Influence by Design: Big Tech's Impact on Mental Health

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Trevor Williams

Spring 2020

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

S. Travis Elliott, Department of Engineering and Society

<center>**STS Research Paper**</center>

Introduction

The modern world is built off connectivity. The U.S. Census found that 84% of households have at least one smartphone (2021). Likewise, the average number of apps installed on a smartphone is 35 (Think with Google, 2016). The smartphone has facilitated an era of social media where anyone can stay up to date with their interests. Facebook and Twitter are popular platforms for users to look at posts they find relevant. These apps take advantage of a feature known as the infinite scroll which allows users to never run out of posts to look at, ultimately increasing screen time (Jovicic, 2021). As screen time increases, there has been a correlated increase in use of mental health services among college students (Lattie et al., 2019). While just a correlation, it raises concern about how much influence tech companies have and whether they are exploiting the users.

STS Framework

The science and technology studies framework that will be used to analyze this problem is social construction of technology (SCOT). SCOT emphasizes that technology is shaped by social factors. The two main parts of SCOT are interpretative flexibility and closure. Interpretative flexibility utilizes relevant social groups to explain various designs for technology that stems from differing problems (Pinch & Bijker, 1984). A social group is any group of people, organized or unorganized, that are affected by the technology in question. The closure aspect of SCOT examines how the need for differing designs eventually decreases as the technology evolves (Pinch & Bijker, 1984).

<center>1</center>

The issue of compulsive device use is one without closure. Many different designs to smartphone technologies have been suggested from different social groups. Some types of social groups include tech companies, groups against unnecessary device use, and content creators. Through analysis using SCOT, it will become clear that each social group has its own agenda. The current state of design most closely resembles that of the tech companies as they seem to hold the most power.

Rise of the smartphone

A fundamental reason why screen time is increasing is because of the constant access one has to their smartphone. But a smartphone is only smart because of its connectivity features that allow for more applications than traditional phones. One of the earliest smartphones was the BlackBerry, a non-flip phone with a physical QWERTY keyboard. It was nicknamed the "CrackBerry" for its addictive nature (Harris, 2006). However, it wasn't until Apple released the iPhone in 2007 that smartphones began to take form to what we see today. It was the first touchscreen smartphone that focused on the finger as the primary driver instead of a stylus (Whitwam, 2011). In terms of connectivity, it allowed for full webpages to be rendered using HTML, a feature previous devices didn't have (Levy, 2011). Perhaps even more influential, it introduced the app store and developer tools. This meant that anyone could release applications for the iPhone that any user could download (Apple, 2018).

After the release of the iPhone, Google created Android OS and the first Android phones was released in 2008. Android is based off Linux, an open-source operating system. Since Linux is open source, the Google engineers were able to modify the code to fit their needs (Hoffman, 2017). Likewise, a Linux based OS allowed for the necessary computing infrastructure to compete with the iPhone. Throughout the years, Android and Apple phones have coevolved to

what we know today. They both have similar and engaging features to allow for any application a user can imagine.

Emergence of social media

Social media is one of the driving forces for why people use their smartphones every day. However, early social media was created for the computer. Facebook, Reddit, and Twitter all were released before 2007 and therefore before the iPhone. Yet, the idea of following people and topics that one found interesting was attractive. Facebook led the charge with 14 million users in January of 2007 (Vogelstein, 2007). Impressive numbers considering the state of the internet and technology. However, with the advancement of smartphones and creation of app stores, social media adapted. Platforms like Instagram and Snapchat emerged with a target audience on mobile. Facebook, Reddit, and Twitter all created apps of their own and it became clear that the ideal device for social media lived in our pockets.

Analysis

The current state of device use comes from one of the primary social groups, tech companies. Tech companies are profit driven and their current approach is to keep users engaged and active on their apps. Therefore, the apps are designed specifically to push users to keep using it. YouTube, for example, employs an algorithm to recommend the next video for the user to watch. It has been found that this algorithm favors recommending videos with longer length than the current one being watched (Ferreria and Agante, 2020). Similarly, TikTok's user personalized video recommendations elicit brain activity that hinders the user's self-control, ultimately allowing for increase app usage (Su et al., 2021). This means that as users scroll through their infinite TikTok feed, their brain can enter a mode in which it becomes difficult to

3

stop scrolling. As a result, Su et al. concluded that 5.9% of TikTok users may have problematic use patterns.

Besides algorithms, tech companies utilize choice architecture by displaying choices that favor consumption. YouTube has autoplay on by default meaning the next video will start playing automatically after the current one finishes. Streaming services like Netflix do the same thing with episodes from TV shows. The companies are hoping that the user accepts the default option and continues to use their app. Other apps like TikTok and Tinder were designed so that the desired content is the first thing the user sees when they open the app. For TikTok, the "for you" page automatically starts playing videos as soon as the app is opened meaning the user is exposed to the recommended video algorithm right away. The first thing one sees on Tinder is their potential matches. As soon as the user decides to like or not like the current person, the next person is immediately presented.

