THE ACCELERATED GROWTH OF TECHNOLOGY AND ITS IMPACT ON THE TECHNOLOGY WORKFORCE

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Andrew Fu

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

Travis Elliott, Department of Engineering and Society

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Today, the technology industry is growing faster than ever before, and it only seems to be accelerating into the future. In recent times, as society has continued to adapt to new technological advancements and the economy thrived, "the support for 'high tech' in the business community, and in particular for software advancement, has grown enormously" (Kurzweil 47). This accelerated growth has made technology widespread, as more people are integrating it into their communities and everyday lives . This success increases demand for different types of technology, and "there are tens of thousands of projects advancing the various aspects… in diverse incremental ways" (Kurzweil 46). Technology has evolved so much that in modern society, anyone can create anything they can imagine.

In some aspects, it seems like technology is adapting faster than society, as news articles appear everyday discussing new innovations in biotechnology, like precision robots performing surgeries, or commercialized space travel in the near future. However, there is also a side of technology that is struggling to keep up with these societal expectations. While everyone embraces technology as the future, society is not prepared to tolerate its rapid evolution. Its accelerated growth puts monumental economic and societal expectations on the people developing the technology. It also makes it susceptible to exploitation in the workplace. This STS research paper will analyze why employees working in big tech (e.g. Apple, Google, or Microsoft) suffer more in toxic work environments and the economic, social, and technological factors that have contributed to this.

ACTOR NETWORK THEORY

This paper will use the Actor Network Theory to analyze the impacts of various factors that affect tech workers as a system. The Actor Network Theory was developed in the 1980's as

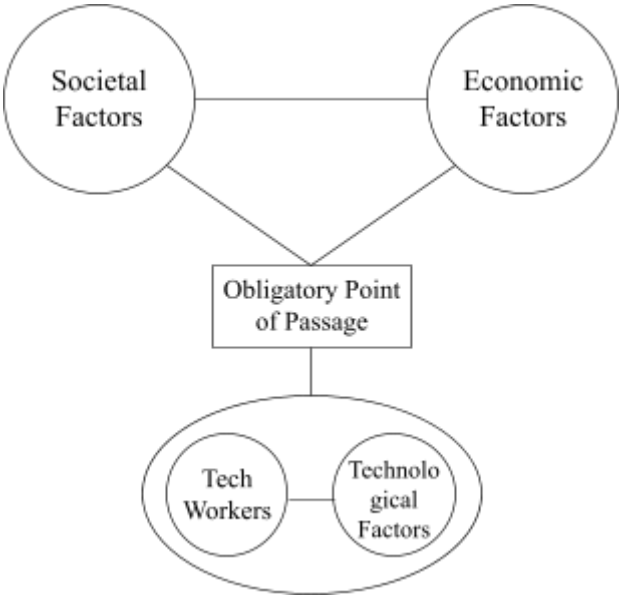
a way to understand how a system worked through separating different elements of the system into actors within a network. (Crawford, 2020). These actors include everything in the system, both human and nonhuman. An actor, or actant, in the system is something that participates in the system by acting or grants other actors the ability to act. For human actors, this refers to their normal human behaviors, and for nonhuman actors, this can be anything from man-made structures, nature, economics, plants, etc. All of these actors create a system known as a network. Additionally, each actor in the network is given some role and purpose by other actors within the network. For example, a simple network for a web application would have users, designers, and the web application as actors in the network, and each actor gives the other actors a purpose in the network. A user interacts with the designers and the web application so the designers know what to make. The same is true for the designer who receives feedback from the user to build the web application. Finally, the web application is built by the designer and is used by the user.

In addition to the actors in a network, Actor Network Theory is also known for having negotiation spaces and local networks. A local network is a sub-network of actors within the global (complete) network. In the previous example of a simple network for a web application, an example of a local network could be in the design team, where there is a hierarchy and chain of command that could be separated into further actors in a local network. A local network also has its negotiation space, which is a space that allows for the local network to have its own autonomy from other actors in the global network. For example, workers in the design team would not be influenced directly by the user or the web application as actors, since they are within their own negotiation space to implement user needs in a way that they see fit.

Finally, Actor Network Theory is known for its obligatory point of passage, which forces the actors in the global network to converge on a specific problem or question through a single communication point. If the web application example is modified to include other actors in the global network like shareholders, the government, the company's higher ups, and users, then all of these actors have to communicate with the local network of the design team through the obligatory point of passage.

