowledge as developers, and thus there needed to be a middle ground of communication where both parties could communicate their needs. An example course from Coursera could be the interpersonal communication for engineers (Moran 2021). This course teaches technical people how to communicate effectively and maintain relationships while under stressful conditions. This would be important in maintaining internal relationships and good company culture. Another course from Coursera could be the basics of slack (Bagley 2021). Slack is an increasingly important tool for internal communication. I was thrown into using slack at Yext, and throughout the summer realized how beneficial various slack features could be. Thus, I think that it is important to emphasize communication skills, as well as communication tools within UVA courses.

These Coursera courses offer important insight into a few important communication topics to include in this new course. As a basis of the course structure, however, I would have a class wide group project similar to Paul Gruba (2010). In his paper, Gruba outlines a pilot course for computer science students with the purpose of teaching effective communication. The purpose of the class is to set up a conference. Students act as members of various committees, working together to set up the conference. The students also develop their own conference

presentations. I think that these are effective strategies to develop communication as they allow for non-technical communication, through committee outreach, as well as technical communication within the conference presentations. I would like to create a similar structure, but base the course around groups that are more aligned with company roles. Thus, there would be a class wide deliverable, and then the class would be broken up into sales, project management, and technical roles, with a rotating system so that students would have an understanding of each role. I believe this course will address the issues with relevant communication education for computer science students.

There could be two thought processes through the lens of the actor network theory (Cressman 2009). The first would be analyzing the sets of employees, ie. developers and project managers, as separate actor networks within the company, and the second would be creating a better connection between the two via a third actor network, education and tools. Education on proper means to address given situations, as well as how to communicate technically is vital in creating am more effective workforce.

STS Problem

The socio-technical case study that I have decided to focus on is the infamous Theranos company, which is again in the public eye because of Elizabeth Holmes's trial (O'brien 2021). Theranos was a medical technology company created by Elizabeth Holmes. The company created medical technology and became a start-up unicorn in Silicon Valley that had a value of 9 billion dollars at its peak (Bilton 2016). The main attraction, or promise of the company, was the idea that it could create a blood testing machine that could only use a finger prick of blood. This was a big selling point as most blood testing machines require a needle to get enough blood to test. The problem with Theranos was that it did not have the technology that it advertised (Bilton

2016). The company kept this under wraps for a long time, continuing to take money from investors, but an article from John Carreyrou, exposed the company, driving it to failure.

I will analyze this failure through actor-network theory. Actor-network theory is a theory which allows companies to be broken up into a heterogeneous combination of actor-networks. These actor-networks align, or go against the values of the company as a whole, and contribute to the technology and functionality of the network. Each actor can be broken up into its own network to be analyzed. (Cressman 2009) There were many actors that contributed to the failure of Theranos. Many believe that Elizabeth Holmes, its creator, was too ambitious, and not transparent enough, using manipulation and scare tactics to maintain control. One could also argue that the science itself was a bad actor, as throughout Theranos's testing, scientists determined that a larger amount of blood was needed for accurate blood testing. I believe that an actor that was mentioned in Carreyrou's book (2018), but is often overlooked, played one of the largest roles in the continuation of Theranous past the point of being a promising organization.

One of the methods that Holmes used to maintain control of her organization was to limit communication between sectors (Tucker 2021). This made it very difficult for capable employees to realize that the organization was lying to its stakeholders. Carreyrou (2018) has several examples in his book where employees ask Holmes whether other sections of the organization are making progress, but Holmes declines to answer under the reasoning that doing so would be divulging company secrets. One of the most important features of a company to effectively innovate is the ability communicate effectively internally and externally (Straker 2021). If the employees had the ability to communicate with each other more effectively, the network could have grown stronger, and realized its shortcomings earlier. If these issues were realized earlier, then the company could have shifted its focus to a product that was more

feasible and not have ended in disaster. Thus, although there were many actors present in the failure of Theranos, the communication issues were integral to the company continuing to cover up its failures, eventually making its ultimate downfall larger.

Thus, lack of effective internal communication was an important actor going against the Theranos network, keeping it from becoming successful.

Conclusion

The deliverable for the technical problem discussed in this paper is a design of the communication focused computer science course. This design will include a proposed course outline that will address the need for education about system wide communication. The STS research paper will seek to establish a connection between weak company communication and company failure through analyzing the failure of Theranos as a case study. I will analyze the Theranos failure through the actor-network theory to establish that the communication between actors is an actor-network that strengthens or weakens the network as a whole. Through research into this STS case study, I will establish the connection between fluid company communication and company success, and thus the importance of communication education in the Computer Science curriculum.

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