

**HOW COULD CENTRALIZED DATA SHARING MITIGATE THE EFFECTS OF
COVID-19?**

HOW DOES COVID-19 AFFECT THE PRODUCTIVITY OF REMOTE WORKERS?

A Thesis Prospectus
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By
Sung Joon Park

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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.

Signed: Sung Joon Park

Date: 11/02/20

Approved:

Aaron Bloomfield, Department of Computer Science

Date: 11/02/20

Approved:

Catherine D. Baritaud, Department of Engineering and Society

Date: 11/02/20

During this time of a global pandemic, COVID-19 has negatively impacted and affected the society that we live in today with over 200 affected countries and millions of cases worldwide (Kumar et al., 2020, p. 1). And with a such global pandemic having great impacts on the way we live today, the world is searching for any ways possible to mitigate the spread of this virus. One proposed solution made by Allam & Jones (2020) particularly suggested the utilization of smart city technologies such as “thermal cameras and IoT sensors,” where these smart city technologies would communicate using a universal protocol (p. 2). It delved into how technology could directly impact to mitigate outbreaks through effective data sharing, which will be the topic of the technical research.

On the other hand, while efforts are being made to mitigate the spread of the virus, many Americans have transitioned to remote work, with over 50% remotely working (Brynjolfsson et al., 2020, p. 2). This has led to mixed responses from the American workforce with some struggling to effectively transition to remote work with good productivity (Adisaputri et al., 2020, p. 2). This leads to the STS research to explore best ways to maintain productivity for remote work.

The technical research and loosely coupled STS research both seek to mitigate the damaging impacts of COVID-19, directly, and indirectly respectively, whether it is through assist in directly mitigating outbreaks or indirectly by helping to best sustain the American workforce during this global pandemic. From the technical side, my team and I will create a centralized data visualization platform that seeks to integrate COVID-19 data for Virginia residents and provide useful data analysis, so that the people of Virginia could take the necessary safety measures to reduce the spread of the virus. On the other hand, the STS research will seek to focus on the factors that affect the productivity of remote workers and what actions could best

be taken to alleviate the challenging effects of remote work, which would be further researched using Social Construction of Technology (SCOT) model (Bijker & Pinch, 1987, p. 107). Both the technical and STS topics are planned to be researched and executed in the Spring Semester of 2021.

CENTRALIZED DATA FRAMEWORK

For the technical project, under the provision of Professor Aaron Bloomfield from the Department of Computer Science, Fourth Year Computer Science Engineer Michael Chang and I will conduct research on different data on COVID-19 in Virginia and create an effective web application that unifies and visualizes the different sources of data for the state of Virginia.

In the midst of an ongoing global pandemic, an article written by Paul (2020) from Biopreservation and Biobanking highlights the importance and addresses the need for a global, centralized data sharing network, where this network would contain COVID-19 clinical data (p. 2). In fact, data sharing has become so vital that now with COVID-19, many collaborative efforts have been made among researchers, pharmaceutical companies to “learn and discover more about the pathogenetic mechanisms ... response to drugs, and review of the cause of adverse events” (Paul, 2020, p. 4). Lenert & McSwain (2020) also support the idea that different clinical entities need to collaborate together to “fully mobilize the full spectrum of researchers” to best address the issues of COVID-19 (p. 966). For example, Allam & Jones (2020) shows how during the 2014 Ebola outbreak, “collaboration sharing of data,” where “scientists, health workers and clinicians, openly worked together,” led to successful containment of the virus in West Africa (p. 6). With that, Moorthy (2020) also attributes the 2013-2017 West Africa Ebola virus outbreaks due to “deficiencies in data-sharing mechanisms” (p. 1). Linking this to the

current global pandemic, Allam & Jones (2020, p. 6) and Vasudevan et al. (2020, p. 12) emphasizes how sharing of data could be key to early prevention for future outbreaks (p. 6).

Unfortunately, in a society where information is available everywhere, the difficult task at hand is to integrate all the important information from different sources into one centralized resource. Therefore, the objective of the team's technical work is to create a unified data visualization platform that integrates all important visual and graphical information linked to COVID-19 in Virginia from different sources online. Some information that would be expected to be on the platform are cases, rates, news/media, and potentially even machine learning predictions, if time permits, which was highly supported by Kumar et al. (2020, p. 1-2). The overarching goal of this project is to provide a single centralized point of COVID-19 data for Virginia residents by simplifying and compiling all information that is provided online. And through the use of data analysis and machine learning, our hope is to also provide practical data analysis that would provide users deeper insight than that of which they can simply find on the web. Working with Michael Chang, this project is to be conducted in Spring semester of 2021, expected to be complete by the end of the semester under the guidance of Aaron Bloomfield, our technical advisor from the Department of Computer Science.