TYING THE FRAMEWORK TO THE ISSUE

This STS research paper will utilize the Actor Network Theory to analyze how the advancement of technology has negatively influenced the lives of employees working in the field of technology through observing various economic, social, and technical factors. The Actor Network Theory is the best suited STS framework for this issue, because it can effectively make connections between human and nonhuman actors in a network and is a robust system for analyzing underlying social factors in a system. Actor Network Theory is effective at explaining relational ties, which is particularly useful for separating and organizing motives for different actors and breaking down their contributions to the system as a whole. Additionally, the obligatory point of passage is an essential part of Actor Network Theory that relates heavily to the issue that this research paper discusses. In the image on the left, there are three actors in the network: societal factors, economic factors, and a local network of technological factors with tech workers. Societal factors



include public expectations from companies to innovate new technologies. For example, the general public and most consumers expect Apple to continue to release new generations of iPhones annually, which puts pressure on the company to continuously come up with new designs and innovate new technologies. This example of societal pressure puts stress on researchers who have to innovate ideas and come up with new products. As technology grows more rapidly, engineers will suffer more from this constant expectation of accelerated progress. Economic factors encompass all of the economic stress on the system, as it is the primary reason that there is such high competition between tech companies and a desire for companies to expand their spheres of influence. Businesses need to make money, and they are more likely to succeed if they have a larger and more powerful workforce. This puts an onus on employees to work harder and to maintain dedication to their respective companies. Technological factors include the new technologies that are available for commercial use now that can be easily exploited to generate additional stress on tech workers. This includes employee surveillance, data privacy issues, etc. This is largely due to how much people rely on technology and how far technology has come to give us these capabilities, as it is advancing faster than law enforcement can put government regulations on it. These three actors network interact with each other to exacerbate the issues that are already present and direct them on the tech workers. Additionally, the societal and economic factors communicate with the local network of tech workers through the obligatory point of passage, which translates these various pressures into different forms of stress and changes to work culture for tech workers. Additionally, the technological factors are present in the local network, because the workers have to deal with them in their work environment. The obligatory point of passage in this network will be the leaders in the company hierarchy that translate the societal and economic pressures into stress for employees in the form of design

plans/expectations, increased work hours, etc. Finally, the technological pressures will be converted into stress in the form of employee monitoring, anonymous worker evaluations, etc. All of these factors slowly become normalized and are integrated into company work culture.

ANALYSIS BY THE FRAMEWORK

Societal Factors:

A societal factor in this paper will refer to a point of concern that stems from the general public and sometimes consumers. This is largely due to the general public's expectation for companies to continue to innovate new technologies and continue to grow. For example, most consumers who use Apple products expect Apple to release new generations of iPhones annually, which puts pressure on the company to continuously make breakthroughs in technology. Societal pressure in this form puts stress on researchers who have to engineer contemporary technologies. This leads to major issues concerning intellectual monopolies and outsourcing work. Large corporations "monopolize knowledge while outsourcing innovation steps to other firms and research institutions" in order to create an intellectual monopoly, so they can maintain their position at the front of the technology sector (Cecilia, 2022). This also puts a burden on workers researching new technologies, as they have to achieve progress faster than anyone else. As a result of this intellectual monopoly, small companies and startups struggle to stay in the race against these large corporations. In fact, startups face much "uncertainty in their businesses, with an expectation that the majority of them will fail within two years after launch" (Ustek-Spilda, 2019). The monopolization of knowledge makes it nearly impossible for startups to compete against tech giants, as many of them survive by creating niche technologies that haven't already been dominated by large corporations. Additionally, it polarizes smaller companies towards large corporations, providing intellectual monopolies with outsourced work

through subordinate firms. This creates a "hierarchy of power", which "trickles further down and impacts workers" (Cecilia, 2022). The direct impact on workers will be addressed later when discussing the obligatory point of passage and tech workers.

Another societal factor that directly introduces stress into the lives of tech workers is the expectation for services of these large corporations to always be readily available. For example, a lot of tech monopolies create services on the cloud, because it is scalable, profitable, and useful for all types of consumers. However, these large scale services require heavy maintenance, as these corporations will lose millions of dollars if their servers go down even for a few minutes. One way of solving this issue is to have employees go on call, similar to how nurses and doctors go on call in hospitals. While they are on call, engineers have to respond to any tickets from customers in a 24 hour period. This is a very draining task for employees, which negatively impacts their work life balance.

