An Exploratory Study on the Spotify Recommender System

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Abstract. Spotify is a world class platform for music streaming, and it offers various kinds of services. As with many digital platforms, Spotify uses artificial intelligence to personalize the user experience, also known as a recommender system. This study investigates what role Spotify's recommender system plays in the use of Spotify and if there are any differences in satisfaction between different ages and gender. Therefore, we conducted a survey about how customers are using Spotify, which was shared in different forums. In total we received 159 answers with respondents from 21 different countries. One of the main findings was that the three services "Make your own playlist", "Playlist made by Spotify" and "Recommended songs" are the most popular. Also, a correlation was made to investigate the relationship between the satisfaction of "Recommended songs" and if customers add them to their own playlists. The Spearman's Rank Correlation Coefficient was 0.43 (significant at the 0.01 level), which is a moderate value. This means that almost half of the time the Spotify users place the recommended songs in their playlist. Further, two conclusions were arrived at. Firstly, the recommender system plays a major part in how customers use Spotify. Secondly, we cannot see that age and gender would significantly affect the satisfaction of the recommended songs that Spotify suggest.

Keywords: Spotify · Audio streaming · Recommendation system · Survey

1 Introduction

In today's society, digitalization is becoming vital to provide simple solutions for our everyday life. This leads in to all the things that we do with our smartphones – we pay with our smartphones, we read books and newspapers in our smartphones, we navigate, and we connect with the world with our smartphones. Nowadays, living in the western world requires everyone to have a smartphone not only because of the need for

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communication with others, but also because it can be used for everything and everywhere. Mobile applications allow users to use their smartphones for a range of different purposes, and music and audio streaming are likely to be included as the most common functions. In the global, interconnected world of today, the availability of audio-streams is high and tracks from all over the world can be accessed everywhere, anywhere. The world's most popular music streaming application today is Spotify with over 381 million monthly users [1, 19]. With the amount of listening data that Spotify gathers from all its users, artificial intelligence and algorithms are used to provide the users with different features that will improve their experience when listening to Spotify. In this article we will investigate the customers' way of using Spotify and their various services. Spotify provide different personalized features based on listening data from each user. However, not everyone enjoys suggestions and recommendations and further some do not use it or do not value the services provided. Moreover, this paper aims to investigate whether there is a relationship between the level of appreciation of Spotify's recommendations ("Recommended songs") and the particular group (e.g., age, gender) that the user belong to. Hence, the research questions are as follows:

1. What role does the recommender system play in the use of Spotify?
2. Is there any difference in satisfaction with "Recommended songs" between different age groups and genders?

The remainder of the article is organized as follows: the following section is a literature review; after that we have a look at Spotify.

2 Literature Review

2.1 Audio Streaming

Streaming services that are currently used give customers full time access to a library which differs from the physical property ownership that was previously the standard. The two most common service agreements are a free version of the service that is financed by advertising and a subscription service with a monthly fee [2]. Audio streaming increases the availability of music and for the music industry it was a big step that people may now have the possibility to listen to music outside their home. Music streaming services also offer a larger extent of music [3]. The services can be used for discovering new content which potentially could stimulate digital music sales and consumption but also to consume your favorite music unlimited with a premium subscription [4]. Premium subscribers usually get advertising-free access to the complete platform whenever and wherever they want.

Audio streaming was originally designed for music but due to the increased desire and demand audio streaming has now made advances into more kinds of streaming services, for example podcasts whose popularity have increased during recent years [5].

One of the features of today's audio streaming makes it possible to measure how the listeners' attention shifts during the stream, thus making it possible to see how the

client's behavior changes and what it focuses on [6]. This can later be used to see what kind of recommendation should be provided to the customers based on their previous actions [6].

2.2 Artificial Intelligence

The aim of artificial intelligence is to impersonate and replace a human to automate the process the technology is being used for [7]. Artificial intelligence is becoming increasingly popular and has become one of the most sought-after technologies for companies. This is because of its way of saving both time and money. However, the primary explanation for its popularity is that artificial intelligence will try to mimic the companies' customers' behavior and recommend similar products or services that the customer is already using. Companies are exploiting this to improve the customer experience by continuing to recommend to customers new ways of using the services the company is offering [8].

