Hero or Villain: A Sociotechnical Analysis of Automation in the United States

STS 4500 Prospectus

Computer Science

Bachelor of Science in Computer Science

The University of Virginia, Charlottesville

Name: Giovanni Cianciaruso

Technical Advisor: Briana Morrison

STS Advisor: Alice Fox

Projected Graduation Date: August 2023

Hero or Villain: A Sociotechnical Analysis of Automation in the Americas

Overview:

The proposed technical project covers an experience I had conducting research for the University of Virginia drama department, working on a robot project that seeks to create a robot to automate the movement of scenery in the theater arts, allowing directors to greatly improve the quality of set design and operation. With my technical project, I seek to find a way to integrate the scenery robot into the theater arts while properly considering the perspectives of the stakeholders most closely involved with managing productions. The advancement associated with this project does not come without potential detriment: those who are doing the jobs in setting up and managing scenery may have their skills become obsolete. It might seem obvious in this case that having a robot move a few pieces of a set is not jeopardizing the careers of members of the stage crew. Yet, replacing or diminishing a person's job — however trivial it may seem — does raise the question, how do we toe the line between making technological progress and decreasing human quality of life? In the proposed STS research project, I will consider the adverse effects of both automation by observing and analyzing trends in quality-of-life metrics in the Americas.

Problematization:

Since the 1950s, computational efficiency has increased by a factor of 100,000 (Roser et. al. 2022). With this increase in computational efficiency, the world economy has seen an unprecedented rate of progress. Raw materials and crops have decreased in price, renewable energy has become accessible, and medical technology has been transformed by new discoveries

on DNA and diseases (Roser et. al. 2022). Technology and automation have revolutionized nearly every facet of human life in the 21st century — computers are now ubiquitous in every industry. However, this technological progress has not come entirely without consequence. While technological progress has increased, social progress has remained stagnant. In the US, the federal minimum wage has not increased in nearly 15 years (Minimum Wage History Chart). The average life expectancy in the country started decreasing in recent years and has gone backwards from where it was 25 years ago (National Center for Health Statistics 2022). Through the hyper-capitalism of the United States, society has achieved great technological progress — driven by profit. With this technological progress comes the assumption that we have achieved great social progress as well. However, despite being more "connected" than ever through technology, we have also become more disconnected from real interaction with others.

Guiding Question:

Have we really improved as a society, or are we simply measuring progress in the wrong way?

Projected Outcomes:

The examination of pre-industrial revolution values and their comparison to contemporary progress allows us to reflect on the alignment of our current definition of progress with historical values and identify potential disconnects between technological advancements and actual human needs. We expect that applying Carol Bacchi's WPR approach combined with Sheila Jasanoff's theory of co-production to notable periods of technological advancement will reveal problem representations that expose the superficiality of our current technological advancements and the invention of solutions to non-existent problems. Most importantly, it will reveal the ugly biproduct of unbridled superfluous automation: replacing workers without

improving their lives — essentially economically gentrifying them. With that understanding, when examining the class-based problems facing American today, we can identify practices that working class people can utilize for maximizing their agency in controlling technological innovation: namely, joining unions, striking, and subsequently pushing for policy change.

Technical Project Description:

In theater, a winch and track system are traditional tools to move large set pieces onto the stage. This system creates a track hidden below the stage, with a set of rails that large design pieces can then travel along to move around the stage. It seems like a good system; however, it requires the rails to be hidden below a false floor constructed overtop of a stage and a predetermined path for the set pieces because the rails must be placed ahead of time. The rail system is difficult to configure for multiple different pieces of scenery, limiting the number of different design elements that can be used in each production. Aside from the physical limitations, this type of system is expensive and labor intensive to set up when factoring in both the winch and track system and the false floor above it, so much so that this choice is often not an option for lower budget productions — just the winch system can cost upwards of $25,000 (Pushtik). These issues are exacerbated by the lack of adaptability should the path need to change due to director adjustments. Modifying the infrastructure adds more cost and more labor.

The purpose of the scenery robot project is to design, construct, and program a robot that will carry heavy objects around on stage on a predetermined path in place of the inconvenient traditional means. This project is a research opportunity sponsored by the Technical Director of the drama department and is meant to be implemented into productions by directors and stage managers overseeing the show. The robot is short enough to fit under a piece of scenery but is still able to move up to 1,000 pounds across the stage. Instead of using a winch and track system,

the robot is powered by two independent gear motors which allow for a zero-degree turning radius, vastly improving mobility compared to the traditional system. By using odometry algorithms and sensors, the robot will be able to navigate any stage independently of a track and thus allow for flexible paths of travel. The system allows a user to plan out the desired path of travel on a custom-built web application and break down the path into cues. These cues will be sent to the robot and controlled via the web interface allowing the robot to move the scenery to the desired location and wait until it is time to proceed to the next position. Additionally, the robot has the added feature of multiple I/O connections allowing for the automated activation of additional moving parts on the object, e.g., initiating the movement of the blade of a mock windmill.

