

PANDEMIC WITHIN A MODERN AGE: THE WIRELESS RESPONSE TO CORONAVIRUS

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Abstract

Since its appearance on the global stage in late 2019, COVID-19 has changed the way the community interacts, shops, and works. In lieu of a vaccine, efforts have shifted to social distancing and quarantine, leading individuals to live their lives from home. The same innovations in technology which have provided unprecedented visibility into the development of the virus are the same innovations which have aided in enriching the personal lives of those under social distancing. While this is an isolating occurrence at never-before-seen levels, human connectedness has adapted, and isolation has only remained in the physical sense. Developments in wireless connectivity, networks, and applications have both brought the world together and given some semblance of routine in a time of uncertainty. Additionally, much of this technology has also helped to ‘flatten the curve’ of viral propagation by providing services to communities while continuing to keep them at safe distances. This same technology which has thus far aided in the mitigation of COVID-19 may see exponential growth and adoption which will hopefully far outlast the virus.

Introduction

In the last several months, life in the world has drastically changed due to the Novel Coronavirus or COVID-19. This virus, having first been reported in Wuhan City, China on December 8, 2019 only took three months to spread world-wide and become categorized as a pandemic by the World Health Organization. This meteoric spread can be attributed to COVID-19’s incredibly contagious nature by way of respiratory droplets transmitted by coughing, sneezing, or talking. Additionally, COVID-19 can remain on surfaces where it can infect a person if they come in contact with the surface and proceed to touch their eyes, nose, or mouth (CDC.gov, 2020). For those who have contracted COVID-19, unfortunately, the result can be potentially life threatening, with the World Health Organization forecasting a 3.4% mortality rate adversely affecting older generations and those with already compromised immune systems (Worldometer, 2020). As such, the scope of COVID-19, while still very much unfolding, has recorded 2,659,557 cases, claiming 185,494 people globally (Worldometer, 2020).

This has led world leaders to enact a great number of steps to attempt to curb this infectious virus while a vaccine can be created. In efforts to ‘flatten the curve’, or lessen the impact of projected cases, many countries have enacted different levels of ‘social distancing’. At its least stringent, the act of distancing involves maintaining a 6ft. distance from other individuals and limiting collective gathering to lessen the ease of transmission of the disease. However, in more stringent cases, cities and countries have gone into total shut downs, closing schools and business, cancelling professional sports and entertainment, and in extreme cases such as Wuhan, China, Daegu, South Korea, and Italy where civilians have been mandated to remain in their homes, are not allowed to drive and must receive permission to leave their homes to get essentials (Wamsley, 2020).

While many industries have taken hits, COVID-19 has presented several additional unique challenges to the US. Despite efforts to socially distance diminish social interaction, the country has experienced unprecedented unemployment due to business shut down and a resulting economic slump toward recession due to heavily diminished spending in certain sectors (as of March 19, 2020, non-grocery shopping is down over 50% and travel nearly 75% (Leatherby & Gelles, 2020)). However, there are other businesses which have seen exponential growth including delivery services, e-books, news media, music streaming, video streaming, and gaming. Outside of consumer culture, additional efforts are being made to keep the workforce at home if possible, with tech giants including Google™, Twitter™, Amazon™, and Facebook™ taking charge (Duffy, 2020). In fact, the slowly growing work from home population, while still under 10%, is up drastically (due mainly to the mandate).

Considering these circumstances, the world has responded quickly and is developing rapidly in the tech environment due to COVID-19. Given this is the first global pandemic experienced while in the age of digital technology, this report aims to identify the technological innovations developed and enhanced which have aided in flattening the curve and lessening the impact of a deadly virus on the global community. Of consideration are innovations in app technology to connect the world for both information and social enrichment, GPS technology and the internet of things to both aid in social distancing and providing forecasting roadmaps of outbreak hotspots, and electronic commerce bolstering the economy and providing essential needs, paying specific attention to the benefit of healthcare technology and health and wellness applications. Lastly, will be considered the overall digital communications structures which have made this possible including 5G networks, VPN and computer security, VoIP phone technology and the internet of things. The aim of this essay is to highlight the current use of this technology not as a panacea to this pandemic. One clear limitation of this research is that these developments are still unfolding so, while some data regarding the curve flatten may be present, it is by no means conclusive. Finally covered will be the future of these items and the tech environment given its galvanization due to this pandemic. Has this provided a platform and social experiment for more companies to work from home? Given the streaming traffic increase, will there be more testing to determine the long-term health effects of 5G signals?

