

## **Video Messaging for Facebook iOS**

### **Sociotechnical Analysis of Facebook's Algorithm and Teens**

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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

For years, Facebook Inc. has made appearances in headlines for controversies surrounding their social media networks. Many of these controversies involve questionable and nontransparent data handling and user feed algorithms (Friedel et al. 2020). One example is the Cambridge Analytica scandal. Through using Facebook, Cambridge Analytica was able to use profile data of over 79 million different users to construct voter profiles for presidential advertisements in the 2016 election that targeted conservatives in the United States (US) (Deni, 2020). While Facebook wasn't the perpetrator of this data-driven election targeting, Cambridge Analytica's legal acquiring of Facebook user data demonstrates the large and potentially detrimental impact of Facebook's massive amount of collected user data in cases of misuse (Leetaru, 2021). This scandal would not have been possible, however, without Facebook's algorithm.

Facebook's algorithm does not simply show users their followings' content, but rather is designed to display content optimized for the user (Usher-Layser, 2016). This results in a filter bubble, a term coined by Eli Pariser as a "personal, unique universe of information that you live in online" (Gould, 2019). In other words, Facebook's algorithm manipulates and censors data so that users stay engaged with the app. The same data used to decide what shows up on a user's feed, generated through an interpretation of content a user likes among other factors, is also collected for internal or external research. In the case of the Cambridge Analytica scandal, Cambridge Analytica used this algorithmic data in addition to survey data for their election targeting (Cadwalladr and Graham-Harrison, 2018).

One of the largest targets of Facebook's social media algorithms comes as no surprise: teens. Instagram, Facebook's platform with the most teen engagement, gets approximately 22

million teens logging on each day in the US (Wells et al., 2021). In the past three years, Facebook's studies have shown that Instagram is mentally harmful to a large percentage of their young user base, specifically teen girls. According to the study, Instagram makes body issues worse for one in three girls, which can be attributed to the news feed algorithm and filter bubble these teen girls are placed in. Although Facebook did not intend to cause harm through their algorithm, public backlash is pushing them towards redesigning their algorithm (Shamaiengar, 2021).

As an aspiring engineer and software developer, I hope to not only sharpen my technical abilities but also understand my ethical responsibilities in the technological industry. The motivation behind pursuing my technical project and internship at Facebook was to gain insight into the benefits and drawbacks of a data-driven and algorithmic society to understand the duality of these controversies. My technical project involves adding video message sending capabilities and a stories camera, the term Facebook gives to their camera with filters used for stories, to the Facebook iOS application. I will also be analyzing the sociotechnical relationships between Facebook's social media algorithms and female teens. Understanding how Facebook's algorithm affects female teens will grant insight into how to improve the design of these algorithms to negate harmful unintended implications.

### **Technical Topic**

Social media is all about being able to share information. With the rise in social media that focus on video sharing, such as Snapchat, it becomes increasingly important to add video capabilities to not lose users, especially teen users who tend to be the primary users of these platforms. Similarly, flashy technology such as the filters that Snapchat employs is targeted

towards younger users in an attempt to increase teen engagement. Facebook loses about 3% of its teen users a year and this can be attributed largely in part to Snapchat and other competing platforms (Kantrowitz, 2020). To minimize this loss, Facebook has sought to improve its platforms, being Facebook and Instagram, through implementing similar features as these other platforms. The attempt to increase teen users contributes to the unintended harm to female teens' mental health and image. The unintended consequences relating to teen mental health will be discussed later in this paper.

Facebook Messenger is the primary platform used for instant messaging by Facebook. While all users used to have the ability to access Messenger through the Facebook iOS app, Facebook now requires users in countries with a high frequency of messaging to install the Facebook Messenger iOS app to use the tool. As a result, the Messenger app has many more daily users than the in-app Facebook messaging and thus has more maintenance and improvement. The Messaging in Blue team at Facebook which I was a part of was responsible for bringing the same user experience to Facebook iOS as the Messenger app. One of the core missing functionalities was video sending. By adding video sending, my team hoped to increase the number of total daily users. In addition, my team had a young adult initiative that aimed towards increasing young adult engagement in messaging.

One of Instagram and Facebook's most widely used features is stories, which allows users to use an innovative camera that includes different filters and capture modes. I was in charge of adding this camera into messaging to both better the user experience and have the messaging feature be more appealing to the teen audience. My implementation was done in Objective-C on the existing code base for Facebook iOS. Sending videos required both frontend and backend work. I was responsible for completing the frontend implementation while

communicating the backend tasks to a backend engineer on my team. To send videos, I had to convert an iOS media video item into the path for the actual mp4 file stored on the phone. Following this, I had to allow users to select videos from the gallery in addition to images, which were already supported. I used an existing framework for media uploads to the backend to create an application programming interface (API) for uploading videos. At this stage, I worked with my team's backend engineer to allow the server to accept mp4 uploads. I used this same API to track the real-time progress of the upload and displayed it on a user interface progress bar I created underneath the video. Lastly, I used the code for the existing camera in the Facebook Stories feature to support the same camera in the messaging view.

