Multimedia Experience that Increases Physical Activity
(Technical Paper)

The Ethics of Addictive App Design: Determining Accountability and Prevention Strategies for Dangerous App Designs
(STS Paper)

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Systems Engineering

By
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November 1, 2021

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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

Currently an estimated 2.71 billion people have or use smartphones (Montag, 2019). These widely used handheld computers have drastically changed the way people connect and communicate with each other and the world around them. Beyond the technological capabilities for connection and information, smartphones and their applications may be rewiring users' brains to develop dependency on the device (Vuong, 2017). This proposal will be exploring how people interact with smartphone apps through the lenses of a capstone design project and an ethical analysis of intentionally addictive apps.

The capstone group partnered with a Netflix representative to work towards creating an interactive feature for Netflix's web application (app) to increase engagement and variety of options for the streaming service. The team decided to create a new interactive cooking show that will allow users to follow along with a recipe entirely hands free. In addition to the gesture and voice recognition, the team is also redesigning how recipes are presented to users and proposing that recipes do not necessarily have to be given in linear steps. Once completed, the technical project will yield a detailed report and prototype of an app that increases physical and mental engagement from users.

While working on designing an app, the second project in this proposal will be researching the ethical components of app design and identifying points for accountability within the design and production processes. Researchers have discovered certain design techniques that make apps more addicting, and therefore profitable (Neyman, 2017; Scales, 2020). Designers are not utilizing these techniques because they align to the values of addictive design, instead they are caving to market pressure and monetization options (Ekambaranathan, 2020). Addictive

design techniques are not officially regulated and can cause significant harm to users. This project will ultimately lead to the completion of a research paper that identifies potential areas of ethical accountability in app design to ensure user safety.

Multimedia Experience that Increases Physical Activity

How can Netflix combine audio, textual, and/or visual components to create an active user experience outside of Netflix's existing products?

Digital entertainment has become the norm over the past decade. While movies have always garnered widespread enthusiasm since their inception, the rise of streaming services that also stream TV series, games, live sports, and more in the palm of one's hand has undoubtedly changed the way people consume media. Netflix has been the driving force in this industry. Their continued desire to develop new forms of entertainment to their user base has culminated in the project of Professor Gregory Gerling's Capstone team.

The project aims to reimagine the Netflix multimedia experience, specifically in terms of a cooking use case. Many platforms such as YouTube, Hulu, and Netflix themselves, offer one-dimensional cooking experiences with little engagement. Specifically, a subject is typically filmed in a single continuous video that requires no decision-making from the user. This continuous video follows a linear recipe that at times has arbitrary ordering of instructions. YouTube specifically has adopted this linear concept and developed the key moments feature to provide better visual aids for their users (figure 1).