Internet Pervasiveness Flattening the Curve

The newest and possibly most impactful difference in navigating the spread of COVID-19 has been the presence of digital communication at the global level. While residents of countries may have their own individual grievances about how the information was acted upon, the accessibility and transparency has been present since December 8, 2019. While the virus has claimed thousands of lives, the fact that the ubiquity of cell carriers and laptops with capability to connect with wireless networks has led world leaders like the World Health Organization (WHO) to enact emergency measures in within less than one month and within another month, begin to implement lockdown rules. All said, there was a period of 98 days from the date of first report to the declaration of national emergency, signaling semi-unified actions like social distancing and relief support, prepping and creation of sanitizer and respirators, etc. Compare this with the previous pandemic, the Spanish Flu, which ravaged the world between 1918-1919. While not a perfect comparison as medicine was less developed and many nations were in the thrall of a world war, word travelled very slowly causing major action not to be taken until October of 1918, six months after the first recorded case of the virus. While social distancing was enacted, many were slow to adopt this, and in Philadelphia, PA, officials downplayed the significance of the first cases in the city. Mass gatherings continued and schools remained open. The city only implemented physical distancing and other measures around 14 days after the first cases appeared. This had significant consequences

(Newman, 2020). Proportionately speaking, the Spanish Flu would go on to infect an estimated 500 million world-wide (1/3 of the global population) and killing an estimated 20–50 million individuals (History.com editors, 2020).

From a connectivity standpoint, moving from first case to pandemic declaration to quarantine has happened in record time due in large part to the data streaming and communications platforms. Not only are the residents able to watch local news but they are able to now access the internet to watch updates on a global level. For example, the world watched as Italy suddenly shuttered doors and enacted a total shutdown of the country. For weeks afterward, the global stage was able to follow the press releases and reporting coming directly from Italy. While this has had a frightening effect on those watching at home, the information has provided the transparency and evidence for other global leaders to forecast the pathology of the virus and model it against their communities. Given this information, residents in the United States had the opportunity not to repeat the actions Philadelphia failed to take 100 years ago. Because of this, the notion of flattening the curve has persisted and communities around the world have used Italy's circumstance as a cautionary tale to take this seriously. Given it is not enough, 4.33 billion or 57.3% of the global population have access to the internet, with 3.9 billion users having access to mobile internet (Lin, 2019). Thus, internet accessibility has allowed the citizens of the world to consider the scope of the pandemic and work in unison to prevent the spread of COVID-19 but it has also allowed world leaders to also enact laws and quarantines to place legal guidelines around those living during the time of a pandemic.

GPS Technology Assisting in Implementing Public Policy

Working in lockstep with the coverage of the coronavirus pandemic, officials are working closely with network providers, using GPS data to identify hotspot areas in efforts to prevent the virus from spreading nearly as quickly. Ahead of the implementation of social policies like social distancing and shelter-in-place, companies like Google™ Maps are using aggregated, anonymized data showing how busy certain places are. While this was primarily used in analytics for marketing purposes, it can now be used to identify pockets of heavy population and can be cross referenced against confirmed cases of COVID-19 and extrapolated to provide forecasting models for impacted volumes of people. This model was particularly helpful when referenced against the same model when considering quarantining protocol. This modeling helped policy makers to enact more stringent policies. While losing some of the previous personal liberties such as going outside or attending large gatherings, the data models projecting the volumes of cases and deaths measured against hospital capacities, allowed the popularization of the social distancing policies. Additionally, by using aggregated GPS data, individual users are not being identified, thus maintaining personal security and the data protection laws where they exist.

Of more controversial note regarding GPS technology are the ethical/moral debates currently being held about gathering personal information from cellular service carriers providing non-aggregated data. Due to the US' lack of systematic privacy protections, data from advertising companies can be very exhaustive and companies have been known to sell that data for ad-targeting purposes. That said, this data provides highly detailed information on the location and movement at a much more granular rate than that of cellular data service providers (5 meters compared to 0.1 km²) (Hern, 2020). That said, the grid which smart phone users have leveraged GPS technology for has also been tracking highly detailed data which could be useful for the world to eradicate the virus. The notion is by gathering GPS collected data from individuals affected or in contact with COVID-19, it can be possible to impose more strict quarantines to limit further exposure to the virus. The concerns highlighted by policy makers involve

giving those keys to the government. In a time of crisis, it can be used to very effectively trace a trajectory of COVID-19 to isolate those in contact with the virus but there are additional datasets available to the government and the question becomes whether this is too much information to have on individual citizens.