Tech companies' motivation for profit is the reason we have the consumption focused model of modern apps. As SCOT would suggest, they solved their problem of gaining revenue with the current design scheme. Of course, this scheme is only in use because the tech companies currently hold most of the power. However, the cost of such a model is placed on the users. As a result, the fear of missing out is a popular phenomenon amongst social media users. They feel as if they need to constantly be using the apps and staying up to date so that they don't miss out on any important event or information. Similarly, these apps help push users to consume a lot of content from the same content creators which may ultimately create parasocial relationships. In terms of YouTube, these parasocial relationships then become a strong factor in developing an addiction (de Berail et al, 2019). The costs to users are what motivates other social groups to suggest different approaches to technology use.

These other social groups include those that are against unnecessary device use. Parents Against Phone Addiction in Young Adolescents (PAPAYA) believes that social media apps have been created to "increase their persuasive technology and keep young people hooked" (PAPAYA, n.d.). However, their proposed solutions to combat addiction revolve around how to control their children's use of technology. For popular social media apps, they provide specific steps to parents on how to restrict their kid's account to be private, have time restrictions, and limit inappropriate content. A group with a similar goal is End Child Surveillance. However, they believe that tech companies are at fault for compulsive device use. They argue that features like YouTube autoplay push kids towards harmful content to maximize profits (End Child Surveillance, n.d.). These two groups and others like them exhibit interpretative flexibility quite strongly. They both want technology to be less addicting and harmful towards children, but their approaches differ slightly. PAPAYA's approach is the focused-on restrictions whereas End Child Surveillance is pushing for fundamental changes towards the technology.

Support groups is another category of social groups that like PAPAYA, separate the solution from the tech companies. Internet and Technology Addicts Anonymous (ITAA) is an online support site that offers a 12-step program like Alcohol Anonymous. Therefore, their program is centered "around the concept of a power greater than ourselves" (ITTA, n.d.). Likewise, Foothills at Red Oak Recovery offer treatment programs to adolescents for social media addiction. They argue that while "a social media addiction treatment center may seem unnecessary, it can be quite useful for this condition" (Foothills at Red Oak Recovery, n.d.). The primary focus of these support groups is to help those that suffer from addiction, not to prevent it. Interestingly, these groups have a monetary incentive to only focus helping those with addiction. ITTA takes donations and Foothills at Red Oak Recovery charges for their services. It

may be true the support groups envision the current state as the ideal design. After all, they can spread their views and gain revenue with the current state. If a different design were to be agreed upon, these groups may lose out on that.

One more type of group worth mentioning is the content creators. These are the people that make the videos and other posts that users consume. There are many examples of a creator gaining a large following and can make a career out of content creation. They can do this because the app will pay them to run ads on their posts. However, it is unclear as to whether the current state of the apps is ideal for the creators. On one hand, compulsive device use would lead to more users posts consumed, more ads watched, and therefore, more money for the creators. On the other hand, posts have been made to combat unhealthy technology habits. For instance, creators on TikTok have put out videos urging people to take a break from the app (TikTok Tips, 2020). These videos are intended to show up on the users' feed when they have spent hours on the app. A different example that addresses the problem of parasocial relationships is that some YouTube creators have published videos with titles like "I Am Not Your Friend" (Ludwig, 2020).

The special thing about content creators is that they hold a lot of power. After all, it is their videos that the algorithm uses, the ads run on, the people watch. But for many of the popular creators, making content is their full-time job. It is logical that there is no clear consensus about the current state of technology amongst content creators. Challenging the current design could mean a potential drop in revenue. Becoming complacent with the current design could mean a growth in parasocial relationships and the negatives that come with them. Negatives including a creator being harassed by followers from another creator because of drama between the two. One possibility for the unclear consensus is that smaller income creators would

rather keep the current design to maintain their income whereas larger creators would rather take a reduction in pay to combat the issues that arise with compulsive device use.

Discussion

As SCOT suggests, closure is the goal of these differing perspectives and designs. However, does the current model need to change? After all, the user voluntarily downloads and opens the apps. Why should the technology change because some users spend too much time on it? Plus, some of the tech companies provide resources for those having problematic habits. For instance, Instagram has a help page about steps that can be taken for someone experiencing thoughts of self-harm. One suggestion is "physically stepping away from social media for a while" (Instagram, n.d.). Likewise, they elaborate on how to control the content the user sees to create a healthier environment. Similarly, the TikTok channel that posts videos urging users to take a break is run by the site. It seems that both Instagram and TikTok would insist that the issue with bad habits stem from the individual and not the app. With the combination of resources from the companies and accessibility to support programs, it is possible for someone to get help.

