Modeling User Interaction for Optimal Music Experience: A usability study of popular music streaming services

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1 INTRODUCTION

Music serves as a universal language that connects people from all corners of the world. The growth of technology has made music more accessible to individuals, with numerous digital platforms now available for streaming music, including music streaming services, online radios, and podcasts. In today's age of digital music streaming, the market offers a plethora of music applications, with Spotify and Apple Music being the most popular. Nevertheless, there are still debates about the usability and user experience of both applications. In this project, we aim to understand and optimize the user experience by analyzing the usability and user experience of Spotify, Apple Music, YouTube Music and Prime Music.

Usability engineering is a design methodology that focuses on creating interfaces that are practical and provide a positive user experience. The approach assesses the effectiveness of an interface by evaluating usability and utility. Usability refers to the ease of using an interface to achieve the user's objectives and is measured using various metrics such as learnability and memorability, while utility refers to the usefulness of the interface to the target user group.

Our objective is to gather user feedback on their experience using the applications, their impressions of the user interface, and their likelihood of using the app or recommending it to others. By understanding these aspects, we aim to design wireframes for an effective music streaming application. The project seeks to optimize the user experience of music streaming application users by examining their usability and user experience, identifying common challenges, effective features, and design principles and strategies to create interfaces that are more intuitive and user-friendly.

- RQ1. What are the common challenges that users experience when using popular music streaming services such as Spotify, Apple Music, Amazon Music, Youtube Music?
  The goal of this research question is to identify the common challenges that users face while using these music streaming services. This can include challenges related to user experience, usability, audio quality, content availability, customization options, subscription fees, and offline access. Understanding these challenges can help developers improve their platforms and enhance the user experience for music lovers.
- RQ2. Which features of the chosen music streaming applications (Spotify, Apple Music, Amazon Music, Youtube Music) are more user-friendly and effective?
  This research question aims to explore and identify the effective features of the two popular music streaming applications. This investigation may involve examining factors such as ease of navigation, search feature, playlist creation and customization, audio quality, and personalized recommendations. By identifying which features are most effective and user-friendly, this research can help inform future updates and developments in music streaming applications.
- RQ3. How can the experience of Music Streaming Applications be optimized for better usability and user experience?
  This research question aims to identify what design principles and strategies could be employed to create interfaces that are more usable and intuitive for users and identify how these principles and strategies impact user experience and satisfaction. We also try to explore user satisfaction and find whether the designed interface is easily usable by end users.

2 RELATED WORK

In recent years, numerous studies have been conducted to evaluate the usability and user experience of music streaming applications.

The paper [15] provides valuable insights into user behavior on Spotify, including session arrival patterns, playback arrival patterns, and daily variation of session length. Additionally, the study analyzes individual user behavior on both multiple and single devices and provides new insights into user behavior in other music streaming services. This study is useful for our project as these findings inform the design principles and strategies that could be employed to create interfaces that are more usable and intuitive for users and identify how these principles and strategies impact user experience and satisfaction.

The paper[9] discusses how music streaming services differentiate themselves from each other in a crowded marketplace. The paper focuses on four prominent streaming services (Spotify, Songza, Rdio, and Beats) and their curatorial devices, interfaces, user identity, and control over the music. The authors argue that these services are in the business of creating branded musical experiences, inviting consumers to see themselves and their attitudes reflected by the service they choose. The paper offers insights into the challenges

of digital streaming models and the ways in which services try to differentiate themselves. These insights can be useful for our project when analyzing the user experience and usability of music streaming services, as well as the challenges of designing effective interfaces for such services.

Overall, these studies highlight the importance of evaluating the usability and user experience of music streaming applications and suggest several strategies for improving the design and functionality of these applications. Our project aims to build upon these studies and provide a comprehensive analysis of the usability and user experience of Spotify and Apple Music.

2.1 Usable Systems

The paper [3] presents a methodology for developing usable user interfaces by defining usability tasks during the application development process. The proposed approach emphasizes user participation in the design process, identifying the requirements, and evaluating multiple usability patterns through an iterative process to create usable user interfaces.

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The paper [4] compares the interface design and functionality of Spotify and Apple Music using human-computer interaction methods and tools to investigate which music application platform provides a better user experience, particularly for users seeking stress reduction. The study found that Apple Music provides a more calming, stress-reducing user experience than Spotify, has fewer usability issues, and was a more enjoyable experience for users.

