Designing an Air Guitar: S.H.R.E.D.
(Technical Report)

Using Actor-Network Theory to Examine Knight Capital Group's Downfall
(STS Research Paper)

An Undergraduate Thesis Portfolio

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Socio-Technical Synthesis: Air Guitars & Market-Making Software Collapses

My technical and STS research are inter-connected by the emphasis on securely using and deploying technologies to facilitate development. Moreover, my two projects - the technical ECE Capstone project & STS research paper, differ in their approach to examining distinct technologies in both the scale of use as well as whether the technology is utilized for personal or economical gain. Specifically, my capstone project explores the use of portable and readily-available technologies such as smartphones and the potential to bring music to the general population, albeit on a personal scale, whereas my research paper focuses on a technology with much broader scope. My research paper emphasizes the importance of the network surrounding Knight Capital Group (KCG), a market-making firm that utilized automatic stock trading software to service its customers, primarily hedge funds and large brokers. While my projects approach technologies of a differing scale and importance, the principles of secure development and maintenance of engineering products are important considerations for future engineers.

My technical work in the ECE department explores the combination of software and hardware devices to create a portable musical instrument while providing a realistic sound. The project involves an Android phone application that takes in the finger positions of the user to determine the notes being played, as well as a distance sensor to determine which frets along the neck of the guitar are being played. An accelerometer is used to determine when the guitar is being strummed, and all of the sensor and phone application data is then relayed to a National

Instruments myRIO board via a circuit board. The myRIO board then creates soundwaves for a variety of instrument types (for our purposes, a guitar) using signal processing techniques such as the Karplus-Strong string synthesis algorithm.

My STS research project is a case study of Knight Capital Group LLC (KCG or Knight), a leading market-making firm posted a net loss of over $460,000,000 in little over 45 minutes in 2012. Knight's collapse came about from the inadvertent reactivation of a piece of dead test code, a mistake largely attributed to the engineers responsible for developing and maintaining the overarching software. While I understand that the engineers exercised a degree of incompetency in deploying incorrect software, I explore the broader picture encompassing the significant factors that led to the unfortunate error. Specifically, I utilize Actor-Network Theory to examine and analyze the actions of not only the engineers and other technical staff responsible, but supervisory staff as well as third-party influencers, and the system of risk management protocols in place to prevent disasters such as the one that occurred.

In working on these two projects simultaneously, I definitely underestimated the influences of two seemingly scopes of technology and their overlap upon each other. Namely, the need to effectively consider not just the technical development of an engineered product but also the socio-economic and political factors surrounding the maintenance and use must be considered. As I enter the workforce, I now not only have the technical 'know-how' to get a job done, but I am also cognizant of outside factors and the necessity and importance to be able to adapt quickly and effectively to changing situations.