With each new feature, there are two stages of testing before public release. This includes internal testing, which allows users within the company to test the feature, and external testing, which exposes a percentage of users to the feature to see if any regression occurs, meaning a decline in message sending statistics. For each type of testing, there is a control and test group. Hundreds of statistics, such as daily usage, are compared between the two groups. If regression occurs in any of these statistics, due to unforeseen bugs, a deeper analysis of the cause occurs. My feature successfully finished internal testing with no regression. At the end of my internship, my feature was undergoing public testing and no regression occurred.

One goal of my feature was to get a positive delta, or increase, in daily messages sent (DMS). While my DMS was neutral at the time of my departure, it could increase after a release.

With the addition of video sending in Facebook iOS, the millions of daily users who use the Facebook iOS platform will be able to share the same experience as those who use Messenger, the more maintained alternative. In addition, the filter camera will increase young user

engagement and assist with decreasing the number of teen users lost every year. Once the video sending tool is publicly released, I hope to see a positive change in daily messages to corroborate these intended results.

### **Sociotechnical Analysis of Instagram**

For the past years, Facebook's goal in its news feed algorithm has been to help people find relevant content and allow for a creative way for self-expression (Hagey and Horwitz, 2021). However, collecting user data, optimizing user feeds, and placing users in filter bubbles often do not have the simple effect of giving users a custom and enjoyable news feed. As previously mentioned, Facebook has found that teens and specifically teen girls are harmed through these actions. To best understand how Facebook's seemingly harmless goal of user engagement leads to a detrimental impact on teens, we can analyze Facebook's algorithmic technology under the lens of a socio-technical framework.

The Interactive Socio-Technical Analysis (ISTA) framework places focus on unintended consequences, which are defined as unanticipated and undesired consequences, of the implementation of a technology (Harrison et al., 2007). ISTA states that these unintended consequences stem from a perpetual relationship between new technology, a social system, the new technology in use, and the underlying technical and physical infrastructure. By understanding this relationship in the context of Facebook's algorithm, we can better anticipate the tradeoffs of future, similar technology to prevent harmful consequences to teens.

In using ISTA to analyze the technology behind Facebook's algorithm, the five ISTA interaction types can be considered relating to this technology. The first interaction is a new technology changing an existing social system. Instagram's news feed algorithm is designed to

maximize teen engagement, which it has been successful in over the past years. As previously mentioned, nearly 22 million teens log in to Instagram each day. On average, teens used Instagram between 3 to 4 hours a day during the pandemic according to two former Instagram employees (Frenkel et al., 2021). Instagram's algorithmic news feed is frequently populating teen users' feeds with filtered images and videos which touch up faces (Wells et al., 2021). The previous social system of more teen human interactions is being replaced by social fulfillment through the usage of Instagram which mis-portrays looks. It is this change in the social system that is increasing anxiety and causing body image issues for teen girls (Kamenetz, 2021).

The second ISTA interaction involves technical and physical infrastructures mediating the use of a technology. This interaction type deals with interfacing incompatibility between an existing and new technology. Instagram copied the concept of the widely used Snapchat camera which contained many filters which teens used for editing and touch-ups (Gallagher, 2018). The implementation of this camera on top of the existing Instagram platform perpetuated unrealistic standards for teens through these editing pictures. The third ISTA interaction is the social system mediating the technology. Teens have been creating finstas, a slang term for an alter Instagram account (Varma-White, 2019). The creations of these accounts were unforeseen by Instagram and are dominated by female teens. The fourth ISTA interaction type builds off the third type and demonstrates the recursive nature of the interactions between the technological and a social system. It is the technology in-use changing the social system and incorporates how the social system has mediated its use. In the case of finstas, we see a great deal of negative unintended consequences. Finstas often use alter-egos and are a means often used for cyberbullying and other forms of harmful drama (Patterson, 2016). This demonstrates an unintended

reinterpretation of Instagram that is causing harm to teens in the US through providing a platform of anonymity for teens to interact with their peers.

The fifth and last interaction type is the technology and social system interactions engendering the redesign of the technology. Because of the unintended consequences caused in teens, Facebook recognized that action needed to be taken. Facebook announced a change in their news feed algorithm, the arguable root cause for many of these negative consequences, to bolster bonds between users and to move away from professionally produced content, which research also said was causing harm to mental health (Hagey and Horowitz, 2021). The new algorithm heavily relied on displaying information from reshares. However, after implementing the change in their algorithm, Facebook soon realized that misinformation and other toxic information were highly prevalent in reshares. This ultimately led to additional unhealthy and unintended consequences.

Through the analysis of Facebook's algorithm and impact on teen girls using ISTA, we can see the perpetual nature of problems that arise when a technology is introduced or changed in a social system. To mitigate negative unintended consequences in their future technology, Facebook should continue to learn from the past interactions their technology has had with different social groups, specifically female teens.