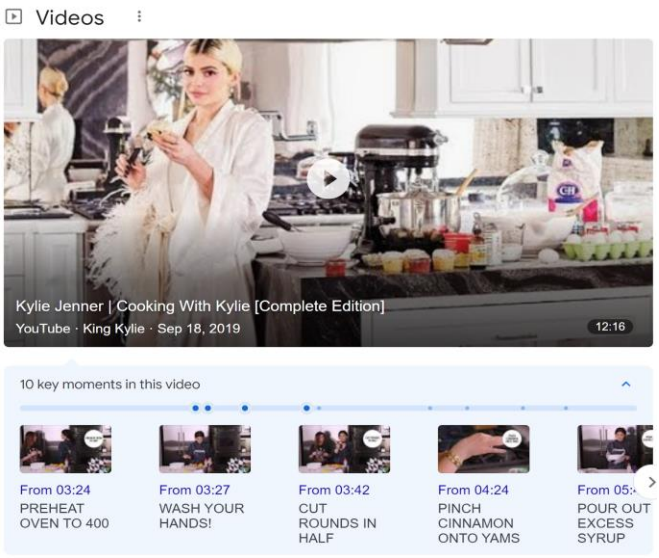
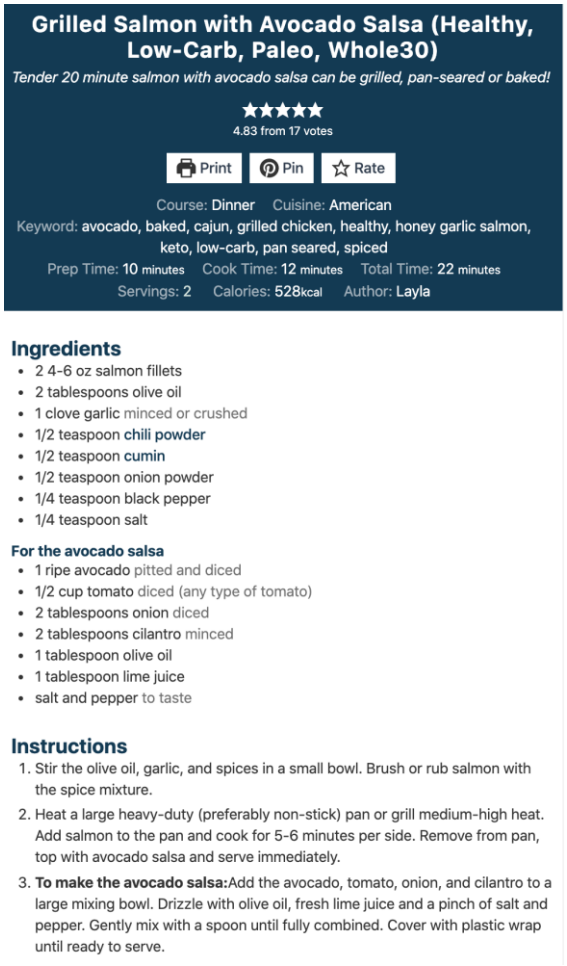


Figure 1. Example of a linear recipe being conveyed through a tutorial with key moments displayed through a timeline (Jenner, 2019).

However, this concept of linear recipes has limitations due to the arbitrary ordering of steps. For example, in figure 2 the recipe has two primary components: grilled salmon and avocado salad. These components are independent until the last step where they are plated together. Thus, this joining of components develops a pain point that disregards the user's preferences and circumstances. In this recipe, the user would have their salmon sitting out getting cold while they make the salad. If the user preferred their salmon piping hot, it would be advantageous to move step three as step one.



Grilled Salmon with Avocado Salsa (Healthy, Low-Carb, Paleo, Whole30)

Tender 20 minute salmon with avocado salsa can be grilled, pan-seared or baked!

★★★★★
4.83 from 17 votes

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Course: Dinner Cuisine: American
Keyword: avocado, baked, cajun, grilled chicken, healthy, honey garlic salmon, keto, low-carb, pan seared, spiced
Prep Time: 10 minutes Cook Time: 12 minutes Total Time: 22 minutes
Servings: 2 Calories: 528kcal Author: Layla

Ingredients

- 2 4-6 oz salmon fillets
- 2 tablespoons olive oil
- 1 clove garlic minced or crushed
- 1/2 teaspoon chili powder
- 1/2 teaspoon cumin
- 1/2 teaspoon onion powder
- 1/4 teaspoon black pepper
- 1/4 teaspoon salt

For the avocado salsa

- 1 ripe avocado pitted and diced
- 1/2 cup tomato diced (any type of tomato)
- 2 tablespoons onion diced
- 2 tablespoons cilantro minced
- 1 tablespoon olive oil
- 1 tablespoon lime juice
- salt and pepper to taste

Instructions

1. Stir the olive oil, garlic, and spices in a small bowl. Brush or rub salmon with the spice mixture.
2. Heat a large heavy-duty (preferably non-stick) pan or grill medium-high heat. Add salmon to the pan and cook for 5-6 minutes per side. Remove from pan, top with avocado salsa and serve immediately.
3. **To make the avocado salsa:**Add the avocado, tomato, onion, and cilantro to a large mixing bowl. Drizzle with olive oil, fresh lime juice and a pinch of salt and pepper. Gently mix with a spoon until fully combined. Cover with plastic wrap until ready to serve.