The majority of the project will consist of research, brainstorming, and implementation through trial and error. Before any execution, my team and I will be expecting to explore a number of different pieces: different sources of data, what data analysis to show, and how to display the data analysis. Before any data analysis, my team needs to decide which data resources through the use of Application Programming Interfaces (APIs) we will be delving more deeply into. After deciding on a source, this data would be fetched from the APIs by using sequences of command line tools on our laptops that connects to the data online. Then, my team

will be brainstorming what potentially useful analysis we could visually show. In order to do this, my team plans to use Python and Javascript, both of which are programming languages, and Visual Studio Code, our code editor, in order to experiment with different data analysis and visualizations. Other online data analysis frameworks and libraries such as d3.js and neo.js are

expected to be utilized for aid in this part of the process. Lastly, my team would need to come up with a way to uniformly display the analysis that was conducted.

This would comprise of researching on User Interaction (UI) and User Experience (UX) and then formulating a mock-up

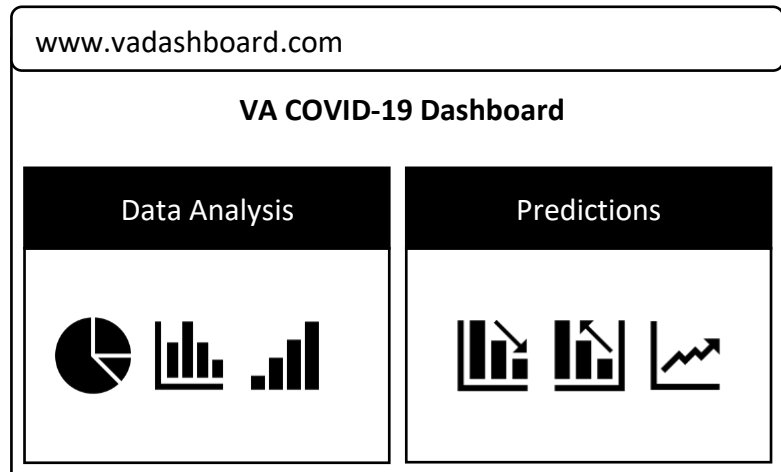


Figure 1: A Sample Mockup. This figure shows how a mockup can visually help in the planning of the design of the application before implementation (Park, 2020).

wireframe design, as shown as a minimal sample in Figure 1. The mockup acts as a blueprint for developers to look to as they engineer and implement their application.

To note however, the majority of the execution of this project would be trial and error as there are many potentially unknown factors that could cause the team to sidestep or circumvent a problem. One potential example could be lack of online resources such as software frameworks and libraries to perform a particular data analysis the team would need to execute.

In the end, through our technical project, our goal is to provide a centralized data visualization framework that shows useful analysis, which we hope will help effectively communicate the growing or lessening trends and impacts of COVID-19 so that the people of Virginia could take the necessary safety measures from the virus. In a conference style paper, our

team will present our technical project using our research on different types of useful data analysis with hands on experience in how we can effectively communicate this analysis to users online.

HOW TO INCREASE PRODUCTIVITY OF REMOTE WORK

Unfortunately, this global pandemic has impacted the world by more than just physical ailments. It has affected the environment, the people, especially the front-line workers such as doctors and nurses. It has also affected people indirectly involved as research by Montemurro (2020) shows that one does not need in the front-line medical staff to be impacted, but that “vicarious traumatization” could happen in non-front-line medical staff (p. 1). This implies that there are potentially spreading mental and psychological impacts of the virus. Khan et al. (2020) noted this when they emphasized the heightened “stress and fear of infections” which leads to major “behavioral and psychological abnormalities” in people (p. 3).