2.3 Recommender System

Recommender system algorithms matchmake users to products, e.g., tracks or artists [9]. The recommendation can be based on the users' rating, how frequently a track has been played, the track feature such as genre or tags and by side information about the user such as age. Recommendations aim for user satisfaction, albeit perhaps reproducing "existing music industry inequalities in the streaming ecosystem" [9, p. 20].

When a company can store data about the way the customer is using their services the company also has the ability to use recommender systems. Currently, most of the digital platforms that you can use are recommended products and options that are based on your previous search. This kind of system can befriend both customers and companies [10]. The most common recommendation technique is called collaborative filtering and is built on using data from the customer and similar customers [11]. For example, collaborative filtering can suggest new music to one user based on storage data from another user.

2.4 Gender Equality and Recommender Systems

As the importance of equality between genders is becoming more evident in society, even with algorithms without subjective judgement one may be subject to gender bias. A gender fairness gap has been identified in which several recommendation algorithms in the music domain perform better in user groups consisting of males than user groups of females [12]. Algorithms that are considered to be more accurate in their recommendation tend to have an increased degree of gender unfairness, while the opposite is true for less accurate recommendation algorithms [12]. Furthermore, another study demonstrated that males benefit more from recommender systems, independently of the size of the sample group, compared to women and others [13].

3 Spotify

3.1 Background

Spotify [19] is an audio streaming subscription service, launched in 2008 by Swedish entrepreneurs Daniel Ek and Martin Lorentzon. Initially a legal manner of streaming music, Spotify now also offers other forms of audio media, such as podcast episodes, and audiobooks [14]. Furthermore, it has become a platform for artists to share their music globally and make revenue by having fans all over the world that can listen to the music via streaming. Spotify is the largest audio streaming provider in the world, offering more than 70 million tracks and 3.2 million podcasts to 381 million users in 178 countries [14]. The company has a freemium-based business model, meaning that both a free version with basic features as well as a premium version with further features are available to users [15]. In addition, the premium version is offered in a range of different price plans, to be more attractive to students, couples, and families. The subscription plans are presented below.

Spotify Free. Spotify free offers the entire library of songs, podcasts and audiobooks with ads occasionally following a track. In the mobile app, the user cannot choose which song (excluding selected playlists), but only shuffle the playlist. Spotify free is only available for 14 days when travelling abroad [15].

Spotify Premium. Spotify premium offers the same library of content as the free version, available ad-free and at all times, no matter the location. Further, the user can download tracks and podcasts for offline listening and the music quality is better than in the free subscription plan. The user can pick and play any track in the mobile app as well [15]. The Premium plan is offered in four different versions:

- Individual: The standard premium plan. The price varies between different countries [15].
- Student: The subscription price is reduced by 50% [15].
- Duo: Two people living together get their own premium accounts at a discount price [15].
- Family: Up to six people living together get their own premium accounts at a discount price [15].

Since its launch, Spotify has developed several features and in-app services, which are described below. Spotify is available as a mobile app and desktop app, as well as an in-browser web player [14].

3.2 Services

Spotify offers a range of different features and some of them are based on a recommender system for suggesting music to users. The recommender system uses Collaborative filtering [16]. Collaborative filtering in Spotify considers many users with similar taste and then recommends tracks or playlists based on the common historical streams of these users [17]. Furthermore, Spotify also uses the algorithm Natural

Language Processing [16] which can identify keywords from scanning data about for example songs, artists, and albums. The combination of these algorithm designs with the help of artificial intelligence provide suggestions to users through the different features that Spotify offers. Those which are relevant for this paper are presented below.

- Recommended songs: Spotify suggests tracks based on the user's previously played tracks [18].
- Playlist made by Spotify: Spotify creates playlists specifically adapted to fit the user, based on historical data by using algorithms. Music experts create playlists for everybody to access, with algorithms including tracks based on the user's listening history [18].
- Spotify Radio: A collection of music based on a particular artist, album, song, or playlist which is updated frequently and somewhat adapted to the user's listening history [18].
- Make your own playlists: Allows the user to create and add songs to a playlist [18].
- Spotify Session: Allows users to listen together in real time where everyone in the session can control what is being played [18].
- Sharing playlists: Allows the sharing of a playlist by link or social media [18].