2.2 Techniques for Recommender Systems

In Content-based recommendation systems, the advantage is we don't need users' data to find a matching item product to recommend it. But the disadvantage is it is hard to find recommendations for new users because their profile is not known. Recommendation systems that are based on content can be applied to a wide range of areas, such as suggesting web pages, news articles, restaurants, TV shows, and products for purchase[10]. Collaborative filtering-based methods utilize the ratings of similar users or items to generate recommendations, while content-based filtering methods rely on features such as categories or extracted keywords to determine recommendations [6][2]. In Collaborative filtering-based systems, recommendations are provided to users based on other similar users. But this also faces the same drawback as content-based recommendation systems. So, the authors[13] propose a hybrid approach that uses content-based methods with collaborative filtering. They used vector representations of users and the items and used similarity metrics like cosine similarity, and Jaccard similarity. For each user, an algorithm matches purchased and rated items to similar items. This combined set of similar items is used to generate a ranked list of recommendations.

In [14] the authors aimed to provide accurate song recommendations by deep neural network-based approach for song recommendation that combines content-based and collaborative filtering information. The authors used Tensorflow and Keras to build, train, and deploy their model and modified Spotify's playlist dataset to obtain a training set. The training set was created by building two training instances for each playlist, one for a positive recommendation and another for a negative recommendation. The first nine songs in the playlist were used to evaluate the user's preference for the tenth song in the positive recommendation instance and a random song in the negative recommendation instance. A testing set was constructed by separating 20% of the training set at random. The authors experimented with different hyperparameter configurations and arrived at a specific network structure specification for their model.

2.3 Analysis of Commercial Music Streaming Systems

In [1], the authors performed a comparison and analysis of two commercial music platforms namely Spotify and Deezer to gain a more comprehensive understanding of how users interact with and perceive music streaming applications. They performed an analysis of the user interactions with the two applications and explored the relationship between user experience and other factors that may impact listening preferences, such as user satisfaction, activity levels, feedback, and other relevant metrics. By analyzing these interconnected aspects, we can gain a more comprehensive understanding of how users interact with and perceive music streaming applications.

In [8], authors investigate the music interaction trends in Finland through two case studies of popular music streaming services: YouTube and Spotify. The authors note that despite the widespread popularity of music listening, there has been relatively little attention paid to it in human-computer interaction studies. The authors found high correlations in the popularity of music across both services, as well as consistent listening peaks over the weekend. The second case study revealed that the audience for Finnish music on YouTube was highly localized, with over 90% of viewers coming from Finland, and that on average viewers retained an interest in the videos for less than 70% of the total duration. This study provides new insights into user behavior and engagement on popular music streaming services and highlights the need for further qualitative research in this area.

The authors of [12], explore the challenges of podcast search on Spotify. They highlight the importance of understanding user intent and behavior when designing search systems for podcasts. The study investigates different approaches to podcast search, such as keyword search, content-based search, and collaborative filtering. The findings show that combining these approaches can lead to better search results and user satisfaction.

The paper [5] focuses on the competitive strategies of music streaming platforms. The study highlights how the basis of competition has shifted from content, price, and curation to the engineering of compelling experiences that harness the unique and interconnected affordances of platformisation. The paper argues that these firms are attempting to generate distinction, value, and loyalty in

new ways by manipulating spatial and temporal dynamics to enhance the user experience and imposing technical constraints and lock-ins to keep consumers using and paying for the platform over time. The study contributes to our understanding of curation in virtual spaces, the geographies of digital platforms, and the experiences and perspectives of platform users.

The paper [7] explores the holistic evaluation of user experience with commercial music services. The study found that users consider "good enough" as the most important criterion for the service. Users exhibited "berry-picking" search behaviors, meaning they use a variety of services to accommodate their needs, suggesting that services supporting very specific use cases may be more reasonable than attempting to develop a "one-size-fits-all" type of service. Participants exhibited very different personalities and attitudes toward music services. Different types of music services seemed to appeal to different types of users. This information is applied to provide insights into the evaluation of user experience and design strategies for music services.