In Louisville, KY, health officials and policy makers have taken a harsher look at the quarantining and are using GPS technology as an agent to enforce said quarantine. “We’re not talking about putting people in jail, we’re talking about requiring them to stay home,” said Angela Bisig, chief judge at Jefferson Circuit Court (Vasan, 2020). In Kentucky, there were individuals identified as having contracted coronavirus who chose not to adhere to the quarantine policy and, as a result, GPS tracking devices were imposed upon those who had tested positive for COVID-19 so quarantining and social distancing could be more closely monitored and enforced. It was made clear that the use of GPS tracking monitoring bracelets was the ‘last resort’ when individuals were unwilling to comply with quarantine orders after being diagnosed with COVID-19. In summation, the leverage of cellular data and GPS technology has provided significant data used to trace COVID-19 and analyze volume of impact. However, the robust data provided by cellular services has highlighted concerns in data privacy and will likely open several discussions on how far data providers can reach into the personal lives of the users leveraging wireless technology.

Comparative Reaction from Internet-Restricted Areas

The concern for countries without internet is also being recognized. Currently, there is a tribal region in northwestern Pakistan, FATA, which has been under an internet shutdown. These 3.7 million residents are largely unaware of COVID-19 and the fear is that social distancing and preventative measures may not be enacted in time to prevent greater loss of life. COVID-19 aside, the quality of life in the FATA region has been poor since the suspension targeting 3G/4G and portable devices left the region mostly dark. Since, residents have lived alongside terrorist attacks and have suffered from few civil rights, only to have protests not receive adequate coverage to provide effective (Kamran, 2017). These inequalities will be amplified current day as residents do not have access to the internet to become educated. An unnamed journalist in the area mentions “Most of the information that is being shared around the virus is online, and since the whole tribal area doesn’t have access to the internet, people are unaware,” he says, adding, “It’s not like we will not have cases of coronavirus, because I’m sure we have people roaming around the streets carrying it. They just wouldn’t know it.” As more people in Pakistan, including FATA, develop COVID-19, there will be a big chunk of the population that might not realize what is happening to their bodies and where to turn to for medical help” (Kamran, 2020). We can only hope that in time like this, media or citizens recognize areas without internet accessibility and come together to spread news and work to bring internet back to these regions future state.

The Rise in Streaming Content

Given the pervasiveness of the internet, news has travelled faster than ever, and the global community has responded by quarantining, leaving the office and working from home, no longer going out to eat, etc. While there are higher degrees of severity imposed dependent on the country, one thing has been clear: people are staying home. As such, there has been an exponential increase in means of entertainment which people have been turning toward. Worldwide, increases as of March 2020 have been recorded in watching news coverage (67%), watching Netflix™ films via streaming services (51%), watching broadcast television (45%), spending more time on messaging services like

Facebook™ messenger, WhatsApp™, etc. (45%), spending time on social media (44%), playing computer/video games (36%), reading/listening to audiobooks (35%) and listening to music streaming services (35%) (Statista. 2020). In total, March 2020 had seen increases in in-home data usage by 18%, online gaming (75% increase YoY) and education app downloads (1,087% increase between March 2-16) (Clement, 2020).

COVID-19 has pushed individuals into a home-life but this has only developed new ways for residents to be entertained, visit with their loved ones, and remain engaged in their educational pursuits. In efforts to continue to visit with family and friends, video conferencing data usage has increased drastically. The Zoom™ app is currently the top free offering in Apple™ Inc.’s AAPL, +2.88% App Store, and JPMorgan analyst Sterling Auty says third-party data indicate that daily usage was up more than 300% from before the pandemic forced workers into their homes, with daily user volumes having quadrupled (Bary, 2020). This has helped allow others to stay connected despite long distances or quarantine efforts which has, in turn, greatly helped adherence to stay-at-home orders in efforts to flatten COVID’s curve.

Entertainment has also evolved to favor online streaming sites to gain access to a near limitless archive of film and television series. Pictured below is a chart of calculated traffic and data usage of Facebook™, Netflix™, and YouTube™ services leveraged directly from the website as well as from the mobile applications. One piece to consider is that website traffic has increased considerably while app traffic is suspiciously low (see Fig. 1). This indicates that, without on-the-go schedules, users are no longer accessing these services by way of their phones and are, instead consuming their entertainment through their computers at home or by leveraging smart technology like televisions or gaming consoles to access entertainment.