In the literature a number of articles have looked at Spotify and its recommender or recommendation system. [21, p. 1] suggests that there is perhaps "a complex web of social relations and corporate interests" which have an influence up and above "technological objectivity" and "the democratisation of music". Similarly, [22, p. 1] states that "bands on international labels have more reciprocal international connections and are more likely to be recommended based on actual genre similarity." On the other hand, "bands signed with local labels or self-published tend to have domestic connections and to be paired with other artists by Spotify's recommendation system according to their country of origin" [22, p. 1]. In turn, [23, p. 10125] alert that "our analyses show that the prevalent attitude in naming playlists results in highly accurate recommendations for playlists concerning a specific theme, such as albums, artists, and soundtracks. As the title space moves away from a particular theme, recommendation accuracy drops."

4 Methodology

In order to perform this study and answer our research questions, a literature review was performed to investigate what areas of Spotify had already been investigated. This step took longer than expected and because of the information that had been found it had to be done multiple times.

The literature review was mainly made through the scientific databases, for example with the search engine "Scopus" because of its credibility. Many articles and papers were found about Spotify and about the different keywords that have been presented in the beginning of the article. The most frequent key phrases that were used in the search engines are presented below:

- Recommender systems
- Case study Spotify
- Audio streaming services
- Artificial intelligence
- Bias in recommender systems
- Recommender systems digital platforms

After the literature review, all of the sources were gathered in order to continue with the study and our framing of questions were created.

1. What role does the recommender system play in the use of Spotify?
2. Is there any difference in satisfaction with "Recommended songs" between different age groups and genders?

Subsequently, a survey was performed with multiple questions regarding people's use of the audio streaming company Spotify. The questions were based on which extra services people are using on Spotify besides just the ordinary music streaming. In some of the questions, the participants were allowed to choose more than one alternative, for example for the question "What kind of services on Spotify do you use?". What we wanted to know was not only if they are using some other services than just listening to music, but also how they are using the different services, especially the recommendation of songs that Spotify are providing their customers with. The survey was published in different groups to get a widespread selection of participants, all from Erasmus groups to family and friend groups back in Sweden, with a final participation of 159 people from 21 different nationalities. The sample may be considered a non-probability convenience sample, due to its ease of access [20]. Convenience samples (namely involving students) are popular in [exploratory or pilot] business and management studies and are good for pointing towards new directions of research, for future more in-depth investigations [20]. After the survey was finished, the answers were gathered and analyzed so the result, which is presented in the next headline, was able to be discussed.

Some of the questions in the survey were Likert scale questions. The two following questions had a 5-point scale: Never, Occasionally, Sometimes, Often, Always.

- How often are you satisfied with the songs that Spotify recommends?
- How often do you add a recommended song to your playlist?

To see if the answers to the questions above had a relationship, we calculated the non-parametric Spearman's Rank Correlation Coefficient [24] between them. Before we did the calculation, we converted the options of answers; Never, Occasionally, Sometimes, Often, Always to 1, 2, 3, 4, and 5 (ranked order [24]). This gave us two variables, one from each question, and with help of the IBM SPSS Statistics software package we could obtain the correlation coefficient. A correlation coefficient is a statistical way of measuring the linear correlation between different data and has a measure between 1 and −1 where a value of 0 gives no correlation whatsoever, and a value closer to the ends of the spectrum means it has a greater correlation.

5 Results

In this section the results of the survey will be introduced. The survey received 159 answers in total during a two-week period in October/November 2021. Most of the people that answered are from Sweden but in total there were answers from 21 nationalities. The results that are presented here are the results that we found relevant for the discussion and therefore we will not present the results of all the answers. The three tables below show information about the people who participated in the survey. The majority of the people were 25 years old or younger (Table 1). Table 2 presents that the distribution between men and women was fairly equal, however the women were overrepresented. Furthermore, the majority of the people who participated were students, noted in Table 3. As summarized in Table 4, Spotify users use several different services. The three most selected services were "Make your own playlist", "Playlist made by Spotify" and "Recommended songs". Table 5 presents the distribution of age of the users using the service "Recommended songs". All six age groups are represented. Tables 6 and 7 summarize the satisfaction with Spotify overall if you are using the service "Recommended songs", as well as if you are not using the service "Recommended songs".

