

Mobile Development: Feature to Promote Sales for a Movie Streaming Application
(Technical Research Project in Computer Science)

Analyzing Racial and Gender Biases in Search Engine Algorithms
(Sociotechnical Research Project)

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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

Software applications have become essential parts of people's daily routines due to the integration of technology in almost all aspects of life. When creating software, teams from multiple areas of expertise from designers to engineers utilize the software development life cycle (SDLC) which is a process-driven methodology for producing high-quality software. With this huge and growing industry, each person must be aware of how their decisions during the development process could impact the final software product as well as its users. Since software and humans are so closely related, it directly reflects the decisions made by these individuals along with their pre-existing biases, which in turn also affects users (Biabile 2022). Throughout the entire development process, individuals should be cognizant of how their decisions have the power to impact the application and its users.

My STS and technical project aim to showcase the importance of the decision-making process throughout the software development lifecycle as well as how these decisions can impact its users. The technical portion of this paper will delve into how the UI of a new application feature aimed to promote movie sales, impacts user behavior and emotions. This section will provide a clearer view of the application development process as well as how decisions made by non-technical roles have the power to directly influence user actions on an application. In my STS Research topic, I will specifically be discussing the impact gender and racial bias have on algorithms used by search engines and how these biases could be avoided through different potential methods.

Technical Topic

It's important for businesses to properly connect with consumers by catering to their target audience. Application design has a huge impact on users' experience and can connect with a user's emotions. There are studies that showcase the correlation between mobile app UI design features and consumer behavior. Different types of mobile design features trigger a certain emotional response from an application's target audience, which in turn determines the consumer's mobile app stickiness intention. Mobile design features contribute to the atmospherics of a mobile application. Atmospherics are building spaces meant to induce specific buyer impacts, specifically designing buying environments to cause specific emotional reactions in the consumer that increase the likelihood that they will make a purchase (Martinez 2017). Atmospherics include aspects of the application such as lighting, ambient sound, merchandise layout, and other features (Dollarhide 2021). All of these elements are taken into consideration during the design process of mobile application features with the goal of marketing in mind.

To look further into the effect of new UI design features on consumer interaction, I interned with a mobile development team at a California-based movie streaming company. The company had difficulty finding new and exciting ways to encourage users to continue purchasing movies through its business. Multiple teams from various areas of expertise i.e. (marketing, design, analytics, project management, product management, Android, iOS, etc.) worked to

implement a new Sets feature for its mobile and web platforms that will promote the purchase of movies to complete a movie collection. The purpose of this feature is to appeal to a collector's mindset by using elements of UI design that will trigger an emotional response from the user whenever they complete a movie set. Once you have one part of a series, you'll want to own the rest. I helped implement the UI of this feature using a framework called Jetpack Compose in Android Studio Code, along with the view-model logic necessary to connect the UI to its backend data. This includes info related to each set and saved user information such as past transactions and user preferences. In order to implement this feature, I had to utilize app development skills I gained from previous coursework where I worked with a small team to create a mobile or web application. Although this feature has not yet been released it's expected to excite existing users of the app who may already have a purchase history. The Sets feature will provide a sense of achievement when a user has all the movies in a set due to the visual evidence showing completion. Future work that will be necessary for the Sets feature is to analyze how it affects the sales of the app and consider how the vast majority of users will react to the app.

STS Research Topic

Throughout history, marginalized groups have been affected by bias in existing technologies, including in search engines which are software programs that enable users to use keywords or phrases to get the information they are looking for online. Every internet search engine uses a set of rules known as an algorithm to decide the best results that match your search and the order they are shown. These algorithms are believed to be neutral or impartial, but this is not the case since they are a direct reflection of the implicit or overt prejudices of the programmers who designed them. When producing the list of "best" results based on the keywords that were entered, how is the prioritization of the list determined? What makes one result "better" than the other? The question I expect to answer is "What can developers do to address gender and racial bias in search engine algorithms?". Statistics demonstrate that Google, Yahoo, Bing, and other providers account for close to a third of all web traffic (Radić 2022). Since Google owns 91.42% market share of the global search engine market (Chris 2022), this paper will mostly focus on analyzing Google's utilization of search algorithms.

