The Effects of Techniques Used by App Developers to Retain Users

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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

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Introduction

"There are only two industries that call their customers 'users': illegal drugs and software" (Orlowski, 2020). This quote by Yale Computer Science Professor Edward Tuftle effectively portrays the massive tech industry, as companies have spent years and millions on research and engineering to evolve their apps to use specific techniques in order to optimize user retention. This paper will be focusing on the influence that these apps have on users, specifically looking into the techniques that app developers use to manipulate users to make the users spend more time on the platforms in order to drive engagement on the platform. The problem is that the technology companies tend to focus solely on revenue generation without considering the potentially harmful effects that these techniques have on their users, and there is no regulation preventing this problem. There is currently literature and media describing the problem of phone addiction that these companies perpetuate. However, there is limited information regarding the background and motivations behind designing these technologies, since the majority of this information is proprietary and unreleased by the companies who develop them.

As people become more and more reliant on mobile technology, it is extremely important to fully understand this problem and the effects of these technologies in order to ensure that long-term, detrimental harm is not inflicted on them. It is also important to fully understand this issue in order to effectively determine whether or not regulation is necessary, and if so what regulation could potentially look like. Overall this paper will attempt to bridge the understanding between a company's motivations and the development of addictive, manipulative techniques on their mobile apps and how it potentially affects the users negatively, ending with a discussion on possible regulations that could be enforced by the government.

Background

App success is directly related to how much revenue the app generates. There are two main paths to monetization that apps use to generate revenue - direct purchasing (ex. subscriptions, in-app purchases, paying to download the app) and advertising (free for users). The majority of the most downloaded apps in the world, such as Instagram, Facebook, TikTok, Google, Snapchat, Twitter, along with many others, use the advertising model to generate revenue, as they allow users to use the platforms completely for free (Curry, 2022). Since users are able to use apps for free, revenue is directly tied to how much time they spend on the app: more time spent on the app leads to more advertisements being shown. As Tristan Harris, former Design Ethicist at Google, puts it: "[Users'] attention is the product being sold to advertisers" (Orlowski, 2020). While users believe that they are using the applications for free, they are actually the product themselves, as they are giving their attention and data to the apps in order to increase the success rate of advertisements. For these types of companies, in order to get more funding and increase valuations, they need to increase the amount of time that people spend on their apps (Andersson, 2018). It's not just enough to get the users on the platform initially - research and engineering need to be done in order to continuously increase the average daily time spent on the app.

In order to increase daily time spent on their apps, some companies will directly target the psychology of humans in order to effectively manipulate their users. Many of the biggest development companies have entire teams of engineers dedicated to "growth hacking", whose job is to hack people's psychology so they can get more growth, such as more user signups and more engagement (Orlowski, 2020). Previous VP of User Growth at Facebook Chamath Palihapitiya explains "We want to psychologically figure out how to manipulate you as fast as possible and then give you back that dopamine hit. We did that brilliantly at Facebook" (Orlowski, 2020). Companies such as Facebook work to specifically increase the amount of

dopamine, a type of neurotransmitter that plays a role as a "reward center", that you get from using the app since an increase in dopamine is directly correlated to developing an addiction (MACİT et al., 2018). They use the psychological technique of positive intermittent reinforcement in order to keep users constantly checking their devices (Wilding, 2017).

There are a multitude of different techniques that have been developed and are used across many popular apps in order to increase retention and engagement. One such example is the infinite scroll, developed by engineer Aza Raskin (Andersson, 2018). This is a design technique where apps will automatically load the next page of content or next video so that the user can keep scrolling "infinitely". Another such example is the use of log-in streaks. Apps such as Duolingo and Snapchat gamify their platforms by introducing usage streaks in order to keep users engaged and coming back to their platforms. Apps also take advantage of the phone's built-in notification system. For example, when a user doesn't log in for a while, apps will send a notification reminding them to come back. This paper will dive into how these techniques work and examine their effectiveness.