This global pandemic has impacted the workforce in different ways as well. One significant way was by stimulating a big transition to remote work. As shown in Figure 2 below, the proportion of workers that switched to working from home is 34.1% in addition to the 14.6% that already worked

from home, suggesting over half of the American workforce working from home from COVID-19

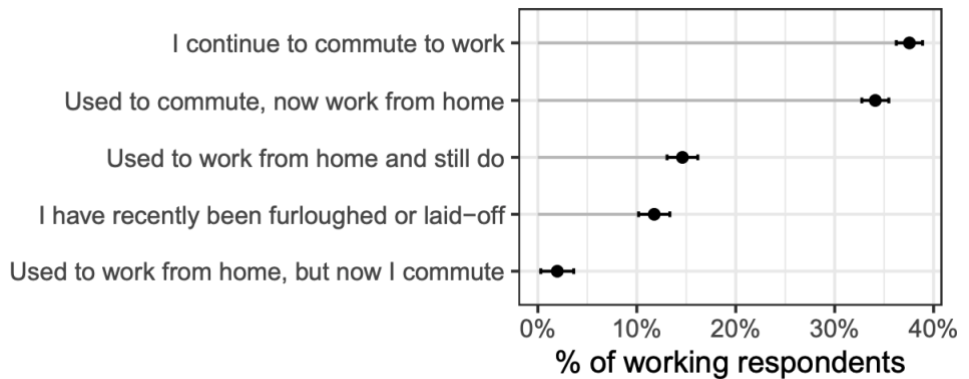


Figure 2: Statistics of Commuting and Remote Workers. The majority of American workers have transitioned to remote work due to COVID-19 (Brynjolfsson et al., 2020).

(Brynjolfsson et al., 2020, p. 2). And as the workforce is gradually adapting to the “new norm”

of remote work with a “surge in the use of digital technologies (Kamal, 2020, p. 310),” there were mixed responses. While Adisaputri et al. (2020, p. 2) show that remote workers have been shown to experience negative effects on their wellbeing and productivity, Kamal (2020, p. 312) offers a different perspective, stating that the majority of the remote workforce did not experience loss in productivity, with 28% reporting increased productivity with remote work.

Kamal (2020, p. 312) also adds that with the ongoing effects of the pandemic, “increasing productivity and resulting in delivering greater outputs, has now become critical for every business sector’s existence.” Given that, it is critical that employers strive to help ensure for the wellbeing and the productivity of their employees in these times of stress and isolation.

WHAT FACTORS COULD BE IN PLAY

According to Adisaputri et al. (2020), quantifying productivity is difficult as it is not explicitly quantifiable, but job satisfaction or emotional state could be very good indicators of productivity as they were shown to have close relations (p. 5-6). Unhappiness “leads to low cognitive performance ... and low motivation” (Adisaputri et al., 2020, p. 6). Given that information, comes the question that adds the first layer of complication: what factors affect the satisfaction or the wellbeing of remote workers? Which ones affect them the most? And according to different studies by Adisaputri et al. (2020) and Russo et al. (2020), there are a number of factors that could affect the wellbeing of remote workers: autonomy, stress, daily routines, social contacts, competence, extraversion, quality of sleep, home office ergonomics, to name some. Chief Executive of the Silicon Valley startup, Chef Robotics, also mentioned some of the problems regarding remote work: “It is just not the same. You just cannot get the same quality of work” (Cutter, 2020). One big underlying problem for the startup was lack of social interaction, as it made it harder to connect and get to know other employees, with less

opportunities to ask for help. And on top of this Cutter (2020) mentioned, “people are [were] getting fatigued.” If employers want their businesses to thrive, they will have to find solutions to these issues so that they may invest long-term into the wellbeing of their employees. For example, suppose social interaction is the affecting factor for wellbeing, then perhaps employees could be given the flexibility to have both remote and in-person working hours that may be safe and under regulations for the global pandemic. This leads to the second layer of complication which comes from the fact that there are different solutions for different factors of wellbeing: what solution would work best for a particular employee with specific needs affected by a certain factor? Given these differing follow-up questions for the STS research topic, the objective of the research work would be to research which top factors would most affect the wellbeing of remote workers and which solutions could best help meet those needs.

IMPACTS OF REMOTE WORK

According to Kamal (2020), as the society advances through the pandemic, we are “witnessing the gradual onset of the new normal - that radically instigated the surge in the use of digital technologies, communication platforms” (p. 310). In fact, Golinelli et al. (2020) talks about how health care organizations, which are slow to adopt to digital practices, have already started to rapidly adopt digital technologies (p. 2). Therefore, with the onset of remote work and the increased use of technology to accommodate for the loss of in-person communication, a SCOT model (Bijker & Pinch, 1987, p. 107), is created, as shown in Figure 3 below.

