Integrating Cybersecurity into Software Development Processes: A Synthesis of Advanced Software Development (CS 3240) and Introduction to Cybersecurity (CS 3710)

Analyzing the Effects of Social Media Site Design on Political Polarization

A Thesis Prospectus
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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

Political polarization has become an increasingly studied topic in recent years, with Social Media's role in it being especially analyzed (Kubin & von Sikorsi, 2021, p.199). While some level of political polarization can be healthy, as it can lead to higher voter turnout and participation in politics (Wagner, 2021, p.10), high levels of polarization can also lead to a higher tendency of mistrust, and in some cases antisocial behavior between the perceived in-group and perceived out-group (Dimant, 2024, pp.1, 10, 23). When discussing social media and political polarization, it is important to mention the prevalence of bots that can potentially exacerbate the impact of polarization. Bessi and Ferrara (2016, p.11) estimate that one-fifth of the overall conversation on twitter surrounding the 2016 presidential election was from bots. The prevalence of bots in the conversation means that part of addressing polarization is finding ways to prevent bots and hacked accounts from controlling the conversation. Compromised accounts can cause issues in spreading misinformation compared to bots since they are usually trusted by users who don't know the account was hacked (Egele et al., 2017).

My prospectus aims to take on this problem through my STS paper focusing on analyzing how the design of a social media site impacts political polarization, and through my technical report addressing the challenges of integrating cybersecurity into software development processes. While these may not seem initially related, since bots and hacked accounts can shape so much of the discourse on a platform, building that platform from the ground up with cybersecurity in mind could hopefully limit the amount of influence these actors have at shaping polarization. The design of a platform is important to study in relation to polarization since it can have a profound impact on how users interact with each other. Guerra et al. (2013, p.215) note that polarization is best measured on the boundaries between communities. Through analyzing

the design of the platforms, we can deduce where these boundaries are created and better understand their impact on political polarization. My technical report will be a synthesis of what I learned in my Advanced Software Development (CS 3240) and Introduction to Cybersecurity (CS 3710) classes focusing on how to integrate security into the software development process rather than leaving it as an afterthought. My STS paper will analyze a variety of sources on political polarization in social media and combine it with analysis of certain social media sites (specifically Reddit, Twitter/X, and YouTube) to better understand how the design of the site impacts the polarization seen on the site.

Technical Report

Cybersecurity incidents can be incredibly damaging to a company's reputation and revenue. When Chrysler had to issue a recall due to a security vulnerability in their cars' Uconnect dashboard, the recall affected 1.4 million vehicles and likely caused over 500 million dollars of damage (Lenhart et al., 2020, p.3). For my technical report, I will do a synthesis of what I learned in my Advanced Software Development (CS 3240) and Introduction to Cybersecurity (CS 3710) classes to understand how to better integrate existing software development methods with cybersecurity so that software is developed from the ground up with cybersecurity in mind and the issues like those that caused the Chrysler recall happen less frequently.

Salin & Lundgren (2022, p.278-279) outline five major challenges currently facing agile development for cybersecurity risk management: the sequential, plan-driven nature often used compared to the agile nature of general software development, maintaining an assessment of cybersecurity risks that stays aligned with the incremental development of an agile project, assuring security vulnerabilities are reported to the proper authorities, blind spots and lack of

experience among developers, and the lack of incentive or return on investment for developers to create secure software. Solving these challenges is important to ensure that cybersecurity can take a more active role in the software development process. The lack of perceived incentive is particularly important to address to ensure secure development, since focusing more on cybersecurity can increase costs without necessarily increasing the profitability of the product (Salin & Lundgren, 2022, p.279). If cybersecurity incidents don't happen, the benefits are not apparent, and even when incidents do happen it is hard to put a value on how much the incident caused the company to lose (Lenhart et al., 2020, p.3). While this is often the perception, cybersecurity risks often can cause substantial damage if not addressed, like with the Chrysler recall mentioned earlier that affected 1.4 million vehicles and likely caused over 500 million dollars in damages (Lenhart et al., 2020, p.3). While Salin & Lundgren claim that one of the challenges is lack of monetary incentive to take cybersecurity more seriously, Lenhart et al. show the real issue is the lack of perceived monetary incentive, as you don't know the monetary value you are losing until disaster strikes.