In recent years this issue of bias in search algorithms has become increasingly prevalent. A well-known example of algorithmic bias was brought to the public's attention by communications scholar, Safiya U. Noble. To find websites about black role models for her young stepdaughter and nephews, Safiya U. Noble typed "black girls" into Google, expecting to be taken to sites with historical context, pop culture for kids, or instructional content. Instead, HotBlackPussy.com was the first result to pop up in their search. On the first results page there were multiple other identical sites. Black girls were not characterized by their history, interests, or aspirations, according to Google, they met the definition of porn (Berlatsky 2018). Many people may conclude that the search habits of the public are the cause of this failure made by Google; search engines return porn for "black girls" because those are the sites that people click on most frequently. But this is a false assumption that is overly simplistic based on the

experiments with Google search and scholarly literature related to search engines. For women, especially women of color, whose identities are already denigrated in the media, these search engine results simply serve to undermine and further debase attempts for social, political, and economic justice.

After much public discourse about the results for "black girls", Google quietly tweaked its algorithm to move porn results off the first page for the search. This change was not at all an indication of the elimination of gender or racial bias in Google's search algorithms since search results still reflect the fetishization and sexualization of women. For example, users can still search "Asian girls" or "Latina girls" and the top results would still contain content related to their sexualization. Algorithmic biases in software programs are a recurring problem in the software development field that further perpetuates society's existing biases surrounding race and gender.

Google's search algorithm recognizes and values distinct sorts of content through web indexing. Search engines utilize artificial intelligence to decide what kinds of information should be gathered, displayed, and in what sequence. These algorithms are created from complex mathematical formulas as part of the automation process. However, social context is not taken into consideration when making these calculations (Noble 2018). Since search engines are so widely used by people of all ages and sexes, social context should be one of the priorities when creating these algorithms. One of the reasons social issues are not a priority in these search engines is because of the capitalistic mindset many companies have. More than 85% of Google's revenue comes from advertisements alone (Berlatsky 2018). Companies will often pay search engines to have their websites or advertisements at the top of a search results page. Evidence implies that most resources for search engine development are allocated in accordance with market reasons or technological/scientific concerns. In the minds of search engine developers, fairness and representativeness are not the primary determinants of search engine quality (Van Couvering 2007). Search engine companies are not always transparent with these marketing techniques in their algorithms which could cause users to make harmful assumptions since they trust that the top result is the best result.

To stop the further spread of these biases, changes must be made in the development of search engine algorithms. The software development industry should also bring awareness to how human biases can affect software algorithms and implement prevention methods that prioritize social concerns. There have been studies that show multiple ways human bias can be dealt with such as bringing awareness to these biases as well as requiring individuals to learn about them in an educational setting as opposed to just implementing a code of ethics. To address my research question, I will gather evidence from previous studies that research how racial and gender biases affect the development process of algorithms used by search engines. I will also gather evidence that analyzes the algorithms themselves whether it's through black box testing or an analysis of the actual algorithms' code. As a potential theoretical framework, I will analyze how other fields, such as social work, account for bias in the decision-making process.

This collection of evidence will provide a clearer understanding of what developers can do to address gender and racial bias in search engine algorithms.

Conclusion

My STS research project aims to capture the scope of gender and racial bias in search engine algorithms and identify ways developers could mitigate these biases, by analyzing previous studies that address bias in the both software programs and other fields as well analyzing examples of the algorithms themselves and how they work. The technical portion of the paper will showcase how the UI design of software applications has to ability to affect user behavior and emotions as well as how the software development cycle works. The overarching subject that links these two topics is to show how decision-making, even biased decision-making, at any stage of the software development life cycle can directly affect its users.

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