Economic Factors:

Economic factors are a real concern, even for the most successful tech companies. The technology sector is growing so rapidly that even large corporations could suffer from a shrinking sphere of influence. This is also why large corporations create intellectual monopolies: to reduce the amount of competition in the market. By creating a monopoly over technological wisdom, large corporations can maintain their sphere of influence and dictate the pace of technological growth entirely, at least until other monopolies rise up. Some may argue that large companies shouldn't have to worry about losing market value or a shrinking sphere of influence, because patents can protect their intellectual property. While this is true, companies need to first make that technological innovation to have the patent, and large corporations stand ahead of their competition in this race. If anything, patents allow corporations to eliminate competition

entirely. For example, in a design patent war between Apple and Samsung, the former claimed its patents over the latter in "disputes [that] expanded to more than 50 lawsuits in numerous courts around the world, and became a design patent war" (Saardchom, 2014). The final patent infringement award determined by the jury was "$1.05 billion, the amount by which most companies would become bankrupt by a single infringement" (Saardchom, 2014). This form of economic pressure on a company and the policies currently in place for the economy only make it easier for monopolies to succeed. As for the impact on tech workers, a lot of this is achieved through temporary workers.

A major adverse outcome of these economic pressures is the rising popularity of hiring temporary workers in big tech. Outsourcing work is important for tech companies when they are suffering from a 'talent shortage', but this is only an issue due to the highly competitive market and demanding societal expectations that these companies have to meet and overcome. Additionally, hiring talent on demand for temporary outsourced work is popular in the tech industry, because it enables companies to save money, as they won't have to put temporary workers on a permanent payroll while simultaneously taking advantage of their abilities. This brings up an ethical dilemma in itself, as temporary workers are compensated less and do not get the same benefits as permanent workers, not to mention the fact that they have volatile job security to begin with. In an article by The New York Times, it states that Google failed to correct for equal pay rates between temporary and permanent workers, potentially owing "more than $100 million in back salaries over nine years of noncompliance in 16 countries with pay parity laws" (Wakabayashi, 2021). Moreover, "there is no federal law requiring U.S. companies to pay temps and permanent employees the same salaries for similar work," allowing companies to exploit temporary workers by compensating them less (Wakabayashi, 2021). Beyond the

inferior wage differences and compensation, companies also put "time limits on individual temp workers' assignments, although these practices exacerbate temp workers' job instability" (Desario, 2021).

Another concern with economic pressure on a company is giving consumers a reason to buy new products upon launch when their old technology is working fine. A very well-known workaround for this is planned obsolescence, which is a tactic used by companies to design their products with a short lifetime or with limited/difficult maintainability. However, it is a violation of the engineer's code of ethics. According to the Viterbi Conversation of Ethics under the University of Southern California, "generating revenue is the end goal, and consumers are treated as the mere means to achieve that goal without consideration for the consumers' wellbeing" (Li, 2021). This goes against principles of Kantian ethics–which the engineer's code of ethics is based on–that state that one should treat humanity "as an end in itself and never as a mere means" (Li, 2021). In addition to the clear moral and ethical implications of planned obsolescence that harm the consumer, engineers are also negatively impacted. It can harm the reputation of the company and other engineers, "as it gives the engineer an appearance of doing a substandard job" (Li, 2021). This can easily cause moral and ethical turmoil for engineers in their work environment. One major counter argument supporting planned obsolescence is the fact that technology rapidly replaces itself, due to its natural rate of obsolescence. For example, even if an iPhone can last several years, many people will still replace their perfectly functioning iPhone upon a new one's release. While this may be true, there are still many people who would willingly maintain their old phone or technology if they could. However, because companies intentionally stop creating software updates for older versions of their technology, consumers are forced to replace their old devices more frequently than they should. Additionally, there is still a

large amount of waste caused by planned obsolescence. Even if products can be recycled, the process itself requires a tremendous amount of energy.

Obligatory Point of Passage:

The obligatory point of passage is how the economic and social actors in the global network interact with the local network of tech workers and technological factors within a particular company. The people controlling the obligatory point of passage are the people highest in the company hierarchy, who determine what the workers have to build and the conditions they have to work in. This means that the head of the corporation, the CEO, will be making a lot of the business decisions that will trickle down to impact the sales, marketing, research, and development teams where the workers are. The societal and economic pressures will greatly affect the business goals for a company. Moreover, the managers will have to find ways to achieve these business goals through proper design plans that may increase or decrease the stress on employees.

Societal pressures like the public anticipation of continuous product development with technological breakthroughs put pressure on engineers at these tech corporations to deliver on the promises made by company leaders and their business decisions. This societal pressure compounded with economic pressure is translated into plans for engineers to invent or innovate new technologies with short deadlines. Additionally, the company will surely want to minimize the cost of production to increase profits and potentially integrate planned obsolescence into these design plans to extend profits further. This means that these engineers are now also using cheaper materials and making products with short lifespans due to decisions beyond their control. Moreover, for maintaining services, engineers also have to work on-call rotations to maintain server uptimes to fulfill customer expectations of readily available services.