Table 1. Age of the people who answered the survey

Age	Quantity
<20	3 (1.9%)
20–25	123 (77.4%)
26–35	11 (6.9%)
36–45	4 (2.5%)
46–60	12 (7.5%)
>60	3 (1.9%)

Table 2. Gender of the people who answered the survey

Gender	Quantity
Man	64 (40.3%)
Woman	95 (59.7%)
Other	0 (0%)

Table 3. Main occupation of the people who answered the survey

Main occupation	Quantity
Student	123 (77.4%)
Working	34 (21.4%)
Unemployed	0 (0%)
Retired	1 (0.6%)
Other	1 (0.6%)

Table 4. Services used by the customers

Services used	Quantity
Recommended songs	84
Playlist made by Spotify	107
Make your own playlist	137
Spotify session	36
Spotify radio	67
Sharing your playlists	41
I do not have Spotify	3
None of the above	6

Table 5. Participants using the service "Recommended songs" made by Spotify

Age	Quantity of customers using "Recommended songs"	Percentage of customers using "Recommended songs" in each age group
<20	1	(33%)
20–25	70	(60%)
26–35	4	(36%)
36–45	1	(25%)
46–60	6	(50%)
>60	2	(33%)

Table 6. Satisfaction with Spotify of people using the service "Recommended songs"

Level of satisfaction with Spotify by those who are using the "Recommended songs"	Quantity of customers using "Recommended songs"
1	0
2	0
3	3
4	29
5	52

Differences between genders regarding satisfaction with ¨Recommended songs" and satisfaction with Spotify in general are presented in Table 8.

As seen in Table 8, the average satisfaction with Spotify differs insignificantly between the genders, with a slightly higher percentage of males who are often or always satisfied with recommended songs, compared to females. Of the respondents who answered that they use recommended songs, again the difference in satisfaction was of little significance.

Table 7. Satisfaction with Spotify of people not using the service "Recommended songs"

Level of satisfaction with Spotify by those who are not using the "Recommended songs"	Quantity of customers not using "Recommended songs"
1	1
2	0
3	9
4	24
5	34

Table 8. Average satisfaction with Spotify and "Recommended songs" by gender

Gender	Average satisfaction with Spotify	"Often" or "Always" satisfied with "Recommended songs"	Average satisfaction with Spotify if using "Recommended songs"
Female	4.27	46.3%	4.59
Male	4.26	50.0%	4.53

The Spearman's Rank Correlation Coefficient between the answers from the question "How often are you satisfied with the songs that Spotify recommends?" and the answers from the question; "How often do you add a recommended song to your playlist?" was 0.43 (significant at the 0.01 level). This means that almost half of the time the Spotify users place the recommended songs in their playlist. This was the only correlation that was found interesting for the research questions and the discussion. To see the calculation of the Spearman's Rank Correlation Coefficient please see Appendix A.

6 Discussion

From the results in the previous chapter various findings of how customers are using Spotify can be discussed. Firstly, this study shows that "Make your own playlist", "Playlist made by Spotify" and "Recommended songs" are the top three services used on Spotify. Both "Playlists made by Spotify" and "Recommended songs" are included in Spotify's recommender system. This indicates that the recommender system is a significant part of how customers are using Spotify in general. Nowadays when customers use Spotify they do not only listen to their own music, instead they find new music easily. However, the age of the participating people was quite young, which is an important factor to keep in mind when discussing the results.

Findings from the study point out that the using of the service "Recommended songs" are common among people between 20–25 years. In the other age groups, it is difficult to draw any conclusion because of the low quantity of answers. The low quantity of answers in the other age groups is due to the fact that the survey was mainly shared in forums with young adults. To be able to draw a conclusion about the

relationship between the use of Spotify's recommender system and age the survey should be shared in forums with wider age ranges.