However, is it fair to ask the user to stay off an app when the app was designed to maximize screen time? Likewise, what is the point of social media apps if the user can't safely feel like they can use it? Social media has many practical applications from running a business to staying in touch with old friends and to try and advise people to not use it in a world that relies on connectivity, seems impractical. Plus, an argument could be made that the actions of these tech companies are unethical. Designing apps to maximize profits at the expense of the user may be making society worse off. Regardless, differing design suggestions from groups mentioned

before are justified. Putting in preventative measures for addiction in the technology instead of just treating the individual is a viable path towards closure.

However, the tech companies hold most of the power and have no real incentive to change their apps. One way change could come about is through government intervention. The government could force tech companies to vet their algorithms, supply more and easily accessible resources about mental health, and be more transparent about how to add app restrictions. These suggestions would still maintain the core functionality of the app while facilitating a healthier user experience. These changes could come about in a more organic way as well. While tech companies are the power holders, the content creators could band together to demand change. Since the content creators are the reason most of these apps work, they may be able to get the attention of the tech companies. However, as mentioned earlier, it is unclear as to how all the creators feel, making this path unlikely.

Conclusion

The modern tech company exists today due to the rise of the smartphone and social media. These tech companies have designed their apps to maximize the time spent on them and therefore maximize profits. As a result, users mental health suffers by ways of addiction, parasocial relationships, and more. Groups against unnecessary device use such as PAPAYA and End Child Surveillance have fought to actively bring attention to this issue. However, with most of the power residing with the tech companies, it will take government intervention or the next most powerful group, content creators to elicit change.

References

Apple. (2018, July 5). The App Store turns 10. https://www.apple.com/newsroom/2018/07/app-store-turns-10/

de Berail et al. (2019). The relations between YouTube addiction, social anxiety and parasocial relationships with YouTubers: A moderated-mediation model based on a cognitive-behavioral framework. *Computers in Human Behavior 99* (Oct.), 190-204. Web of Science.

End Child Surveillance. (n.d.). *End Child Surveillance*. https://www.endchildsurveillance.com/

Ferrerira, MR and Luisa Agante (2020). The Use of Algorithms to Target Children while Advertising on YouTube Kids Platform: A reflection and analysis of the existing regulation. *International Journal of Marketing Communication and New Media 8* (May), 29-53. Web of Science.

Foothills at Red Oak Recovery. (n.d.). Social Media Addiction. https://www.foothillsatredoak.com/adolescent-treatment-center-nc/process-addiction-treatment-center/social-media-addiction-treatment-center/

Harris, D. (2006, August 23). 'Crackberry' Addiction. https://abcnews.go.com/WNT/Technology/story?id=2348779

Hoffman, C. (2017, July 12). Android is Based on Linux, But What Does That Mean? https://www.howtogeek.com/189036/android-is-based-on-linux-but-what-does-that-mean/

Instagram. I'm having thoughts about suicide or self-injury ... Instagram Help Center. (n.d.). https://p-upload.facebook.com/help/instagram/506877722821421?helpref=uf_permalink.

ITTA (n.d.). (Internet and Technology Addicts Anonymous). Tools of Recovery. https://internetaddictsanonymous.org/resources/tools-of-recovery/

Jovicic, Suzana (2020). Scrolling and the In-Between Spaces of Boredom: Marginalized Youths on the Periphery of Vienna. *Ethos 48* (May), 498-516. Web of Science.

Lattie et al. (2019). Technology and College Student Mental Health: Challenges and Opportunities. *Frontiers in Psychiatry 10* (Apr.). Web of Science.

Levy, S. (2007, June 25). First Look: Test Driving the iPhone. https://www.newsweek.com/first-look-test-driving-iphone-102625

Ludwig. (2020, December 27). I Am Not Your Friend [Video]. YouTube. https://www.youtube.com/watch?v=WzyQbfh4t_8

PAPAYA (n.d.). (Parents Against Phone Addiction in Young Adolescents). Solutions. Papaya Parents. https://www.papayaparents.com/solutions

Pinch, T. J., & Bijker, W. E. (1984). The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other. *Social Studies of Science*, *14*(3), 399–441. http://www.jstor.org/stable/285355

Su et al. (2021). Viewing personalized video clips recommended by TikTok activates default mode network and ventral tegmental area. *Neuroimage 237* (Aug.). Web of Science.

Think with Google. (2016, October). Average Number of Apps Installed on Smartphones. https://www.thinkwithgoogle.com/marketing-strategies/app-and-mobile/average-number-of-apps-on-smartphones/

TikTok Tips. [@tiktoktips]. (2020, January 13). Pause your scrolling. Time for a night time snack break! [Video]. TikTok. https://www.tiktok.com/@tiktoktips/video/6781608784990178566

Vogelstein, F. (2007, September 6). How Mark Zuckerberg Turned Facebook Into the Web's Hottest Platform. https://www.wired.com/2007/09/ff-facebook/

Whitwam, R. (2011, October 7). How Steve Jobs killed the stylus and made smartphones usable. https://www.extremetech.com/computing/98923-how-steve-jobs-killed-the-stylus-and-made-smartphones-usable