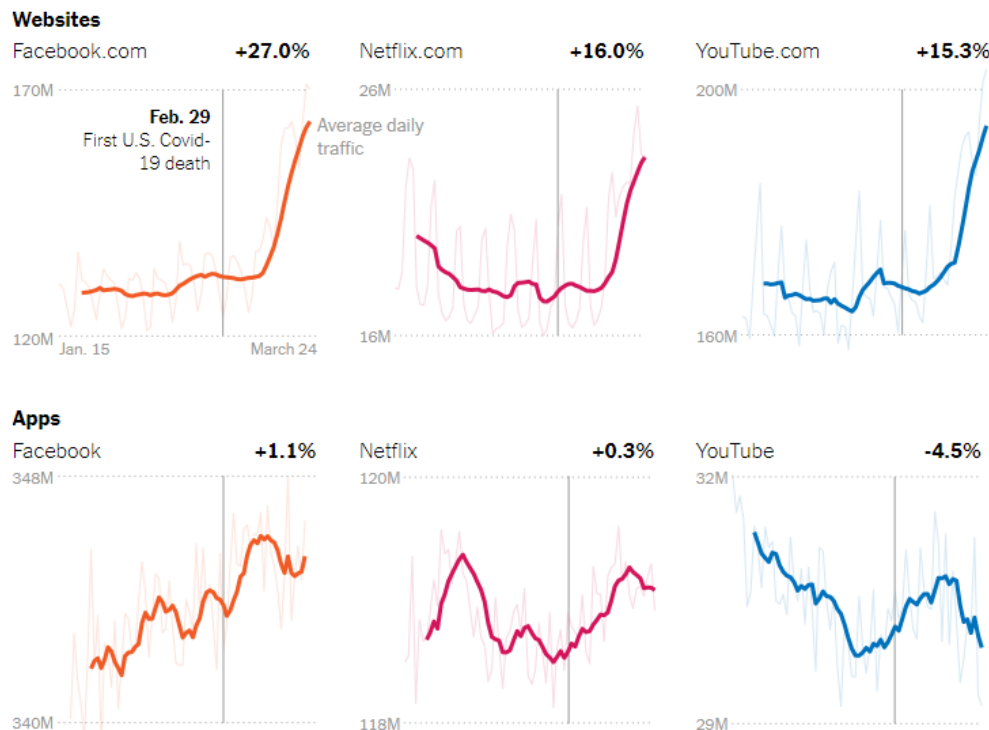


Figure 1: Increases in Data usage of websites vs. applications post quarantine (Koeze & Popper, 2020)

Lastly, we consider the exponential growth in distance education and educational technology. When, on February 23, 2020, Italy announced the shelter-in-place protocol including schools. In a quick response, the International School of Monza organized and had their educators begin to offer distance education remotely by way of Microsoft™ Teams, becoming part of the world's greatest educational technology experiment. Per Anderson, "The International School of Monza is part of the world's biggest educational technology ("edtech") experiment in history. With 1.5 billion students out of school and hundreds of millions attempting to learn solely online, the experiment will reshape schools, the idea of education, and what learning looks like in the 21st century." That said, the implementation of educational technology has not been perfect and has not necessarily been perfectly contrived due to the compressed timelines imposed by the pandemic. Current iterations of these remote schools include more leverage of conferencing platforms like Microsoft™ Teams and Zoom™ but this will likely continue to improve upon itself. As mentioned, mass distance learning may be off to somewhat of a rocky start it will only continue to gain momentum.

Easing the Strain on the Healthcare Industry

In addition to radically affecting the social and entertainment needs of global population, COVID-19 has drastically altered healthcare, those working in hospitals, and those seeking medical help. With the eve of the COVID-19, hospitals were in fear of being filled without space to handle excess patients afflicted with the virus. In fact, the notion of "flattening the curve" has been an effort to make certain that the bell curve of the viral outbreak will be lessened below the maximum capacity lines of hospitals and healthcare institutions across the world. Mixed with the finite space are additional problems which hospitals, doctors, and nurses are faced with are finite resources such as respirators for patients and masks for workers, testing kits and implementation plans to effectively treat diagnose patients so they receive the appropriate treatment plans. Again, the internet provided by 3G, 4G, and 5G networks have provided some assistance toward these needs while also connecting biologists and pathologist around the world so a vaccine can be created to hopefully end the outbreak. Lastly, additional health and fitness applications have increased in the time post-COVID which have helped individual users to maintain healthy lifestyles so they can avoid hospitals altogether, leaving them for more exclusive use of COVID-19 and other serious illness treatments.

