Thesis Project Portfolio

Rock-slide: Developing an Indoor Climbing Volume with a Linearly Actuating Hold

(Technical Report)

Universal Basic Income as a Countermeasure to Automation-related Unemployment (STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

(Executive Summary)

Automation and a Permanent Infrastructure Approach to Automation-Related Unemployment

Automation poses a threat to the general public by replacing workers resulting in an increased automation rate which has profound negative impacts. As the fourth industrial revolution boosts productivity and efficiency through automation, the labor market is jeopardized as, "47% of people employed in the US are at risk of being replaced by machines" (Gray, 2017, p.3). Additionally, it has been previously shown that, “Automation is significantly positively related to unemployment (that is, it reduces employment)” (Anakpo & Kollamparambil 2021, p.8). Widespread automation will lead to higher corporate profit margins at the cost of an increased unemployment rate, which has real-world consequences and could wreak havoc on society unless mitigating countermeasures are implemented. Crudele (2020) argues that an increased unemployment rate has disastrous real-world consequences as only a, "1 percent increase in the unemployment rate will be associated with 37,000 deaths" (p. 3). Many of these deaths are preventable and could be saved if an offset to the increased unemployment rate was considered.

My STS research focuses on examining possible countermeasures to automation-related unemployment and considering the net benefit of each countermeasure. My research specifically investigates expanding existing social welfare programs, implementing a negative income tax, implementing a Universal Basic Income, or implementing a combination of these countermeasures. My research then evaluates these countermeasures through Alvin Weinberg's framework of Technological Fix. Weinberg (1978) posits that "A more rational approach is not simply to match the technology to the existing institution but to create the institution that better meets the intrinsic demands of the technology" (p.11). One major finding of my research is that the most effective countermeasure to automation-related unemployment is a permanent indestructible infrastructure, combining multiple mitigating candidates,

which can last growing the proliferation of automation and can be maintained indefinitely by a multi-national alliance of actors similar to NATO or G7

My technical project (RockSlide) is the modeling, design, testing, and manufacturing of an automatically moving indoor rock climbing 'hold' on top of a rock climbing 'volume'. The rock climbing hold and volume can be visualized in Figure 1 below.

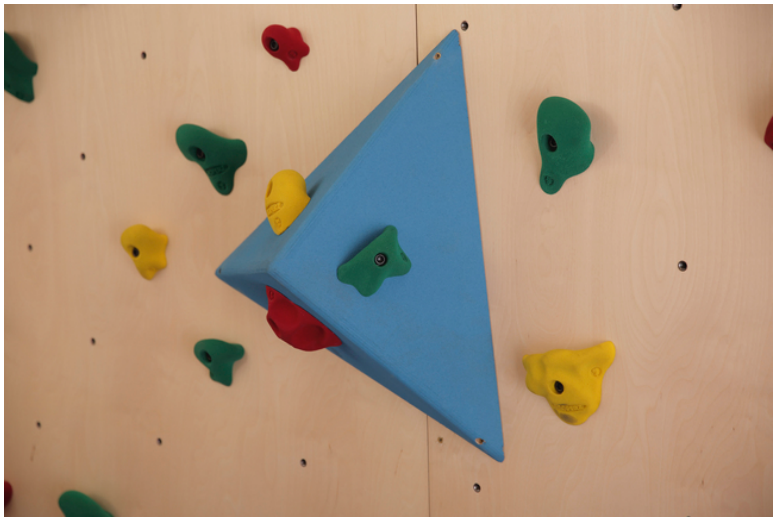

Figure 1: Rock Climbing Hold & Volume. The Volume is the blue triangular prism and the holds are the smaller yellow, red, and green rocks that climbers can grab on to.

This results in a dynamic experience for the rock climbers and eliminates the need for employees to reposition the holds to create new climbs for climbers. RockSlide implements multiple mechanical, electrical, and software components into a responsive mechatronic system. The mechanical assembly consists of a worm-geared motor, flexible shaft coupling, and lead screw to maximize torque while still being able to move the hold across the volume quickly. With my project advisor, Gavin Garner, the aim is to create a safe, robust, and maintainable device that is installed in UVA's Slaughter gym and will last for years to come.

Loosely tied, both my STS research and my technical project are related to the central theme of automation. By completing both these projects at once I was able to form a better understanding of what the automation of employees will look like in real-time. In my technical project, by automating the

movement of the hold on top of the volume, RockSlide will eliminate the need for employees to reposition the holds on the indoor wall. Instead of needing 5 employees to reposition holds to make new climbs, Slaughter would only need to employ one worker to maintain the RockSlide device. Extrapolating this case study to the world economy in the age of widespread automation, many workers will be laid off as only a select few will be needed to maintain the automated machinery. This machinery could be physical devices, like RockSlide, or Artificial Intelligence (AI) such as GPT-3. This further demonstrated to me why mitigating automation-related unemployment is imperative.