The Local Network:

Technological Factors:

Today, technology is at its peak, and its growth is only continuing to accelerate. However, this accelerated growth has its own risks, since employment and labor laws aren't able to regulate its safety and prevent exploitation fast enough. This leads to use of technology that can generate inadvertent ethical backlash. Some examples of this that are used in the workforce include productivity monitoring of employees, wearable technology to obtain worker data, opaque employer decisions due to complex algorithms, and even data privacy concerns. For example, In the Arias v. Intermex Wire Transfer, LLC lawsuit in 2015, employees were required to download a Xora app and "were required to keep their phones on '24/7 to answer phone calls from clients'" (Ajunwa, 2018). However, they later discovered that the app contained a GPS function, which supervisors were actively using to monitor employees. Eventually, Arias, an employee at Intermex at the time, uninstalled the app stating that "the Xora app was similar to a prisoner's 'ankle bracelet'" (Ajunwa, 2018). As a result, Arias was laid off from the company after her refusal to reinstall the app. This is an example of a case of employee monitoring that is unethical, but has not been regulated by legislation yet; as a result, workers are able to be exploited. Many other cases are very similar, as they all address different forms of employee exploitation.

Tech workers:

The employees like engineers and developers are in their own local network with the technological factors. They also have their own negotiation space. This space allows them to work with some level of autonomy without worrying about the other actors in the global network affecting them. However, the technological factors are present within the workers' negotiation

space, so they have to interact with them constantly. While workers don't have to worry about societal and economic factors complicating the workplace directly, they have to deal with these translated into other forms of pressure by the obligatory point of passage. This includes tight deadlines, cheaper cost of production for product development, and working on-call rotations for software developers. These decisions are all made by leaders in the company hierarchy, which directly affect the workers' negotiation space. For example, in 2012, Apple's CEO Steve Jobs changed the iPhone screen less than a month before it was launched. Apple forced its main supplier to overhaul the assembly line, and the "managers woke up workers in the middle of the night to fulfill Apple's requirements" for the new iPhone screen (Cecilia, 2022). This kind of disruption of autonomy in the workers' negotiation space introduces a lot of stress on workers and demonstrates the dynamic between the obligatory point of passage and the local network.

CURRENT PROGRESS AND POSSIBLE SOLUTIONS

While there seems to be many downsides to working for big tech companies, some of the issues discussed in this paper are currently being resolved through better ethical business practices and new labor laws limiting the exploitation of workers in the tech industry. Additionally, large corporations depend on public support and shareholders to increase in market value. This means that if we bring the public eye towards issues with these corporations, they will have to remedy them or lose customers and support. For example, planned obsolescence has made marginal improvements in recent years, especially when we look at Apple's Airpods, which "are designed to function for just eighteen to thirty-six months of daily use before planned obsolescence renders AirPods as long-lived, toxic, electronic waste (Taffel, 2023). However, because fourth wave environmentalism in the 21st century has brought the environmental issues concerning technology and business responsibility to the public eye, large corporations have

begun to make products out of recycled or recyclable materials and facilitate these processes themselves. While these products are still meant to have a short lifespan and to be replaceable, they are at least reducing the impact on the environment.

Other economic improvements have also been made, especially regarding the unfair treatment of temp workers in tech, as "countries are passing laws to push for more equal treatment. More than 30 have some form of pay parity laws for temps" (Wakabayashi, 2021). While this system isn't perfect, it brings attention towards the issue and makes progress towards a positive resolution.

Societal pressures, on the other hand, are very difficult to resolve, as they are formed by consumers who are using services provided by these large corporations. Constantly innovating new technology and having employees maintain services with high criticality are an essential component of competition that makes businesses and technology thrive. However, there are ways for the corporations to accommodate workers, and some progress has been made by companies to make working on-call for employees less strenuous. Employees are limited in the frequency that they have to go on-call, they are compensated with overtime pay, and there are resources available for them when additional support is required.

CONCLUSION

This paper has discussed the accelerating growth of technology and its implications on society as well as the workers in the industry. Through the use of the Actor Network Theory, this paper analyzed how the growth of technology has created societal and economic factors that both influence not only the path technology is taking, but also its impact on engineers and developers working in the field. Moreover, we are able to see how external factors can easily find their way into the work environment in unhealthy ways through the obligatory point of passage. While

some progress has been made in recent years to reduce worker exploitation, the field of technology is ever changing, and society will have to find ways to keep adapting when new problems arise.

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