Social Networking as Means of Knowledge

As with news outlets, perhaps one of the most revolutionary developments in handling a pandemic has been the prevalence of social media outlets allowing the medical community to disseminate information about COVID-19, allowing less panic to drive concerned individuals into public spaces like hospitals. "Right now, Twitter™ is the best way to get medical information out," Raja told CNN Business. "Because of the fact that everybody gets a voice [on social media], it's very easy for alarmist messages to pick up steam. We have to be constantly vigilant about trying to get that panic under control and spread a different message" (Yurieff, 2020). That said, doctors, nurses, and healthcare workers around the world are taking to their media platforms not only to provide information on COVID symptoms but also to dispel any potential misinformation. "Social media is the disease and the cure. It is responsible for the dissemination of misinformation as much as it needs to be a tool for repairing that," said Rick Pescatore, an emergency room physician and public health expert in the Philadelphia area, who is active on Twitter™ and Facebook™ and has treated COVID-19 patients. "It's incumbent upon physicians, who want to get real information out there, to meet these patients where they are -- and that's social media"

(Yurieff, 2020). In fact, many nurses and doctors have been able to make a great impact as social influencers, debunking false information about the spread and symptoms of COVID-19. Platforms such as TikTok™, a short-form video sharing platform have become common place for healthcare professionals to discuss facts about COVID-19 and personal hygiene. As mentioned by Pescatore, this can provide trouble though, as anyone with an account can provide information on TikTok™ or a social media platform. Thus, it is important for individuals to be critical and discerning of the content they consume on these platforms or in general media. Recently, companies like Lysol™ have come forward and repeated general warnings about consuming cleaning products after President Donald Trump alluded to a potential cure by ingesting cleaning chemicals. Ultimately, by meeting individuals on these platforms, doctors have been able to provide knowledge to the global community while limiting the number of patients flooding hospitals so they can instead be used for effective treatment. The flipside to this transparency is that there is transparency toward every individual's opinion and while companies like Facebook™ and Twitter™ have instituted bans on COVID misinformation, that misinformation is still easily spread, potentially doing more harm than good.

The Turn toward Teledoc™

In addition to the presence of healthcare workers providing information on social networking platforms, there has also been a significant rise in health and wellness applications for users' mental and physical needs. Perhaps one of the most heavily used applications has been the use of Teledoc™, a service wherein global insurance issuers, employers, and hospitals work together to deliver remote triaging and care for those who call. This way, those who are concerned they may have contracted COVID-19 or those with non-COVID-19-related symptoms can receive treatment without being in a hospital. This has led to explosive increases in users to about 15,000 users per day, a 50% increase in traffic than the week prior to start of the outbreak in the United States. "There is no doubt that we are seeing positive momentum and that awareness has increased. Telemedicine is now a household term," said Dr. Lewis Levy, chief medical officer of Teladoc™, in an interview with CNN Business. (La Monica, 2020). Not only has Teledoc™ seen success in reducing hospital crowding, it has also prompted healthcare providers to begin exploring offering their own remote services, like Lifestance™, who had their plans of moving to a distance model galvanized by remote social policies. Per Anisha Patel-Dunn, "Everyone had to be quick on their feet to address the needs of clients. There has been a learning curve for clinicians and patients," (La Monica, 2020). While many may return to physical locations for their checkups, there is no questioning the convenience of Teledoc™ services, which will surely continue to develop, offering broader services to users well beyond the course of COVID-19.

Increase in App Governance

As with social media platforms, there is a concern in of the credentials of the applications which are being developed which has led to carriers like Apple™ and Google™ to reject applications not developed by health organizations in order to curb the dissemination of misinformation. Per Google™ policy, apps have governance against apps that deny the existence of major tragic effects, that lack sensitivity toward or attempt to capitalize on a natural disaster, or those which appear to profit from such events with no benefit to the victims (Statt, 2020). As such, several apps developed for profit have not made it past the manual review process and have not made it to the public. Furthermore, iOS operating system has also effectively limited COVID-19 applications from appearing when searched on the

Apple™ Store. The Android system (Google™) has taken a more stringent approach, outright blocking any services for COVID within their app stores.