Salin & Lundgren (2022, p.286-287) propose an agile framework of cybersecurity risk management to address these issues. I will cover and assess this proposed framework more in the actual Technical Report, but as a brief outline it describes five steps: risk collection, risk refinement, risk mitigation, knowledge transfer, and escalation. These steps aim to ensure that risks are found, prioritized, and mitigated, that teams can share with each other how they mitigate risks, and that when something is high risk it is reported to stakeholders. Most of the above steps are integrated directly into existing agile development rituals, helping ensure that they happen as new meetings do not need to be planned. While the authors seemingly provide a great framework for integrating cybersecurity risk management into an agile development

environment, the framework itself was based on literature review and has not yet been studied in practice. This is an important limitation to keep in mind, as while we can discuss the merits of the framework on a theoretical level, we lack the proper data to definitively say if it properly addresses the challenges the authors outlined.

STS Research Paper

In a study on how participants treated other participants who either loved or hated Donald Trump, Dimant (2024, p.23) notes that outgroup hate was much stronger than ingroup love. The study had participants play a "dictator game" where both participants where participants were given money, and one of them (the "dictator") could choose to take any amount of money from the other participant or give any amount of their own money. Participants were told the other participant's views on Trump, and it was found that "ingroup-love can be observed in terms of feeling close to one another, whereas outgroup hate appears in the form of taking money away from and being less cooperative with others (p.23)." While one could argue against the simplistic and unrealistic nature of the game, it shows that even in a fictionalized setting polarized political views can affect how we treat others. This shows that affective polarization can have a genuine negative impact on our society by affecting our everyday interactions and isn't just a purely ideological or political problem.

My STS research paper will address how the design of social media sites impacts political polarization on those sites through infrastructure theory (Star, 1999). Infrastructure theory can help us analyze social media as an invisible infrastructure that can influence us without our knowledge. Before we can really talk about political polarization, we must define it. In their literature review on social media and political polarization, Kubin & von Sikorski (2021, p.188) define two types of polarization: *affective polarization*—or how we feel about the other

side—and *ideological polarization*—or how extreme our opinions are. Their review finds that many studies do not properly distinguish between the two, meaning for some sources I must deduce which type they discuss myself.

In my research, I hope to analyze the differences in polarization on different platforms so I can look at the design of those platforms to see what makes them different. In their 2021 study comparing the echo chamber effect on different sites, Cinelli et al. noted that "A clearcut distinction emerges between social media having a feed algorithm tweakable by the users (e.g., Reddit) and social media that don't provide such an option (e.g., Facebook and Twitter)" (p.6). This is an example of an important design distinction between sites. While the fact that the study looked at different topics for different sites makes comparison harder, the study focused on interactions between users, which should broadly be measurable across a range of controversial topics. Looking at Reddit as a specific example, a study by De Francisci Morales et al. (2021, p.10) found that Reddit was used as a tool for discussion by people with opposing views in contrast to other social media like Twitter that largely facilitated echo chambers. One important thing to note, however, is that polarization was associated with increased interactions between groups holding opposing opinions. This finding largely agrees with a study by Bail et al. (2018, p.9216) that measured users' political alignment before and after being regularly exposed to accounts that posted views opposite to theirs which found liberal participants had slightly more liberal views after treatment and conservative participants had significantly more conservative views after treatment. While the study by De Francisci Morales et al. does show interactions between users with opposing views on Reddit, I believe it doesn't properly account for how subreddits act as self-selecting echo chambers and communities that users can run back to when

their views are challenged. This means that while people see opposing political views, there is always a place where they can re-affirm their beliefs if challenged.

Conclusion

My technical paper will focus on synthesizing my Cybersecurity and Advanced Software Development classes to understand how to improve the integration of cybersecurity in existing software development methods. My STS paper aims to investigate the polarization present on different sites and then analyze the design of those sites to understand the impact it has on polarization. By doing this we can work to improve social media by designing it to at the very least not exacerbate polarization. In conclusion, both of my papers will come together by using the fundamentals learned by creating apps with more integrated cybersecurity processes to help protect social media sites against harmful bots and hacked accounts that can exacerbate polarization by including better security measures, allowing us to work towards designing social media sites that are more aware of the impacts they have on our political climate.

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