Other research has also explored the challenges of podcast search and discovery. Studies have examined the role of metadata, such as show titles and descriptions, in aiding search results. The need for effective recommendation systems and personalized content has also been highlighted.

3 METHOD

The primary objective of this proposed project is to optimize the music streaming experience of users by conducting a usability study of the most popular music streaming applications. The study aims to collect feedback from participants on their experiences using both applications, specifically evaluating the usability and user experience. To assess usability, the study will employ established metrics, including learnability, memorability, efficiency, error frequency, and subjective satisfaction.

The study's results will provide a comprehensive assessment of the strengths and weaknesses of both applications, allowing for the identification of areas for improvement. Ultimately, the project aims to provide actionable recommendations that enhance the overall music experience for users of these streaming applications.

The research methodology involves conducting a comparative usability study using a combination of qualitative and quantitative research methods, including user reviews, user group study, and surveys. The study will recruit participants who use music applications, and usability tests will be conducted to evaluate their experiences with both applications. The collected data will be analyzed using statistical tools to derive insights and conclusions on the usability of both applications, providing a comprehensive comparison of the two platforms.

4 DATA COLLECTION

4.1 Reviews Data Collection

RQ1 was addressed by collecting the existing review data of Music applications from Google Playstore and Appstore. We collected reviews that had ratings of 2 stars and below. 30 reviews for each application were collected. We performed a thematic analysis using this collected data by summarizing and categorizing the most common issues faced by end users while using respective applications.

4.2 User Study Data Collection

To address RQ2 we conduct a user study by using a survey with questions that capture the user-friendly and user-effective features of the applications. Human participants involved in the study are the students of the University of Wisconsin–Madison and Eagle Heights Community. The age groups of the participants involved are below 18, 18-25, 26-35, and above 35. Thirty participants were recruited via emails, word-of-mouth, and convenience sampling in a large university setting. The gender ratio for the participants is % female and % male. The survey was created on the Qualtrics platform. The participants were provided with a close-ended questionnaire. The close-ended questions were designed using the Net-Promoter Scale (NPS) which is widely used to understand the customer satisfaction metric. There is no time constraint on how long participants have to respond to the questions. The participation is entirely voluntary, with the possibility of refraining from continuing at any point of time during the study.

The survey questions were designed keeping the 5 E's of Quesenberry's model in mind. The 5 E's are as follows:

- **Effective**: Evaluate the effectiveness of Spotify and Apple Music in providing a high-quality music experience, analyzing how well the two platforms fulfill the users' music listening goals and provide personalized and relevant recommendations.
- **Efficient**: Assess the efficiency of Spotify and Apple Music in delivering a seamless music experience, analyzing the speed, responsiveness, ease of navigation, and search functionalities.
- **Engaging**: Evaluate the engagement factor of Spotify and Apple Music, analyzing the user interface, overall design, and ability to captivate and retain the users' attention.
- **Error Tolerant**: Assess the error tolerance of Spotify and Apple Music, analyzing their ability to prevent errors and support users in recovering from mistakes or issues during their music listening experience.
- **Easy to Learn**: Evaluate the ease of learning and continued use of Spotify and Apple Music, analyzing the onboarding process, learning curve, and support for continued learning and discovery of new music.

In addition, we conduct a user group study comprising five participants to evaluate the usability of four Music applications. The study involves providing the participants with three different scenarios to complete tasks while measuring the time taken, navigation efficiency, and the number of finger taps used. Furthermore, we assess the ease of one-handed use, which is an essential aspect, especially for users who may use the app while multitasking or on the go. Additionally, we track the number of times users had to switch hands or adjust their grip to reach specific areas of the app. These metrics can be used to identify areas of the app that may be difficult for users to access, and the results can be used to optimize the interface. The three test scenarios are designed to comprehensively evaluate the usability of the Music applications.

Scenario 1: Playing a new song - "Blinding Lights".
Scenario 2: Sharing an album with a friend.
Scenario 3: Creating a new playlist.

5 DATA ANALYSIS

In this study, both qualitative and quantitative data analyses were performed. The qualitative data analysis involved conducting a thematic analysis on the collected reviews to summarize and categorize the most common issues faced by end-users while using the respective applications. The identified issues were organized into categories to provide a comprehensive understanding of the challenges experienced by the users. On the other hand, the quantitative data analysis involved performing statistical analysis on the numerical data collected during the study. Key numerical metrics, such as maximum, minimum, and mean values, were determined to provide a quantitative assessment of the data.