Preliminary Literature Review & Findings:

In a speech given by Cesar Chavez, he discusses the struggle of the farm workers and how large farming companies using pesticides to maximize profits without proper consultation with stakeholders such as workers and consumers is an example of innovation without responsibility. Chavez notes that the chemical industry promised the growers that pesticides would bring great wealth and bountiful harvests to the fields, but the use of pesticides has resulted in hazardous work conditions, underpay, and toxic chemicals that pose a threat to both American consumers and farm workers. According to Chavez, "pesticides have created a legacy of pain, and misery, and death for farm workers and consumers alike" **(**Chavez, 1990). Unions, such as the United Farm Workers, can help by advocating for the rights of workers and ensuring that innovations are made with consideration for all stakeholders.

STS Project Proposal:

Automation: Hero or Villain?

STS explores the relationships between science, technology, and society, taking into account the social, cultural, historical, and political contexts that shape and are shaped by them. Analyzing how automation affects quality of life highlights the need for socially responsible approaches to technological innovation. By examining the impact of technological innovations on society, we can gain insights into the benefits and limitations of automation.

The theoretical framework of co-production and WPR problem framing can be synthesized to best analyze the relationship between increased automation compared to quality-of-life metrics. As defined by the New Economics Foundation, "Co-production is an approach to decision-making and service design rather than a specific method. It stems from the recognition that if organizations are to deliver successful services, they must understand the needs of their users and engage them closely in the design and delivery of those services" (New Economics Foundation 2011). Initially posed by Sheila Jasanoff, she coins the instruments of co-production as making identities, making institutions, making discourses, and making representations. These instruments refer to ways technology influences other spheres of life which is uniquely important when assessing the intersection of automation on quality of life (Jasanoff 2004). As a theoretical approach, co-production is not without its critics. Durose states, "One prominent critique within academic work is, unsurprisingly, that co-production (as with many other concepts) is a messy and unclear concept." (Durose et al. 2022) but goes on to differentiate it from the standard academic practice of being highly scientific. Durose refers to this framework as "clarification" and says it is "achieved by reducing excess meaning." In an effort to be highly scientific and precise, clarification misses out on an intersectional understanding of how complicated the way automation has affected society might be — that excess meaning is important, and it's not necessarily through traditional analytical approaches that we can make sense of it.

Automation: Hero or Villain?

The 'What's the Problem Represented to be?' (WPR) approach is a tool developed by Carol Bacchi to analyze public policies by examining their underlying problem representations. The WPR approach involves asking six questions, which focus on identifying the problem representations in a policy, exploring their assumptions and origins, identifying any unchallenged aspects, and evaluating their effects and potential alternatives. "For example, if forms of training are recommended to improve women's status and promotion opportunities, the implication is that their lack of training is the 'problem', responsible for 'holding them back' (Bacchi, 2012, p.22)." This critical analysis can help reveal underlying biases and assumptions in policy proposals and lead to more effective and equitable policymaking. Combining these two approaches we are able to find the right people to answer the right questions. When we utilize the 'what's the problem represented to be?' approach, we can find clear questions to ask to identify the problem; when we utilize this within the co-production ideals, we are able to leverage both the ideals of the people who are involved in the decision-making process and those who have been present when proposing the issue that needs to be solved. Ultimately, the combination of these two approaches can be seen when we look at unions – by asking a union to solve the problem, we are allowing both service providers and users of the service to work together to solve the problem effectively, guided by a strategy to identify the issues they face as a group and solve them in the context of their own industry knowledge.

The question that guides this research project is: How has the way society defines quality of life evolved from before the first and second industrial revolutions in the 19th and 20th centuries through the dot com boom in the 2000s and how are these changes related to the technological developments of the time? If we apply the metrics of today to the past, how does

our quality of life in the present compare? Conversely, using the metrics of the past to analyze today, how does the quality of modern life fare against the standards of the past?

To best analyze a change in definitions over time, documentary research will measure these changes. The goal of documentary research is precisely to analyze the material culture found in various forms of print. Sometimes this research method is overlooked due to lack of information on the topic or ease of access, but in this case the reality is there are multiple ways to access extensive information that could be of interest to how definitions evolve throughout history. Keywords that guide this research include, “quality of life history,” “historic measures of quality-of-life industrialization,” with a focus on three points in history: ancient times, the industrial revolution, and the technological revolution in the late 1900s to 2000s. Through this unique documentary research, I will be able to ascertain the true nature of quality of life and how it has changed over time, gaining new insights into these developments. If the definition of quality of life evolves the metrics evolve with them. This is especially important when considering how automation has caused a shift in so many aspects of the modern quality of life. While introducing automation into services like mail to speed them up may increase quality of life for many people, those losing their jobs due to this change certainly have their quality of life reduced.