The Increase in Smart Mind and Wellness Applications

Outside of medical and COVID-19 specific applications, the world has also seen a large increase in mind and wellness applications to service those who are in quarantine to try to help keep their routines and provide additional services for those struggling with managing their lockdown. As people are coping with COVID-19, many are turning to meditation and mindfulness applications to try to maintain positive mindsets. Downloads for ‘mindfulness’ topped 750,000 during the week of March 29th, 2020, and Android users were noted to have spent 85% more time using those apps than typical (Lerman, 2020). However, this increase in mindfulness has not been relegated to applications alone. Additional traffic has been noted in conferencing platforms (Zoom™, Microsoft™ Teams) for individuals to conduct mindfulness exercises in groups. Additionally, app developers and companies are offering services at discount or, in the case of the app ‘10 Percent Happier’, healthcare workers have been provided the application free of charge. “I think we are craving human connection and shared stories more than ever,” Headspace CEO Richard Pierson said, and “People are deriving a sense of community from it,” Harris of 10 Percent Happier states (Lerman, 2020). In this way, these applications have provided calming service but also bolstered a community during a challenging time.

Joining the suite of mindfulness applications are also mental wellness applications like E-Mental™, MoodGYM™, and Beating the Blues™ which are developed to provide anonymous psychoeducation, screening assessment, monitoring of symptoms, intervention, and social support for those struggling with depression or other mental illnesses. At current moment [when this article is written], COVID-19 has claimed over 100,000 lives globally, 50,300 in the US in addition to causing social isolation and economic and financial stress to those furloughed or laid off as businesses shuttered. In these unprecedented times, it is understandable for need to check in on mental wellness and these applications have provided a means for individuals to connect directly with therapists to share thoughts. In this way, these applications have further helped the community stay together and impress the ‘not alone’ message which has become more important than ever during isolation (Cook, 2020).

Maintaining Physical Fitness with Integrated Applications

Though mindfulness is an important facet in maintaining a healthy lifestyle, the physical aspect should not be disregarded and, in a time when social distancing has shuttered gyms, it is more important than ever. However, the development, specifically in smart health applications have provided a much-needed outlet to ensure individuals are able to maintain a semblance of their active lives. While social distancing has mandated that individuals avoid groups, individuals are still able to get out and walk to maintain physical well-being. The wearable Fitbit™ uses smart technology to connect with other devices, tracking and measuring distances walked but, more importantly, heart rate and other biofeedback data. While it has been useful to those interested in monitoring their step counts, there are deeper implications and benefits wearable technology may have with early detection and prevention of COVID-19 and other strains of the flu. That said, Fitbit™ is collaborating with Scripps™ Research and Stanford™ Medicine to study, detect, track, and contain infectious diseases. Researchers are aggregating data such as heart rate, skin temperature, and blood oxygen saturation, among others to see if there are trends which may signal the onset of a cold before the symptoms appear (Fitbit, 2020). Short term, this provides individuals with an outlet to track fitness and allow them alerts to potentially inform them to

stay home due to early warning of COVID. Long term, this could curtail the proliferation of seasonal flu or infectious diseases in general.

Aside from Fitbit™ and similar wearable technology, there has also been an increase in other, less portable smart technology for fitness purposes. One such example is the Peloton™ company, who produces an exercise bike with smart technology allowing connection to app which connects individuals together in remote spin classes. Recent downloads of the Peloton™ application indicated the trend is catching on, showing five times the download traffic from their February-2020 numbers (Bary, 2020). While Peloton™ has ceased ‘live’ sessions where an instructor guides the exercise, there are still several pre-recorded sessions which are available to users who would like to join to compare their times. Additionally, it has yet to be seen whether Peloton™ has partnered with healthcare institutions but, given the biometrics which Peloton™ tracks, there may be further ancillary uses of that data much like Fitbit™ has begun with Scripps™ and Stanford™.