As shown, none of the customers using "Recommended songs" are dissatisfied with Spotify. The majority are very satisfied and will probably continue to use the product. This could indicate that Spotify should continue to develop their recommender system and get more people to find the service. However, the people not using the service "Recommended songs" are also satisfied, which indicates that Spotify is appreciated overall. One potentially important factor that might have affected the results is that everyone may not know if they are using "Recommended songs" or not. Spotify uses algorithms to produce recommendations in multiple cases and it is possible that the customer does not even notice it. Additionally, "Playlist made by Spotify" is as said one of the most popular services which is also a service that personalized the playlists by the recommender system without that the customer knows that it is.

The correlation result indicates a moderate relationship between how often the Spotify user is satisfied with the song that the Spotify recommender system proposes and how often the same user adds songs because of the recommender system. A correlation coefficient has a value between –1 and 1 were 0 means no relationship between the statements investigated. In this case with a Spearman's Rank Correlation Coefficient of 0.43, this means appreciating the recommender system does not always lead to the user adding the song to their own playlist (almost half of the time the Spotify users place the recommended songs in their playlist). If the coefficient had a value closer to 1 the relationship between the questions would be stronger, which means that all the songs recommended would be added to the playlist. Because of the small sample size of this study (and due to the convenience sample nature of the sample), the findings from this correlation must not be generalized. However, this result could indicate that customers trust Spotify's recommender system regarding the next time the customer wants to explore new music. Therefore, they do not feel that they need to save the songs in their own library because they know they will be satisfied next time as well. Unfortunately, this was the only correlation that was found.

As seen in the results, the difference in satisfaction with Spotify as a music streaming platform between males and females is insignificant in this sample. However, the percentage of respondents who are often or always satisfied with recommended songs on Spotify is of more importance. Though just 3.7% points, considering the number of Spotify users, this difference could represent millions of users. Nevertheless, the sample in this study is too small to make any conclusion with such small differences. Considering that a major part of the respondents are Swedish citizens in the age group 20–25, larger differences may be seen in a larger sample with a better representation of nationalities and ages. Furthermore, the results obtained confirm the conclusions in [12] though again, the sample is too small to give anything else than minor indications.

7 Conclusion

This study shows that the use of the service "Recommended songs" and "Playlist made by Spotify" are two of the most common services, which are both structured by the recommender system. Therefore, we can say that the recommender system is a big part of the product in general for customers. Additionally, the study shows through the correlation that was made that the users that are satisfied with the "Recommended songs" do not always add them to their own playlist (only about half of the time do the Spotify users place the recommended songs in their playlist), which could indicate that they trust Spotify's recommender system every time they want to explore new music. In conclusion, the recommender system plays a significant role in how customers are using Spotify.

However, we cannot comment on which age group benefits most from the service "Recommended songs" because of the low diversity in age of the participants. Furthermore, gender unfairness is found to be a minor yet important issue in Spotify's recommender system and as our results show, females are currently slightly disadvantaged.

In future studies there are some aspects that need to be considered and done in another way. One of these aspects is the number of participants. For our survey we had 159 participants, but to get a more secure and more reliable result it would be better to get a larger number of participants to answer the survey.

Considering gender fairness in recommender systems, more research is needed to progress in the area. We suggest further research which includes larger datasets with a balanced variety of age but also nationality as this could bring clarity to the utility gap of recommender systems between genders. Furthermore, it could be interesting to investigate if recommender systems achieve gender fairness to a higher degree in cultures where gender equality is more evident (or not).

By getting more people to participate you get a wider perspective on things, for example getting more elderly participants and more participants that are not students to see if there are any more differences from the answers we have got now. The large number of participants that are a student is because the survey was mostly shared in different kinds of forums where the majority of people are studying as their main occupation. Where the surveys were shared also corresponds to the amount of younger people that answered, hence the majority of students usually are younger than if you are working which also can be seen in our results.

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Appendix A – Spearman's Rank Correlation Coefficient Calculation

Variable X: "How often are you satisfied with the songs that Spotify recommends?"

Variable Y: "How often do you add a recommended song to your playlist?"

Nonparametric Correlations

Correlations

			VarX	VarY
Spearman's rho	VarX	Correlation Coefficient	1.000	.434**
		Sig. (2-tailed)	.	.000
		n	151	151

**. Correlation is significant at the 0.01 level (2-tailed).

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