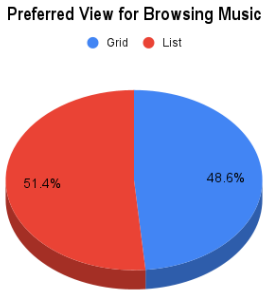
6 RESULTS

6.1 RQ1 Results:

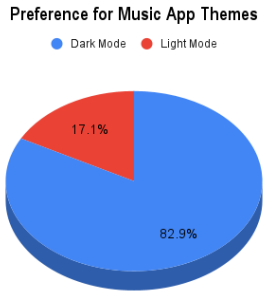
- **Recommendation Feature**: Spotify's recommendation algorithms are widely acclaimed for their effectiveness in suggesting relevant songs and artists to users. However, some users have reported instances of the algorithm suggesting unpopular or irrelevant content, leading to dissatisfaction among users. Additionally, some users have complained about the sheer volume of recommendations in Spotify, leading to endless scrolling. On the other hand, Apple Music has been reported to exhibit unrelated song recommendations, which can be a significant drawback for users. In comparison, Amazon Music's library may not be as expansive as other streaming services in terms of international content, which could deter users interested in exploring global music scenes.
- **User Interface**: Several users have expressed dissatisfaction with the recent update to the home screen user interface and layout of Spotify. In addition, Apple Music has received criticism for lacking basic functions such as a global search and having an unusual combination of iOS and Android in its user interface. The overwhelming interface of Apple Music has also been cited as a source of discomfort for some users.
- **Application Reliability**: Spotify's mobile application lacks ample options to adjust sound quality, and it is prone to frequent crashes and screen freezes. Similarly, Apple Music users have reported issues such as songs not getting added to the queue, song freezing, and inaccessibility to certain songs. Furthermore, YouTube Music's inconsistent interface can make it challenging to navigate and locate features, especially on the desktop version.
- **Functionality**: Apple Music has been criticized for lacking strong social features, which may deter users looking to connect with fellow music enthusiasts. YouTube Music's music discovery options have also been noted as not being as comprehensive as other apps. Meanwhile, some Spotify users have expressed frustration over features that were removed in earlier versions of the app and have requested their return in future upgrades. Finally, Apple Music users have reported experiencing issues such as delayed or early lyric entries in a few songs and have suggested implementing new features such as Show Artist and the ability to delete multiple songs/albums at once.
- **Premium Subscription Issues**: When it comes to music streaming services, Apple Music has a noticeable drawback in that it does not offer a free, ad-supported option, unlike its competitors. Meanwhile, non-premium users of Spotify have restricted access to features. On the other hand, premium Spotify users experience issues with downloading songs. Despite paying for a premium subscription, Apple Music users may still encounter songs that cannot be played.

6.2 RQ2 Results:

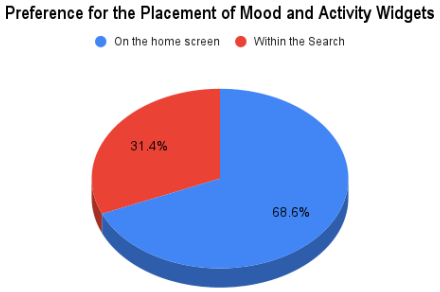
We analyzed the survey data collected from the users. We received 35 responses for the survey.



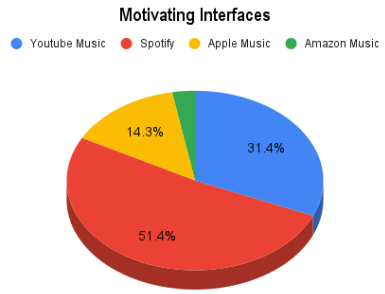
6.2.1 Preferred View: In response to the query regarding the preferred view for browsing music, 51.4% of the users chose the list view while 48.6% opted for the grid view.