Sources

The research paper will make use of a wide variety of different sources of evidence in order to fully understand the design and effectiveness of these techniques, the impact the techniques have on users, and the regulation that could possibly be introduced. To understand the motivations for designing these manipulative techniques, the paper will include quotes from interviews and articles of past executives and engineers at technology companies such as Facebook and Google. To show the effectiveness of the techniques, the paper will utilize screen time and app usage statistics over time. The paper will also take advantage of public documents and information released by the companies themselves to shareholders that describe company

motivations to increase daily active user and engagement metrics. One example of this is the public Duolingo Engineering Blog which describes the “habit-building research behind your Duolingo streak” (Mansur, 2022). To understand the effects of these techniques on users, the paper will dive into psychological literature describing the effects of certain mobile apps on users’ psyche (Neyman, 2017). The paper will then look at critiques of addictive techniques by certain critics, such as those at the Center for Humane Technology. Finally, I will look at transcripts of congressional hearings, such as the Senate hearing on persuasive technology (*Disrupting Dangerous Algorithms: Addressing the Harms of Persuasive Technology*, 2021) and the testimony of Mark Zuckerberg regarding Facebook’s data and misinformation principles to better understand the government’s view on some of these technologies and gather information on how possible regulation has been pitched (*Zuckerberg Testimony*, 2020). To gather evidence, I initially searched for primary sources that involve the topic of developing applications with the goal of making users spend more time on them. I chose sources that include quotations from employees at technology companies because these sources clearly show the motivation behind certain development techniques. I also searched for literature regarding scientific links between dopamine and social media use, as well as the role of dopamine in addiction, and for primary sources such as hearings with technology executives.

Discussion

As mentioned above, there are many different techniques that companies have developed in order to increase user engagement. Implementing "streaks" in their apps is one strategy tech companies employ to boost user engagement. Streaks are essentially a count of how frequently a user has used the app over a specific period of time. Examples of apps that make use of this strategy include Duolingo and Snapchat. Users of Duolingo are encouraged to keep up their daily

streaks by collecting points and unlocked achievements. On Snapchat, users can construct streaks by sending each other photos on successive days.

Streaks were developed for the purpose of making it a habit for a user to use the app. As Duolingo describes on their engineering blog, their team utilizes “habit-building research” in order to develop this feature, and that it helps the user become more consistent in using the app in order to help them reach their language learning goals. They have a team of engineers and designers developing this feature in order to make “extending your streak feel as satisfying as possible”, and they have data showing that the streaks make a difference in terms of user engagement (Mansur, 2022).

With this blog post, Duolingo themselves are saying that they developed the streaks feature in order to make it more motivating for the user to use the app. They mention that this helps the user hit their language learning goals, which can be considered a positive consequence for the user. Users feel pressured to use the app consistently because of streaks, which appeal to their drive for accomplishment and consistency. However, the app is also getting the benefit of more user engagement, which in turn may lead to the user becoming a paying customer, which is ultimately the end goal of the app.

Another strategy used by tech companies to increase user engagement is the implementation of "infinite scroll" on apps or websites. Users can scroll through content forever with infinite scroll without needing to click the "next" or "page" buttons. All major social media websites utilize this technique: TikTok, Instagram, Facebook, Twitter, Reddit, etc. The purpose of infinite scroll is to keep users engaged by providing a constant stream of new content, making it easier for them to consume more and more information.

The engineer who initially designed infinite scroll in 2006, Aza Raskin, said that he and many other designers were driven to create addictive app features by the business models of the

big companies that employed them. "If you don't give your brain time to catch up with your impulses," Mr. Raskin said, "you just keep scrolling." He describes techniques such as infinite scrolling as "behavioral cocaine", and that it's "the thing that keeps you like coming back and back and back" (Andersson, 2018). An experiment was performed in order to test the impact of infinite scrolling - some participants in the experiment were told to download the "Stop Scrolling Facebook" Google Chrome extension that was designed to stop interrupting the user every 5 minutes while scrolling through Facebook and ask if they would like to continue scrolling. They used Facebook for 2 weeks - one with the extension enabled, and one with the extension disabled. The experiment showed that the participants spent an average of around 10 more minutes on Facebook without the interruption than with it, going from an average of 9.2 minutes spent to 19.7 minutes spent (Neyman, 2017).

The infinite scroll allows the user to continuously scroll through content and stay on the app before the brain can realize what's happening, and was implemented within companies with the intent of increasing user engagement. As seen by the experiment, this technique encourages users to stay on the site for longer periods of time, as they are more likely to continue scrolling through content rather than navigating away. Without the scrolling interruption extension, the users would spend an average of double the amount of time on the website.

