Popular Music Genres for Productivity

Final Visualization Report

IMT 561 - Team Fog

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Audience

College Students and Working Professionals

US College students and working professionals between the ages of 18-29 that listen to music when studying with the intention to remain focused. This age range was chosen based on Statista's Global Consumer Survey on Spotify users in the United States which indicated that nearly 40% of Spotify listeners are in this age bracket (Statista 14). Students would be interested in our visualization as on average students spend many hours studying, so being effective is important. Specifically, "According to the National Survey of Student Engagement's findings, the average student spends about 17 hours each week preparing for classes. Preparation for classes includes homework, reading and any other assignments." (Pierre). Information workers also benefit from the visualization as it can help them find a genre that might make them more focused. Worker productivity is important . "According to the Bureau of Labor Statistics, the average American works 8.8 hours every day…" (Curtin). However, they are only productive on average for about 3 out of 8 hours (Curtin).

As college students and working professionals, there is an assumption of basic reasoning skills and the ability to read and understand basic visualizations. There are no known situational limitations for our users.

There is existing research that indicates what music characteristics are good for studying, but our analysis looks at these characteristics and recent music genres on Spotify from 2022. Research has shown that there can be benefits to listening to music when studying, but listening to the wrong music can impact its effectiveness (Whitten). The effectiveness of music is personal and can be task based and the presence of words can impact focus too so generally avoiding music with words when focusing is suggested (Whitten).

Based on brief conversions with 4 users and a small online survey of around 20 students and working professionals we determined that some users enjoy working with music without words, some with words, and some do not like studying with it at all. Some individuals use music to focus and ignore distractions. The response rate of the survey was too small to have statistically significant results, and the majority of respondents were college students, but there were only a few working professionals.

Context of Use

Students and professionals will view the one page visualization online as a PDF, or as a printed handout to pick up and take home with them. Consuming the visualization on desktop and mobile device use is assumed. Our audience will review the visualization and might learn some new genres on Spotify that they might be interested in checking out when they need to focus.

Questions

1. What are some popular music genres for studying/working and concentration?
2. What are some common features the best music genres for studying share?

Data Source

The Spotify track dataset consists of music tracks available on Spotify in the United States as of 2022. The creator of the dataset, Maharshi Pandya on Kaggle, scraped and cleaned the data using Spotify's official Web API and Python, and the dataset has an Open Database license. The dataset contains song tracks ranging from 125 different music genres, and each genre includes about 1000 tracks on the US version of Spotify. Song-associated information such as artists, song durations, popularity, and audio features are included.

We selected this specific dataset since it includes a wide range of music genres on Spotify. It contains multiple audio features indicated with values from the same scale of 0 to 1. It would be helpful for us to find out the characteristics of audio features that make certain genres or songs preferable for focusing during studying so that college students and young working professionals can be provided with better recommendations for their studying playlists.

From the description on the Kaggle website,the dataset contains 114,000 tracks with 21 variables. Below are the column descriptions from website:

- **track_id**: The Spotify ID for the track
- **artists**: The artists' names who performed the track, separated by ; if there are multiple artists
- **album_name**: The album name in which the track appears
- **track_name**: Name of the track
- **popularity**: The popularity of a track is a value between 0 and 100, with 100 being the most popular. The popularity is calculated by algorithm and is based, in the most part, on the total number of plays the track has had and how recent those plays are.
- duration_ms: The track length in milliseconds
- **explicit**: Whether or not the track has explicit lyrics (true = yes it does; false = no it does not OR unknown)
- **danceability**: Danceability describes how suitable a track is for dancing based on a combination of musical elements including tempo, rhythm stability, beat strength, and overall regularity. A value of 0.0 is least danceable and 1.0 is most danceable.
- **energy**: Energy is a measure from 0.0 to 1.0 and represents a perceptual measure of intensity and activity. Typically, energetic tracks feel fast, loud, and noisy. For example, death metal has high energy, while a Bach prelude scores low on the scale
- **key**: The key the track is in. Integers map to pitches using standard Pitch Class notation.
- **loudness**: The overall loudness of a track in decibels (dB)
- **mode**: Mode indicates the modality (major or minor) of a track, the type of scale from which its melodic content is derived. Major is represented by 1 and minor is 0

