

Modeling Biological Rhythms to Predict Mental and Physical Readiness

(Technical Report)

Are people making decisions based on their own free-will or because of influence from predictive models?

(STS Research Paper)

An Undergraduate Thesis Portfolio
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Sociotechnical Synthesis

(Executive Summary)

The research project seeks to enhance human productivity through awareness of personal rhythms. Individuals are independently composed of various biological clocks that may prompt certain behaviors. Modeling biological rhythms provides the means to understand the effect of internal and external factors on human mental and physical performance. The research team utilized data collected from Empatica (E4) devices and Oura smart rings to build models of human rhythms. Using the model parameters, the research team developed machine learning algorithms to predict mental and physical readiness. The results indicate a prediction accuracy above the 66% baseline.

Human decisions may be altered due to the existence of the system developed. Therefore, it is important to consider how human and societal behavior may shift and conform to the standard that is set by the developers. While the technical component of this research deals with the development of predictive technology, the STS project is focused on how those predictions may increasingly bias our decisions toward certain actions, ultimately hindering our sense of free-will. The integration of predictive models can be analyzed through the STS framework of soft determinism. Despite the success of predictive models, I argue that their impact is limited by human intuition and psychological behavior. The complexity of human behavior indicates that there are many factors that influence decisions, not only technology.

I have explored the impact of machine learning through the analysis of case studies. By using the STS framework, I have investigated the mediating effects of the technology in three specific industries: politics, education, and criminal justice. Based on the evidence collected, I have identified specific instances where predictive algorithms have influenced, and continue to

influence, human decisions. Second, I discovered limitations of the technology within each case study. The two findings provide a thorough understanding of the technology and its impact, and the combination of the STS research and the technical project provides a comprehensive analysis. By developing the algorithm and analyzing its impact, I recognize the practicality and the threats that this technology poses.