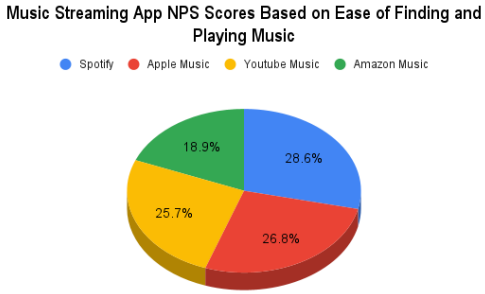
6.2.2 Preferred Theme: 82.9% of users prefer the dark mode theme in music streaming applications, while only 17.1% prefer the light mode.



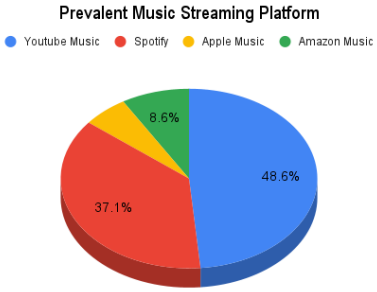
6.2.3 Preferred UI:. 68.6% of the respondents preferred to see moods and activities widgets on the home screen of the music streaming application, while 31.4% preferred to have them within the search.



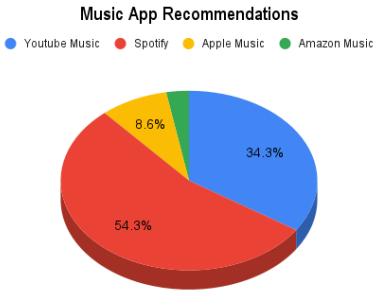
6.2.4 Usability: According to the survey, only 2.9% of the respondents found the interface of Amazon Music motivating to learn and use, while 14.3% preferred Apple Music. The majority, 51.4% of the users, found Spotify's interface to be the most motivating, and 31.4% preferred YouTube Music's interface.



6.2.5 Usability: Among the given music streaming applications, Spotify was preferred by 28.6% of users as the easiest app to find and play music, followed by Apple Music with 26.8%, YouTube Music with 25.7%, and Amazon Music with 18.9%.



6.2.6 User Choice: Among the surveyed participants, the majority (48.6%) used YouTube Music, while Spotify was used by 37.1%. Amazon Music and Apple Music were used by 8.6% and 5.7% of participants, respectively.



6.2.7 Recommendation: According to the survey results, among the four music streaming applications evaluated, Spotify is the most recommended app with 54.3% of the participants recommending it to their friends. YouTube Music was the second most recommended app with 34.3%, while Amazon Music and Apple Music received lower recommendations of 2.9% and 8.6%, respectively.

Table 1: Comparison of Music Platforms for Different Tasks

Task Scenario	Easy Platform	Hard Platform
Playing a new song	Youtube Music	Spotify, Prime Music
Sharing an album with a friend	Youtube Music	Spotify
Creating a new playlist	Prime Music	Spotify, Apple Music

6.2.8 User Study Results:

6.3 RQ3 Results:

The results of the survey and user study had been analyzed and three most widely addressed issues were identified. Keeping these in mind, three wire frames have been designed to tackle these problems in music streaming applications. The details are described below.