Tech companies also utilize notifications in order to subtly remind users to come back to their app. Notifications are a way for apps to alert users of new activity or updates, such as new messages, friend requests, or breaking news, and serve as a constant reminder to users to check the app. Studies show push notifications can boost app engagement by 88% (Shukairy, 2022). Research by Tandoc et al. in 2015 has shown that exposure to notifications can lead to compulsive checking, which further contributes to app addiction (Tandoc et al., 2015). App developers utilize the dopamine-driven feedback loop, where the anticipation of receiving a

notification and the reward of a social interaction triggers the release of dopamine in the brain, reinforcing the habit of using the app (Alter, 2017). Notifications are used as intermittent variable rewards (Tandoc et al., 2015), which give users a dopamine rush. Furthermore, apps often display notification badges or banners, which can trigger the Zeigarnik effect, the psychological tendency to remember incomplete or interrupted tasks, compelling users to open the app and clear the notification (Harner, 2023). As a result, users are more likely to engage with the app even when they do not necessarily intend to use it, fostering a habit that can eventually lead to addiction.

As shown above, apps utilize various techniques in order to make the user spend more time on their platforms. Year over year, users spend more time on their devices, likely partially as a result of these techniques (He, 2019). These companies consider this result as beneficial, as the more time a user spends on their app, the more money they can make from them. Although this result may be beneficial to the companies, it has shown to have negative consequences for the user.

"The short-term, dopamine-driven feedback loops that we have created are destroying how society works", explains former VP of User Growth Chamath Palihapitiya. Aza Raksin, inventor of the infinite scroll, says "One of my lessons from infinite scroll: that optimizing something for ease-of-use does not mean best for the user or humanity" (Raskin, 2019). Many studies have connected excessive social media use to poor psychological health, and scientists have discovered a connection between mental health problems and increased social media screen time (Twenge et al., 2018). Rates of depression and suicide have increased especially among young people who use social media apps (Lin et al., 2016). There is evidence of clear association between screen time and lower psychological well-being among children ages 2-17, and they

show less curiosity, self-control, and emotional stability. As described in a study, twice as many high users of screens had an anxiety or depression diagnosis vs low usage (Twenge et al., 2018).

Former VP of User Growth Chamath Palihapitiya highlights the damaging nature of these dopamine-driven feedback loops on society. Similarly, Aza Raskin, the inventor of infinite scroll, regrets optimizing for ease-of-use at the expense of user welfare and broader social implications. Research has consistently linked excessive social media use to poor mental health, with increasing evidence demonstrating a correlation between mental health issues and prolonged screen time. Rising rates of depression and suicide, particularly among young social media users, underscore the gravity of the situation, and these findings emphasize the urgent need to reevaluate the design principles that govern app development in order to prioritize user well-being over profit.

With the alleged harm that some apps cause on users, some call for government regulation on apps. Some government officials seem to be aware of the harm that social media and other apps do to consumers. Utah Governor Spencer Cox stated the state of Utah will sue social media corporations to address the harm that digital platforms are causing to Utah's youth's mental health (Coombs, 2023). “You can expect that any lawsuits we filed together will include demands for safeguards commensurately higher given the importance of what is at stake, the well-being of our kids”, says the Governor. In February 2023, President Biden called for limitations on social media companies. “We must finally hold social media companies accountable for the experimenting they’re running on children for profit”, he says. School districts are also looking for regulation, as the Seattle school district sued social media companies, complaining that its students have been harmed by social media’s negative effects on youth mental health (Shen-Berro, 2023).

Although many have called for regulation and have sued social media companies, no regulation policies have been implemented so far. Policymakers face the challenge of finding a balance between preserving the innovative spirit and potential benefits of social media while mitigating its negative effects on users. The continued push for regulation underscores the growing awareness of the need to prioritize user well-being and mental health in the digital age. It is important that all stakeholders - government, tech companies, and users, engage in dialogue to identify and implement effective solutions that address the harmful consequences of social media and app usage.

Conclusion

This paper has highlighted the various addictive design techniques employed by apps, such as infinite scroll, streaks, and notifications, and their subsequent negative impact on users, particularly in terms of declining mental health among young people. As the evidence of harm continues to accumulate, calls for government regulation have become more prominent in order to protect users, especially vulnerable populations, from the detrimental effects of these apps. With potential regulation, the goal should be to foster a digital environment that promotes user well-being, mental health, and responsible engagement, without stifling innovation or infringing on the core principles of freedom and expression that the internet was founded upon. Next steps in terms of research could be to look into specific regulations that could be passed on social media companies and the potential impact of these regulations.

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