Remaining Employed During Isolation

The COVID-19 outbreak has drastically affected the professional landscape but developments in technology have made strides in reducing the number of businesses which have shutter. While unemployment is at a record high of 15%, well above that of the Great Recession, developments in VPN technology, VoIP and conferencing technology have allowed a great deal of individuals to continue working remotely. As mentioned before, educational institutions are now fully remote for students and teachers alike, meaning that educators and education administrators have been able to continue to work from their homes rather than from the classroom. As mentioned, conferencing technology has become a necessary piece of professional telecommuting and without VoIP phones, managing meetings would be far more difficult and would be rife with far more disconnections and fail-outs. The flexibility of VoIP software has allowed individuals to join conferences on Skype™, Microsoft™ Teams, or Zoom™ from anywhere with an internet connection, allowing work-from-home spaces to be anywhere with wireless signal. Additionally, the networks dedicated to these conferencing lines are HIPAA and FERPA compliant, allowing for privacy and security needed to operate remotely in the healthcare and education environments (TechAdvisory.org, 2020). VoIP auto-attendants also provide a level of comfort to potential customers calling in or looking for updates and lastly, VoIP technology provides a cheaper and more flexible plan for companies looking to tighten belts during a slouched economy. As VoIP technology can be layered over existing data networks, it can be set up at much lower costs and is scale-able due to the ease of adding/removing additional networks over existing network infrastructures.

Additionally, VPN networks used to privately connect to business servers has increased drastically as well. Using a VPN, an employee can gain connection directly to the office servers and by using services like Amazon workspaces, employees are offered additional flexibility as they now have the ability to use their personal computers to bridge to remote desktops which convert the personal to professional. As evidence of the massive move to remote and work-from-home, AT&T has recorded a near 700% surge in user connections to VPN networks. "These were customers in healthcare, financial services, and other vital segments around the world. And AT&T was able to accommodate that demand surge without missing a beat. Just a few years ago, that would have been impossible. In fact, we've been adding more capacity to be ready for future needs..." (Robuck, 2020).

Due to the developments in wireless networks to become more supportive, the number of unemployed has been reduced slightly, allowing the economy to maintain some semblance of life. While remote work has not been the sole reason the economy has not dropped further, it is a factor in keeping it from falling further as there are still disposable incomes which are providing purchases. While those

purchases cannot be made on site at businesses, developments in network technology has allowed commerce to continue to operate on a remote level.

E-Commerce Developments

With the sequestering of consumers, both how money has been spent and where the money has been spent has been changing. Additionally, services like GrubHub™ which provide the restaurant-delivery link, have played a large part in keeping the restaurant business from closing completely.

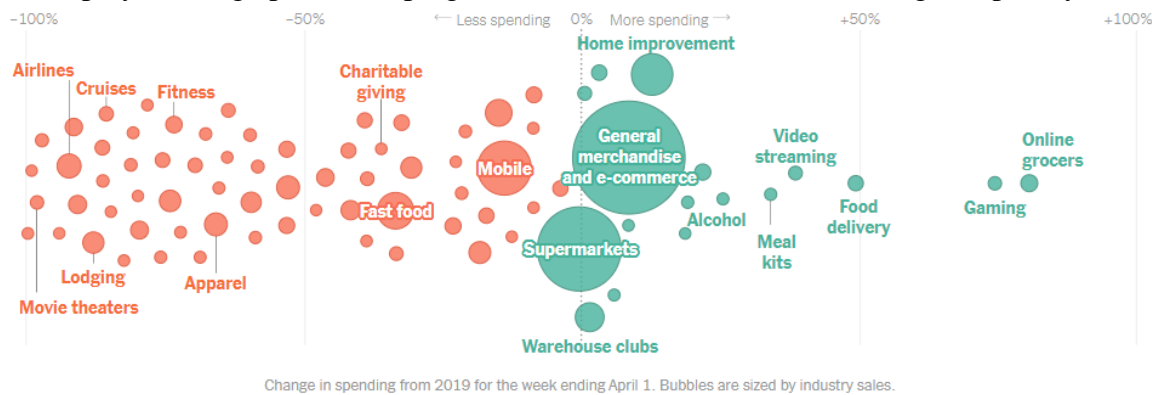


Figure 2: Changes in spending by various businesses from 2019 for the week ending April 1, 2020.

As seen in the info-graph pictured above, businesses like airlines, movie theatres, cruises, and lodging have been heavily hurt, dropping nearly 100% whereas general merchandise and e-commerce, food delivery, gaming, and online grocers have jumped heavily. The ease of access and delivery means have led to an increase in subscription services like Hello Fresh™ food deliveries. Additionally, sources like GrubHub™, DoorDash™, and UberEats™ have seen substantial increases in not just the frequency of ordering (up 70% year over year) but also in the volume of food ordered (order size was up 24%) (Savitz, 2020). That said, the accessibility of delivery services connecting user devices to restaurant menus has allowed restaurants to remain in operation, allowing individuals to remain employed as well as allowing users to remain at home and limit exposure in public places like supermarkets. To that point, stores like Walmart™ and Kroger™ have also seen increased usage of their online order-to-pickup application which allows users to purchase their groceries, then come to pick them up without having to enter the store. Other businesses have taken note and have implemented similar processes like BestBuy™, who have converted stores into pickup locations for those who shop online. Given the quarantine, it has become more important than ever to be connected and offer services online as, without, stores have no other choice but to shutter and wait until businesses can safely reopen their physical locations.