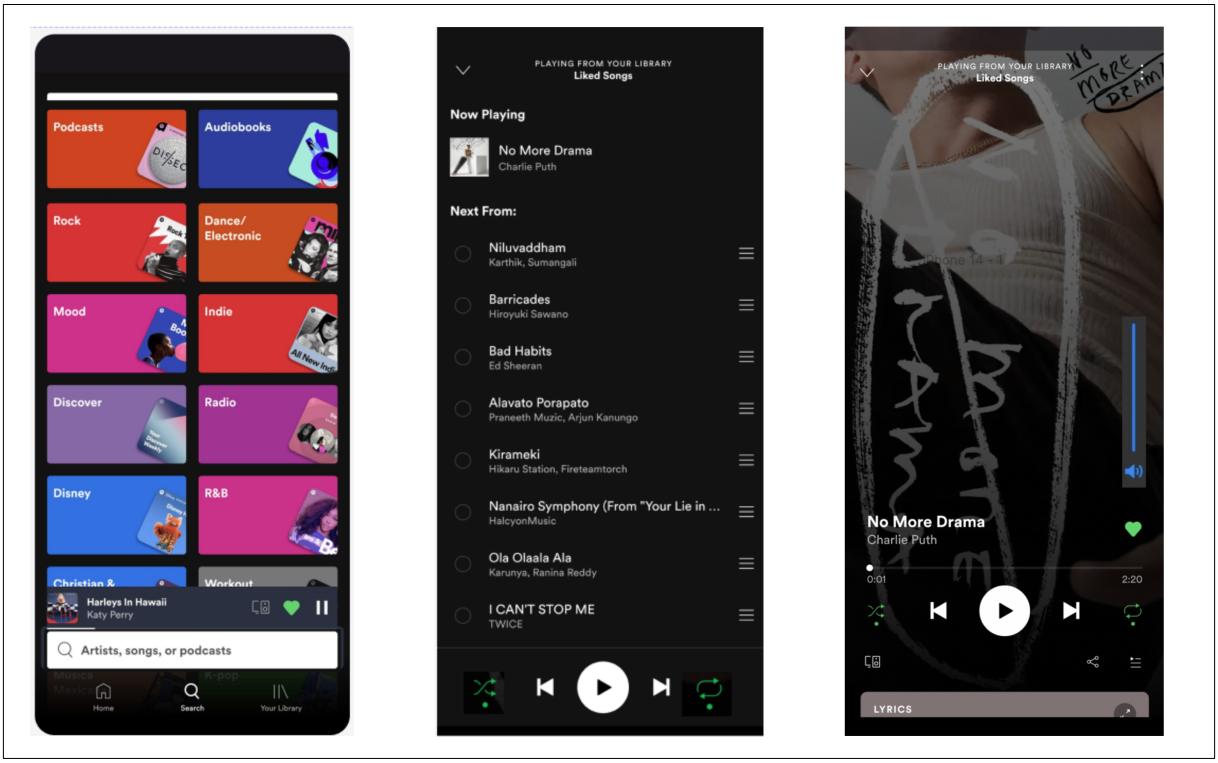


Figure 1: a) Search Wire frame b) Shuffle and Repeat Wire frame c) Volume Wire frame

6.3.1 Search Wire Frame: Many users complained that the search icon is at the bottom of the screen but the search bar is at the top. It requires the user to reach from the bottom to the top of the screen to search for song or artist. The search wire frame is shown in Fig 1. The search bar was designed to be placed above the search icon in the bottom of the screen. The bar is displayed only when user clicks the search icon. It is later collapsed when user is not searching.

6.3.2 Shuffle and Repeat Wire frame: The second figure in Fig 1 shows the design of the shuffle and repeat wire frame. The shuffle button and repeat button have been added in this screen. With the addition of this feature, the user can see the songs in queue and can also shuffle and use the repeat options from this screen instead of going to previous screen. The addition of this feature reduces the number of taps the user needs to perform to access these features.

6.3.3 Volume Wire frame: The volume slider has been added to the screen where the song is played. It would be easier for the user to adjust the volume in this screen as some songs are better when listened with appropriate volume. For example, instrumental songs played with high volume would give a good experience to the user. It is also convenient to use a volume slider instead of physical volume buttons in mobile phone.

7 CONCLUSION

The aim of this project was to conduct an in-depth analysis of the usability and user experience of existing music streaming applications. By carefully examining various music streaming platforms, we identified common challenges and effective features that impact the user experience of these applications. Based on our research findings, we proposed new interfaces that are more intuitive and user-friendly. Our proposed interfaces have the potential to improve the user experience of music streaming services and meet the expectations of users. Through this project, we have successfully addressed the three research questions we set out to answer. Overall, our project has contributed significantly to optimizing the user experience of music streaming application users by providing valuable insights and practical recommendations for creating user-friendly interfaces.

8 FUTURE WORK

To gain a better understanding of how users' perceptions of music streaming applications change over time, a longitudinal study could be conducted. This would involve following a group of users over a set period and gathering data on their perceptions and experiences with different music streaming applications. Additionally, investigating the impact of personalization features and social networking features on the user experience could provide valuable insights into how to improve these platforms. The use of emerging technologies such as voice assistants and virtual reality may also offer opportunities for enhancing the user experience and could be explored further. By conducting such research, music streaming applications could gain a better understanding of their users' needs and preferences, leading to more personalized and engaging experiences.