Figure 2. Example of a linear recipe for grilled salmon with avocado salsa demonstrating the arbitrary nature of how instructions are ordered (Layla, 2021).

The current Capstone team comprised of Nathaniel Barrington, Caton Gayle, Erin Hensien, Grace Ko, Megan Lin, and Sreya Palnati are working to not only reimagine the linear cooking experience, but also incorporate an interactive aspect through hand gestures, voice recognition, and textual elements to simplify the cooking experience and increase Netflix's user engagement.

While cooking itself is an active act, its current form within existing multimedia platforms is a passive experience which creates a contradiction. Why sit back on a couch and press play on a cooking video when the videos are rooted in connecting the chef in the show with the user's kitchen? With this Capstone project, said end-state will no longer suffice. However,

with this project, we must keep a focus on entertainment and integration with Netflix's existing portfolio in mind. At the end of the project, if successfully completed, the prototype will be researched and modified by Netflix until a launch version is built, implemented into their platform, and maintained/updated long-term. This product would ideally increase physical and mental engagement from users.

The Ethics of Addictive App Design: Determining Accountability for and Prevention of Dangerous Designs

Over two thirds of the UK population currently show signs of nomophobia, the fear of being without your phone ("66% of the Population", 2012). Phone addiction can lead to physical, mental, and emotional damages to an individual. These include but are not limited to: distraction while operating a vehicle, depression, anxiety, eye strain, back/neck issues, and exhaustion (Allred, 2020; Paek, 2017). This addiction is created by dopamine driven development of smartphone apps as well as addictive qualities that are built into the design of the iPhone for apple users (Dopamine, Smartphones & You, 2018). This paper will focus on apps in particular, but it is important to note that the design of the smartphone is intrinsically addictive as well. The three design techniques that make apps the most addictive are endless scrolling and streaming, social pressure (think "read receipts"), and social reward and positive feedback (Molaug, 2019). Many of the features that make an app addictive are on the experience side of the design rather than the interface (Montag, 2019). Through analysis of the consequences of addiction and the design techniques that lead to them, this paper will attempt to identify practical points of accountability with actionable potential so that some form of regulation may be created moving forward.

The STS frameworks to support this analysis are Technological Momentum and Actor Network Theory. Technological Momentum will help to describe the current state of smartphone apps, between SCOT and Technological Determinism (Hughes, 1994). In the early stages of professional app development, apps were designed to meet consumer desires and needs, following the SCOT framework (Klein, 2002). However, as more people become addicted to the apps, a certain reliance on and melding by the technology comes into play. App technology is still influenced by societal and cultural standards but has clearly shown that it can influence those standards as well. As the system continues to age, it will lean towards Technological Determinism and society may lose control over this potentially dangerous creation (Smith, 1994). Technological Momentum is critiqued as being too broad a framework, as the give and take between technology and society can fall on a variety of levels within the Technological Momentum spectrum. In order to counteract this critique, shifts of smartphone application usage and interaction with society in either direction on the Technological Momentum spectrum will be identified.

Methodologies

Research Question: What ethical points of accountability can be created in the new grey area of malicious app design to protect users?

In order to properly analyze this problem, Network Analysis and Policy Analysis methods will be utilized. For Network Analysis, the manner in which apps tie people to each other and other aspects of their own lives will be determined. In addition, the negative and positive impact of apps on an individual's health (mental and physical) will be identified. The data for Network Analysis will be pulled from personal user experiences by performing a

mapping exercise with other smartphone users. For Policy Analysis, information will be gathered on the extent of current restrictive policies to smartphones and how they came to be. The policies that will be considered are only those that have an end goal of decreasing total time spent on smartphones (or specific apps) and/or protect the mental and physical health of a device user. If there is no existing precedent, regulation on similar devices (laptops, televisions, etc.) will be explored and analyzed based on how those regulatory bodies create and uphold decisions.

