

Thesis Project Portfolio

Personalization in Circadian Rhythm-Based Event Scheduling

(Technical Report)

Equitable Use of Wearable Technology in Employee Wellness Programs

(STS Research Paper)

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Sociotechnical Synthesis

As individuals have increasing access to personal health data and technology that can guide/make recommendations to improve our lives and wellbeing, we must consider the benefits and drawbacks regarding the efficacy and ethical integration of these products. While the capstone project focuses on the benefits of aligning one's daily schedule to their natural circadian rhythm, my STS research paper explores the current problems of wearable devices in workplace wellness programs. The two papers work in tandem to provide evidence of how human wellbeing can be improved through greater awareness of one's health, but also shows how the current implementation of wearable device technology and the infrastructure surrounding wellness programs continues to isolate already marginalized communities within the medical field.

The capstone project seeks to improve human wellbeing and productivity by increasing awareness of personal rhythms. The human body follows a natural circadian rhythm, influencing sleep timing, cognitive abilities, and physical energy, but many people live contrary to this biological rhythm, leading to reduced cognitive performance and sleep loss. The research team investigated the feasibility of circadian-based activity scheduling for college students through three increasingly personalized levels of scheduling: (1) common activity timing according to circadian rhythms research, (2) timing curation according to sociodemographic context, and (3) timing adjustment based on individuals' specific constraints and context. In developing the activity timing schedule with sociodemographic context, the research team conducted a survey of college students' daily activity habits, wellbeing, and activity timing preferences. Once the three approaches were developed, the team conducted a three-week user study, one week for each recommendation approach, of college-aged participants investigating the impact of following

increasingly personalized recommendations on wellbeing. The results of the study indicate that participants who followed more of the recommended activity timings reported a higher wellbeing, but increasing the level of personalization did not significantly impact improvement in wellbeing. These observations provide useful insights into design requirements for future circadian-aware recommendation systems.

In my STS research paper, I explore the origins of workplace wellness programs, the integration of wearable devices into these initiatives, and the inequities created by the employer - wellness program - wearable device system. In the paper, I primarily use the Social Construction of Technology framework, along with Disability Studies and Race Critique, to analyze the development of the modern workplace wellness program which boast improving employee's health, reducing absenteeism, and allowing companies to reduce their overall health care costs and premiums. Wellness programs often incentivize employee participation through financial benefits, either as direct rewards or reductions in health care premiums for employees that meet their fitness goals. Though wellness programs have seen success with already "healthy" employees, their current structure, underlying issues with wearable device technology, and limited government regulation prevents disabled (wellness program goals are usually not designed with disabled employees in mind) and employees of color (wearable devices have significantly higher error rates on skin with higher melanin levels) from benefiting from the programs at equal rates. This is especially concerning because people with disabilities and people of color have been historically marginalized from medical treatment in the United States. Without a fundamental change in the wellness program structure, the country's healthcare access divide will continue to grow.

To solve the issues outlined above, I propose: (1) encouraging technology developers/manufacturers to improve the accuracy of wearable devices on all skin tones by using both infrared light and green light technology as well as incorporating a more diverse set of participants during testing; (2) creating freely available, alternative fitness plans for disabled employees with federal standards; (3) increasing awareness of how wearable technology continues to develop but the data collected is not protected as medical information; and (4) providing flexibility in wellness program schedules in the post-pandemic era where work from home jobs are becoming more common.