REFERENCES

[1] Willian Garcias de Assunção and Luciana Aparecida Martinez Zaina. 2022. Evaluating User Experience in Music Discovery on Deezer and Spotify. In *Proceedings of the 21st Brazilian Symposium on Human Factors in Computing Systems* (Diamantina, Brazil) *(IHC '22)*. Association for Computing Machinery, New York, NY, USA, Article 15, 11 pages. https://doi.org/10.1145/3554364.3560901

[2] Alexander Felfernig, Michael Jeran, Gerald Ninaus, Florian Reinfrank, Stefan Reiterer, and Martin Stettinger. 2014. *Basic Approaches in Recommendation Systems.* Springer Berlin Heidelberg, Berlin, Heidelberg, 15–37. https://doi.org/10.1007/978-3-642-45135-5_2

[3] Jean Garcia-Gathright, Brian St. Thomas, Christine Hosey, Zahra Nazari, and Fernando Diaz. 2018. Understanding and evaluating user satisfaction with music discovery. In *The 41st International ACM SIGIR Conference on Research & Development in Information Retrieval*. 55–64.

[4] Moushume Hai, Ariana Lacue, Yuwei Zhou, Yogesh Patel, Asturias Roncal, and Patricia Morreale. 2021. Usability Evaluation of Music Applications for Stress Reduction. In *Design, User Experience, and Usability: Design for Diversity, Well-Being, and Social Development: 10th International Conference, DUXU 2021, Held as Part of the 23rd HCI International Conference, HCII 2021, Virtual Event, July 24–29, 2021, Proceedings, Part II*. Springer-Verlag, Berlin, Heidelberg, 467–476. https://doi.org/10.1007/978-3-030-78224-5_32

[5] Brian J. Hracs and Jack Webster. 2020. From selling songs to engineering experiences: exploring the competitive strategies of music streaming platforms. *Journal of Cultural Economy* 14 (2020), 240 – 257.

[6] Dominik Kowald, Peter Muellner, Eva Zangerle, Christine Bauer, Markus Schedl, and E. Lex. 2021. Support the underground: characteristics of beyond-mainstream music listeners. *Epj Data Science* 10 (2021).

[7] Jin Ha Lee. 2016. User Experience With Commercial Music Services: An Empirical Exploration.

[8] Lassi A. Liikkanen. 2014. Music Interaction Trends in Finland: YouTube and Spotify. In *Proceedings of the 18th International Academic MindTrek Conference: Media Business, Management, Content amp; Services* (Tampere, Finland) *(AcademicMindTrek '14)*. Association for Computing Machinery, New York, NY, USA, 127–131. https://doi.org/10.1145/2676467.2676472

[9] Jeremy Wade Morris and Devon Powers. 2015. Control, curation and musical experience in streaming music services. *Creative Industries Journal* 8 (2015), 106 – 122.

[10] Michael J. Pazzani and Daniel Billsus. 2007. *Content-Based Recommendation Systems.* Springer Berlin Heidelberg, Berlin, Heidelberg, 325–341. https://doi.org/10.1007/978-3-540-72079-9_10

[11] Kênia Sousa and Elizabeth Furtado. 2005. From usability tasks to usable user interfaces. 103–110. https://doi.org/10.1145/1122935.1122956

[12] Mi Tian, Claudia Hauff, and Praveen Chandar. 2022. On the Challenges of Podcast Search at Spotify. In *Proceedings of the 31st ACM International Conference on Information amp; Knowledge Management* (Atlanta, GA, USA) *(CIKM '22)*. Association for Computing Machinery, New York, NY, USA, 5098–5099. https://doi.org/10.1145/3511808.3557518

[13] Chittaranjan Tripathy and Yannis Pavlidis. 2020. Recommendation systems: principles and practice. *XRDS: Crossroads, The ACM Magazine for Students* 26 (04 2020), 54–56. https://doi.org/10.1145/3383396

[14] Xinxi Wang and Ye Wang. 2014. Improving Content-based and Hybrid Music Recommendation using Deep Learning. 627–636. https://doi.org/10.1145/2647868.2654940

[15] Boxun Zhang, Gunnar Kreitz, Marcus Isaksson, Javier Ubillos, Guido Urdaneta, Johan A. Pouwelse, and Dick Epema. 2013. Understanding user behavior in Spotify. In *2013 Proceedings IEEE INFOCOM*. 220–224. https://doi.org/10.1109/INFCOM.2013.6566767