

Thesis Project Portfolio

UVA CS Department Cybersecurity Focal Path: A Different Approach

(Technical Report)

Cybersecurity in a Quantum Realm: Persuasive Language

and Analogies in Academic Papers

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Department of Computer Science

Sociotechnical Synthesis

(Executive Summary)

UVA's Computer Science Department and Cybersecurity

As Cybersecurity is becoming more prevalent in the workforce, Computer Science students need to be educated to be well prepared. My STS Research Project, the Cybersecurity Focal path within the University of Virginia's (UVA) Computer Science department is what pushed me to choose my topic, which I then critique and propose new ideas for in my Technical Report. Cybersecurity is immensely important to anything computer science related, as personal data and databases are a large target for hackers because that information can be sold in the black market or taken hostage for ransom. Quantum computing is an unregulated tool that can facilitate these attacks and break through modern cyber security infrastructures.

In my STS research on cybersecurity and quantum computing, I focused on understanding how analogies used in academic discourse influence our understanding and expectations of this emerging technology. My investigation discussed the concept of "Analogical Imagination," by Claudia Schwarz-Plaschg, to look at how analogies in scientific literature influence our perception of quantum computing's risks and potentials in cybersecurity. Through content analysis of four scholarly articles, I categorized the analogies into explanatory, structural, metaphorical, and other types. This categorization helped in analyzing how each analogy type contributes to the understanding or potential misconceptions of quantum computing concepts. I discovered that while analogies are powerful in making complex quantum theories relatable, they also risk oversimplification or misrepresentation, especially in critical fields like cybersecurity. My findings showed that analogies impact both public and academic perceptions of cybersecurity challenges in the quantum era. This influence also affects policy discussions and decisions. It is very important for accurate and reflective analogical use. The research states

that analogies in technology discussions can clarify but also obscure which means that academic research needs to be clear, critical, and informed in order to properly emphasize and convey the issues and solutions that will stem from quantum computing.

In my Technical Report, I propose changes to UVA's Cybersecurity Focal Path. This Focal Path is a set of classes for students that once taken, the student can receive a certificate of completion. My own experience with UVA's Cybersecurity Focal Path was rocky to say the least, and I feel like I did not get as much out of it as I could. So, I propose a new curriculum structure for the Focal Path that (1) better the students' knowledge with integration of interactive labs and case studies, (2) prepares them for any future jobs in the cybersecurity field and establish connections with industry partners, and (3) create a pathway for the Computer Science department to enact concentrations within the major. This structure is pulled heavily from the cybersecurity education guidelines from Gelareh Towhidi and Jeannie Pridmore's "Aligning Cybersecurity in Higher Education with Industry Needs," which layout how cybersecurity education could be restructured to create more prepared graduates for the Cybersecurity workforce. My proposal will not only improve the Computer Science department, but also give students more direction and specification with their major that will help them with their graduate work and life.

When looking at cybersecurity in an academic setting, it is important to understand how it is both being taught and discussed in academic papers as a whole, with organization, technical systems, and culture in mind. It was beneficial in my research to see the connection between how students who can specialize in cybersecurity can take that knowledge to properly and effectively convey their education to academic papers in a comprehensive manner. But, through my research, it becomes apparent how easily different words and analogies about cybersecurity

can explain it in a different light. This puts perspective into academic papers and reminds the reader to remember that all authors could have some inherent bias without intent. It is impossible to clearly see the issues of a sociotechnical system without understanding all the ethical implications. Conducting my research through an STS framework allowed me to comprehend the ethics in conveying a complex topic such as cybersecurity and quantum computing and propose solutions. It is important to analyze sociotechnical systems through STS frameworks to understand all aspects of a problem and best address it.

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