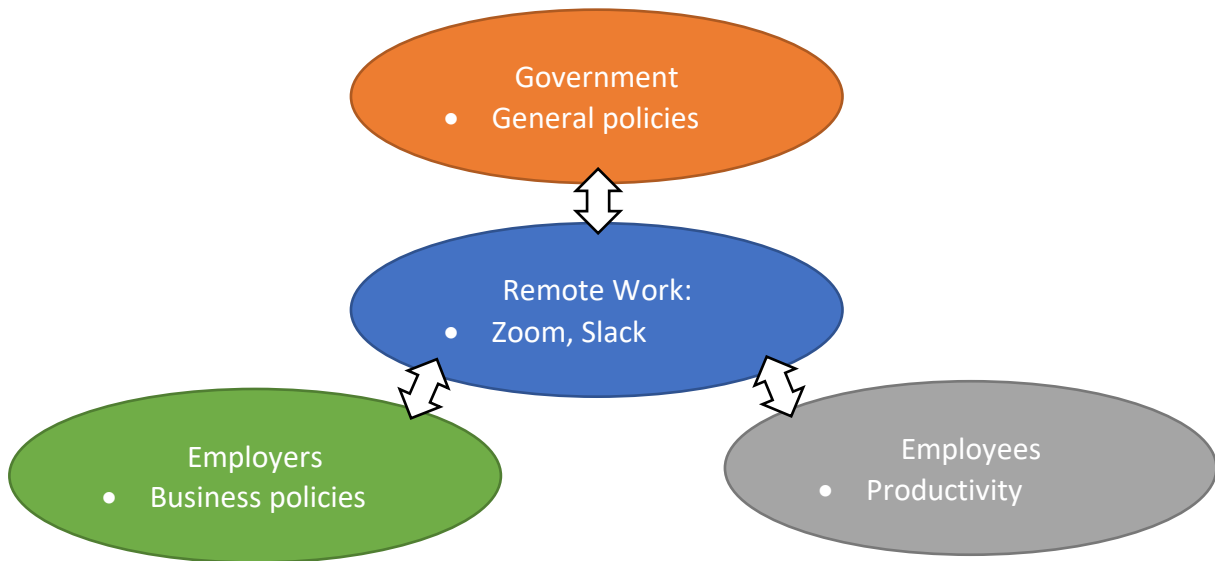


Figure 3: Remote Work SCOT model. The big transition to remote work caused by COVID-19 is responsible for affecting the policies as well as the productivity of each actor (Park, 2020).

With the quick adoption of remote work through the use of technologies such as Zoom and Slack, remote work affects a number of different social groups such as the employees, employers and the government in focus, as shown in the figure. One of the most interesting aspect of the SCOT model is the quickness of the stabilization and closure of the technologies connected to remote work. In fact, Golinelli et al. (2020) explains how speed of the adoption of these technologies “demonstrates their ease of adoption and manageability” (p. 15). Ever since the government ordered a lockdown from the pandemic, the transition and adaptation to virtual technology such as Zoom was quickly made to stay connected. However, despite the fast adoption, there were different opposing concerns such as privacy. One form of this interpretive flexibility came from Golinelli et al. (2020) as they note how privacy is a “key challenge for designers and engineers who design digital tools for epidemic control” (p. 14). Nevertheless, remote technology has still been widely adopted. One primary reason for this could be that there were no other means to stay connected and thus, people had to look for the next immediate options like virtual technology. Under the government policy, the need was dire so the society

had to conform to those circumstances, as Kamal (2020) describes how government policies has “instigat[ed] the most severe destruction to the global economy” (p. 310).

With the emergence of virtual technology, it has revolutionized the communication and the work with relation to the government, employers, and the employees. In order to combat the global pandemic, the government, as the policymaker, has imposed lockdowns and has encouraged other forms of digital communication. For example, according to Kamal (2020), the government has “allocate[ed] a great deal of resources to implement emerging digital technologies” (p. 313). And those policies such as lockdowns also shaped how employers formulated their work from home business plans and strategies, as Kamal (2020) shows that the employers have no choice but to adopt digital technologies to continue their businesses. In turn, this adoption has impacted the wellbeing and the productivity of the employees in different ways. From the SCOT model, the varying and interrelated effects of remote work technologies from the onset of COVID-19 could be observed.

With the increasing trend of remote work from the effects of the global pandemic, many employees are still struggling to perform their best, most productively, in the “new normal” of remote work. The STS research project, which will be a scholarly article, will strive to uncover which ways could best help to increase the productivity of remote workers.

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