

Design and Construction of a Ferrofluid Kinetic Art Clock
(Technical Report)

The Ethics of Apple's Refusal to Unlock the iPhone of San Bernardino Shooters
(STS Research Paper)

An Undergraduate Thesis Portfolio

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By

David Xiao

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David Xiao
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The connection between my technical work and my STS research project is the idea of responsibility. Although the technical and research projects are not explicitly connected by the type of technology explored (one focuses on timekeeping and the other focuses on security features), the theme of responsibility is clearly present in both of these projects. For the technical work, the core question is how a designer can discover and responsibly satisfy their users' needs. In the case of the research project, the core question was whether the the designer is responsible for the misuse of their technology.

My technical project explores how we as engineers can fulfill the need for timekeeping in the 21st century. Our capstone team created a ferromagnetic clock for display in the University of Virginia Mechanical and Aerospace Engineering building. This clock was meant to provide an aesthetic appeal to the otherwise mundane timekeepers adorning the halls of the engineering school. It was also designed in order to attract more students into the mechanical engineering major. As a team, we spent a great deal of time assessing user needs. We then prototyped several hardware and software designs from scratch. After several iterations and many failed designs, we ultimately were able to create the ferromagnetic clock that is featured in our technical report. This project explores the duty of engineers in fulfilling the aesthetic and practical needs of users. Our team hopes it serves as an example of responsible engineering for future generations.

My STS research project examines responsibility in a different way. I explore whether Apple as a company was ethical in their design of the iPhone security features, as well as

whether they had the obligation to comply with the FBI's orders during the San Bernardino mass shooting case. In this project, I use care ethics to analyze Apple's actions before and during the San Bernardino case to see whether they fulfilled their duties as designers. Through my research, I seek to show that Apple did in fact design their iPhone in a responsible way, and that they had no obligation to the FBI to unlock the shooters' iPhone due to Apple's ethical responsibility toward their customers' privacy. This research is important because it highlights the importance of designers to consider the potential misuse of their devices, as well as prepare for the consequences associated with that misuse.

Working on the technical and research aspects at the same time had a profound effect on both projects. For the technical aspect, there were important questions raised about the use of technology to defer responsibility. Are humans using clocks to neglect the responsibility to be aware of the passage of time? If so, is our engineering project both satisfying this need as well as perpetuating it? Another question is whether we as engineers are responsible for the shaping of our users' habits. In other words, should we consider our role in influencing people to check time more frequently and develop a dependence on clocks? These questions are extremely applicable to all technologies, since users are constantly looking for ways to shed responsibility instead of taking it on. The research project was also affected, with questions arising about the external forces that affect our engineering decisions. I realized that we often didn't ask why the FBI needed the iPhone specifically. Why didn't the investigation obtain data from other sources? Why didn't we scrutinize the forces that enabled the shooters to obtain these guns in the first place? In a way, the responsibility was being pushed onto Apple and their technology.

Ultimately, working on both projects greatly impacted the way I approach engineering.

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