Implications of Magnified Data Use

As mentioned in the previous sections, COVID-19 has halted many social aspects of everyday life but, given developments in technology, work arounds have been created, allowing individuals to leverage VoIP and conferencing technology to connect to friends and family as well as doctors and healthcare professionals and their employers. Given the broadness and ubiquity of streaming, the question has become: will this increased pressure break the internet? The answer from internet service providers has been an assuredly not. However, the problem has not been with the capacity of users but rather the

spiking usage. As such, broadband download speeds had been recorded in many Asian countries though fixed broadband has fared much better. Regardless, streaming services, telecom operators, and users all have a joint responsibility to take the steps necessary to ensure the smooth functioning of the internet. To this effort, Netflix™ has reduced the quality of their stream-able movies and television shows to reduce the load on European networks by around 25% (Fleming, 2020). Other internet service providers are continuing to add additional network capacity such as Vodafone™, who is providing more capacity and network services to hospitals and doctors in the UK, and Comcast™, who eliminated data caps on cellular phone bills and opened additional wireless hotspots to customers and non-customers alike (Fleming, 2020). Unfortunately, though, many countries operating on older, 2G networks are not capable of handling this increased traffic and may struggle through the pandemic.

5G Network Roles

Given the heavy increases in traffic to download and spikes in activity, the general notion would be toward galvanizing 5G networks. By using data frequencies, data can be transmitted at much, much faster rates but the notion of the frequencies have drawn safety concerns which may have been exacerbated by the COVID-19. Prior to COVID-19, 5G was no stranger to health concerns, as there had not been research enough to provide beyond reason of a doubt that the frequencies would not have lasting health concerns. While there have been some studies which have tracked no discernable health concerns to using 5G networks, coupled with misinformation from incorrect research has created a spectrum of concerns and 5G networks has become a convenient bogeyman to explain for illnesses. In 2019, physicist Bill Curry published data explaining 5G networks were linked to tissue damage without considering human physiology shielded such radiation from the brain (Heilweil, 2020). Since then, individuals like Alex Jones have broadcasted less solidified statements, not founded on official research or by collecting research confirming their biases, which has galvanized a more ‘tin-foil hat’ community which has been looking to place 5G networks as the silent problem causing many modern health problems today. COVID-19 has become the most recent ailment caused by 5G radio frequencies, leading to the arson and destruction of several 5G radio towers in Europe (Heilweil, 2020). Whether or not 5G networks have lingering effects on health is still being researched but it would be hard to believe that 5G-COVID-19 connections would be effectively silenced given the connectedness of today’s economy.

Conclusion and Implications

As with social media and applications, one thing has been certain about the new age of digital technology: consumers have a great deal of information at their fingertips and becoming connected with others is incredibly easy. However, the danger now lies in discernment as users have *everything* accessible to them, including content that is unfounded or is developed not to solve for an issue but instead to earn profit. The notion of manipulating accessibility to create profit margins is particularly dangerous as non-credentialed individuals can easily drum up fervor or fright to sell products. This messaging is easily mixed in with more informed content. Ultimately, the ease and convenience which has been provided by developments in applications and technology has transitioned where effort is exerted. Information is widely accessible, but caution and care need to be made on an intellectual level to discern whether content is biased or manipulative. Regardless of how information is consumed, it is more readily accessible though, and due to this, it provided unprecedented visibility into the rapid

development which led to a more rapid response. While COVID-19 is very much still affecting the global community, the final impact is uncertain in terms of mortality. However, it will assuredly be far lower compared against an unconnected world. Additionally, many of the developments under quarantine-times are likely getting their first pressure tests for development in a future world without the virus. With stouter e-learning, education providers can extend their classes to the global community rather than regional areas and companies can save overhead if there is no physical office but rather a virtual one. VoIP, video conferencing, supportive fast and reliable networks (whether 5G or otherwise), will be the keys to unlocking these next steps. Additionally, from a user perspective, personal health may take giant leaps in providing increased accessibility to mental and physical healthcare providers. By leveraging smart technology, biometric data may lead to early detection on illnesses leading to improved quality of life.

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