## **Research Question and Methods**

My research question is as follows: how should Facebook change their current operation model in order to minimize unintended harm for female teens in the US? Facebook is a profit optimizing company, making nearly 56% of its revenue from advertising as of 2021, which stems from data collected through their algorithm (Isaac, 2021). Consequently, Facebook makes



many of its decisions for profit optimization rather than what is best for the public interest. Many believe that Facebook's failures when dealing with the ethics around their news feed algorithm, such as the one discussed for female teens, are knowingly done and are an inherent consequence of their business model (Lauer, 2021). In addition, after the Cambridge Analytica scandal, public trust in Facebook's commitment to protecting private user data plummeted with a decrease from 79% to 27% (Weisbaum, 2018). By understanding how much data Facebook should collect and use to optimize public trust and profitability while minimizing the associated unintended consequences for teens, I will be able to propose a better operation model, which describes how a business can provide value for its users, for social media giants driven by data.

Facebook's data policies have been heavily analyzed by academia throughout the past years due to all of the surrounding controversies. Performing a historical analysis of case studies would provide insight into what historical actions Facebook has taken to break trust with the public and inflict harm to teens. To fully understand Facebook's current operation model, I will consult official policy documents, such as their community standards and data policy which are available online. Another important step in fully understanding an optimal data policy would be considering prior surveys. I aim to find data pertinent to the percentage of teen girls who feel that Instagram negatively impacts their mental health in addition to whether the reason is cyber bullying or body image related. I will also conduct surveys with college students on what they think are potential changes to Facebook's current operation model that would reduce unintended consequences.

After conducting evidence collection, I will organize the evidence as seen in Figure 1. Using case study analysis and policy documents, I can ensure that I consider failed, past actions to prevent repeated mistakes in the new operational model. Data from prior surveys and my own conducted survey will allow me to synthesize an improved operational model and news feed algorithm to gain back public trust. The ISTA model will also be applied to my proposal to minimize any unintended consequences that could arise with my proposed change in the news feed algorithm.

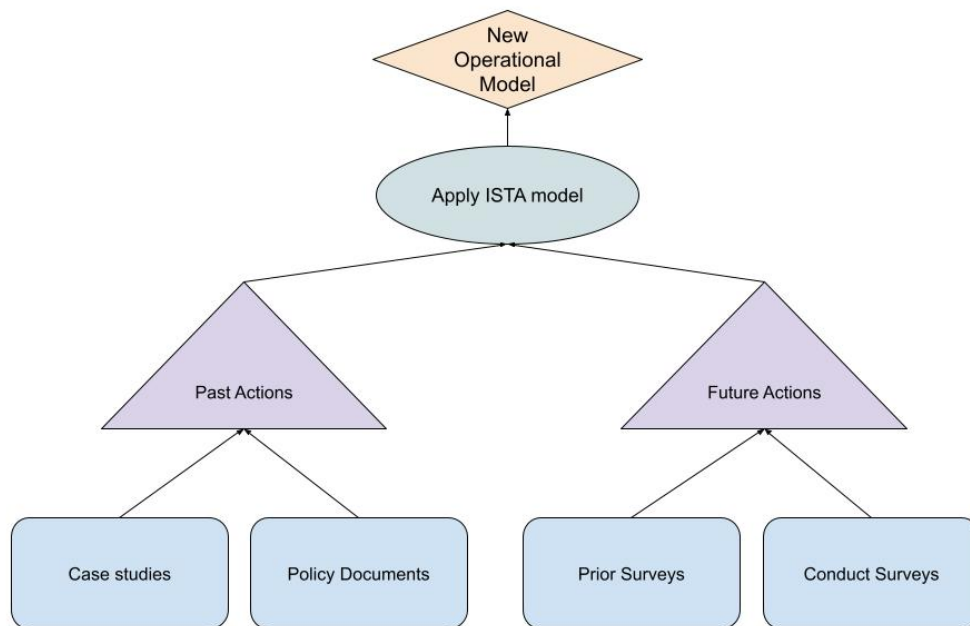


Figure 1. Usage of methods and ISTA model for new operation model. (Berlik, 2021)

## Conclusion

With millions of teen users using Facebook’s social media platforms each day, it becomes increasingly important to address the unintended consequences of Facebook’s news

feed algorithms on teens. My technical project aims to improve the user experience of messaging and to increase the number of daily teen users. Once completed, my research will offer a proposal for a news feed algorithm that improves trust between Facebook and its users.

Facebook is currently taking the wrong approach to much of its public criticism through denial and deflection (Godwin). By improving their public perception through an adaptation of their news feed algorithm, which my research aims to do, Facebook can minimize the harm its platforms are doing to teen mental health. As Facebook continues to redesign its algorithm, it should consider the sociotechnical interactions that shape how teens use their platform. Through doing so, unintended consequences can be avoided and the trade-offs can be better considered.

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