Conclusion

Smartphones and their applications are a pervasive part of daily life, and their design process and regulations should be reflective of the magnitude of their impact on society. The capstone team will utilize thoughtful and intentional design in order to create a product for Netflix that allows them to increase physical and mental engagement from users and succeed in the market without compromising designer values. Navigating through the Netflix design process will aid in my STS research to identify points of accountability that have actionable potential in the app development process. Finding the proper points for accountability is essential in creating effective regulation for user protection. These potential accountability points will be explored in a final research paper to assess their validity and effectiveness in relation to the design process, business model, and user interaction.

References

66% of the population suffer from Nomophobia. (2012, February 16). SecurEnvoy. https://securenvoy.com/blog/66-population-suffer-nomophobia-fear-being-without-their-phone-2/

Allred, R. J., & Atkin, D. (2020). Cell phone addiction, anxiety, and willingness to communicate in face-to-face encounters. *Communication Reports*, *33*(3), 95–106. https://doi.org/10.1080/08934215.2020.1780456

Cressman, D. (2009). A Brief Overview of Actor-Network Theory: Punctualization, Heterogenous Engineering & Translation. https://summit.sfu.ca/item/13593

Dopamine, Smartphones & You: A battle for your time. (2018, May 1). *Science in the News*. https://sitn.hms.harvard.edu/flash/2018/dopamine-smartphones-battle-time/

Ekambaranathan, A., Zhao, J., & Van Kleek, M. (2020). Understanding value and design choices made by android family app developers. *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–10. https://doi.org/10.1145/3334480.3383064

Hughes, T. P. *Technological Momentum*. (1994). Cambridge, Massachusetts. London, England. The MIT Press.

Jenner, K. (2019, February 7). *[FULL VIDEO] Kylie Jenner | Cooking With Kylie and Victoria | Candied Yams Recipe*. Youtube. Retrieved October 28, 2021, from https://www.youtube.com/watch?v=mXGpwklKbHI.

Klein, H. K., & Kleinman, D. L. (2002). The Social Construction of Technology: Structural Considerations. *Science, Technology, & Human Values*, 27(1), 28-52. https://doi.org/10.1177/016224390202700102

Layla (2021, September 30). *Salmon with avocado salsa.* Gimme Delicious. https://gimmedelicious.com/grilled-salmon-with-avocado-salsa-healthy-low-carb-paleo-whole30/

Molaug, J. (2019). *How can designers influence the development of addictive mobile services?* https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2621773

Montag, C., Lachmann, B., Herrlich, M., & Zweig, K. (2019). Addictive features of social media/messenger platforms and freemium games against the background of psychological and economic theories. *International Journal of Environmental Research and Public Health*, *16*(14), 2612. https://doi.org/10.3390/ijerph16142612

Neyman, C. (2017). A survey of addictive software design. *Computer Science and Software Engineering*. https://digitalcommons.calpoly.edu/cscsp/111

Paek, K. S. (2017). A convergence study the association between addictive smart phone use, dry eye syndrome, upper extremity pain and depression among college students. *Journal of the Korea Convergence Society*, *8*(1), 61–69. https://doi.org/10.15207/JKCS.2017.8.1.061

Scales, S. (2020). Autonomy and addictive design. *Ethics in Biology, Engineering and Medicine: An International Journal*. https://doi.org/10.1615/EthicsBiologyEngMed.2021039591

Smith, M.R. (1994). Technological Determinism in American Culture. *Does Technology Drive History?: The Dilemma of Technological Determinism*. (pp. 1-17). Cambridge, Massachusetts. London, England. The MIT Press.

Vuong, Z. (2017). *Are smartphones as addictive as drugs?* USC News. Retrieved October 30, 2021, from https://news.usc.edu/trojan-family/are-smartphones-as-addictive-as-drugs/