Barriers & Boons

The immediate concern of finding sources throughout American history that contain useful information pertaining to a quality-of-life metric is not unfounded. Finding survey or any largescale data about the topic is practically impossible pre-telephone. Despite this, there are still a multitude of primary sources — namely, anecdotes in the form of a memoir or interview — that can have meaning extracted from them addressing what woes a person’s life may have or

even what makes their life worth living. Though this style of research can be grueling, it is ultimately mitigated by the fact that there is no shortage of people complaining about their problems and that this documentary research is preferable for use with WPR and co-production, as the closer the source is to the stakeholders affected by the policy change, the better.

References

Acemoglu, Daron & Pascual Restrepo (2022, September). Tasks, Automation, and the Rise in U.S. Wage Inequality. Econometrica, Econometric Society, 90(5), 1973-2016.

Bacchi, C. (2012). Introducing the ‘What's the Problem Represented to be?’ approach. In A. Bletsas & C. Beasley (Eds.), Engaging with Carol Bacchi: Strategic Interventions and Exchanges (pp. 21-24). The University of Adelaide Press. doi:10.1017/UPO9780987171856.003

Chavez, Cesar (1990). Lessons of Dr. Martin Luther King Jr. *Cesar Chavez Foundation*. https://chavezfoundation.org/speeches-writings/#1549063914152-2996f9ba-439c.

Durose, C. et. al. (2022, September). Is co-production a ‘good’ concept? Three responses. Elsevier, Futures, 142.

Eurostat. (2022, October 31). *Quality of life Indicators - measuring Quality of Life*. Statistics Explained. Retrieved December 10, 2022, from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quality_of_life_indicators_-_measuring_quality_of_life

Gardner, R. N. (1970, May 15). The Quality Of Life: A PROGRAM FOR GLOBAL ACTION. Vital Speeches of the Day, 36(15), 466 - 470.

Harari, Y. N. (2018). Sapiens: A Brief History of Humankind (Digital ed.). New York: Harper Perennial.

Jasanoff, S. (2004). Ordering Knowledge, Ordering Society. from States of Knowledge: The Co-Production of Science and the Social Order, 2, 13-45. Routledge.

Kridel, Craig (2022). *An Introduction to Documentary Research.* American Educational Research Association. https://www.aera.net/SIG013/Research-Connections/Introduction-to-Documentary-Research.

McCulloch, G., & Ebook Central - Academic Complete (2004). Documentary Research in Education, History, and the Social Sciences. London: RoutledgeFalmer.

Michalos, A. C. (2015). Ancient Views on the Quality of Life. Springer Cham Publications.

Michelangeli, A. (Ed.) (2015). Quality of Life in Cities: Equity, Sustainable Development and Happiness From a Policy Perspective. Abingdon, Oxon: Routledge.

New Economics Foundation (2011, July 8). *Stories of Co-Production* [Video]. Youtube. https://www.youtube.com/watch?v=aKATrzUV2YI&ab_channel=NewEconomicsFounation.

Reamer, A. (2022, August 24). *NCHS: U.S. life expectancy fell from 78.8 yrs 2019 to 76.1 yrs 2021 (8.31.22), State Variation 2020 (8.24.22)*. Economics Forum. https://www.aeaweb.org/forum/2994/nchs-life-expectancy-fell-from-2019-2021-state-variation-2020

Scott, J., & SAGE Knowledge Complete Navigator Collection (2006). Documentary Research. London: SAGE Publications.

Scott, A. J. (2021, September 1). WOrk and LIfe in the Early Industrial City: Social Economy of

Stiglitz, Sen, Fitoussi, et al. (2009) Report by the Commission on the Measurement of Economic Performance and Social Progress. Eurostat.

Tight. (2019). Documentary research in the social sciences. Sage Publications.

WHO. (2022). *WHOQOL: Measuring Quality of Life*. World Tight. (2019). Documentary research in the social sciences. Sage Publications.Organization. Retrieved December 10, 2022, from https://www.who.int/toolkits/whoqol

WHO (2012). The World Health Organization Quality of Life. World Health Organization.

Wolff, E. N., & Jerome Levy Economics Institute (2004). What Has Happened to the Quality of Life in the Advanced Industrialized Nations?. Cheltenham, UK: Edward Elgar.