- **speechiness**: Speechiness detects the presence of spoken words in a track. The more exclusively speech-like the recording (e.g. talk show, audio book, poetry), the closer to 1.0 the attribute value. Values above 0.66 describe tracks that are probably made entirely of spoken words. Values between 0.33 and 0.66 describe tracks that may contain both music and speech, either in sections or layered, including such cases as rap music. Values below 0.33 most likely represent music and other non-speech-like tracks
- **acousticness**: A confidence measure from 0.0 to 1.0 of whether the track is acoustic. 1.0 represents high confidence the track is acoustic
- **instrumentalness**: Predicts whether a track contains no vocals. "Ooh" and "aah" sounds are treated as instrumental in this context. Rap or spoken word tracks are clearly "vocal". The closer the instrumentalness value is to 1.0, the greater likelihood the track contains no vocal content
- **liveness**: Detects the presence of an audience in the recording. Higher liveness values represent an increased probability that the track was performed live.
- **valence**: A measure from 0.0 to 1.0 describing the musical positiveness conveyed by a track. Tracks with high valence sound more positive (e.g. happy, cheerful, euphoric), while tracks with low valence sound more negative (e.g. sad, depressed, angry)
- **tempo**: The overall estimated tempo of a track in beats per minute (BPM). In musical terminology, tempo is the speed or pace of a given piece and derives directly from the average beat duration
- **time_signature**: An estimated time signature. The time signature (meter) is a notational convention to specify how many beats are in each bar (or measure). The time signature ranges from 3 to 7 indicating time signatures of 3/4, to 7/4.
- **track_genre**: The genre in which the track belongs

Moreover, from the Spotify data analysis by Matt Zajechowski (2022), more than 1,200 playlists and 182,000 songs on Spotify are analyzed to determine which artists, playlists, albums, and genres people like to listen to while focusing. Our team retrieved information specifically about music genres in this study as references for our visualization. The report shows that Acoustic, Ambient, Lo-fi/Chill, Classical, Deep House, Electronic, Jazz, and Piano are the most popular genres for productivity.

Using Zajechowski's research on the most popular genres we analyzed the Spotify sample data and identified similar genres in Spotify that could help users. We used the findings of the report to identify the following genres in the dataset and these genres were further analyzed: Acoustic, Ambient, Chill, Classical, Deep-House, Electronic, Jazz, and Piano. In the dataset, we also found out that some tracks are in the genre called study, which is intended to categorize those tracks that might help with focusing and productivity. We also included the genre Study in our analysis and visualization.

In terms of the audio features, we focused on the following characteristics to see if they are the determining factors that make the genres stated above feasible for studying: Energy, Speechiness, Instrumentalness, Valence, and Acousticness. The popularity of genres was also considered for the overall overview of genres on Spotify.

As for data accuracy, since the data is accessed through the Spotify API, and then cleaned it is subject to errors and inaccuracies. Biases might occur in the subsequent data cleaning procedure. We are presuming that the dataset has no data loss, error, or inaccuracy.

Ethical Concerns

Limited Scope

The entire study and the data used are limited to Spotify users located in the United States. The visualization is not made to draw conclusions about general listening habits or users around the world. By limiting the data to a specific geographic location and user group, the visualization may not accurately represent the diversity of users and listening habits around the world.

Biases

The potential biases in the Spotify data used for the visualization is the accuracy and fairness of the insights and conclusions drawn from it. Because the data is influenced by factors such as multiple genre classifications, and being part of multiple playlists, the visualization may not accurately reflect the true popularity of artists or genres in the real world. This could lead to a misrepresentation of the music industry trends and insights derived from the data.

Qualitative Characteristics of Elements

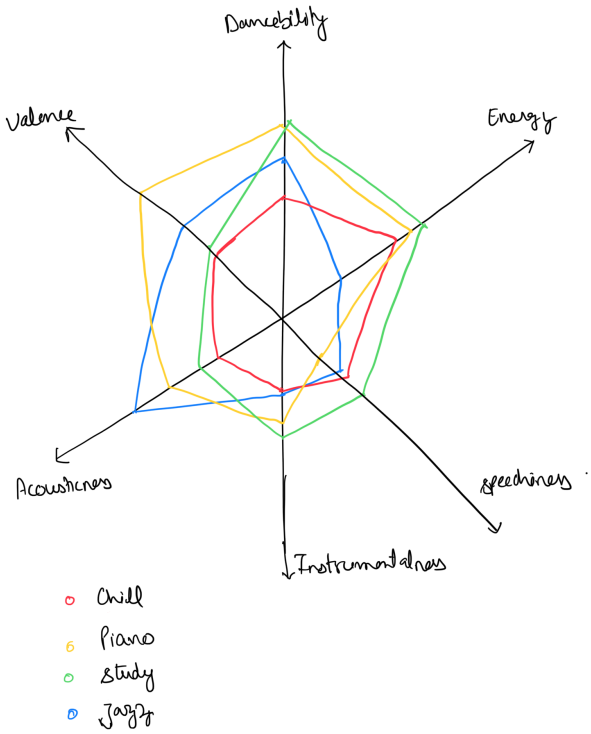
Qualitative elements such as Energy, Speechiness, Valence, and Instrumentalness cannot be measured with an objective instrument and are subject to individual interpretation and bias. Because they are subjective, comparisons of various elements of different genres may have different values.

Test Participant Privacy

We decided not to include participants' names in the report to respect the privacy of our users and asked them if they were comfortable sharing their age and pronouns. We also considered individuals with ADHD might be interested in our one pager as research indicates music can be effective with focus (Gill), but thought that we would not be equipped to explicitly ask or handle that sensitive information.There could be the potential for misuse and users would be unintentionally harmed.

Sketches

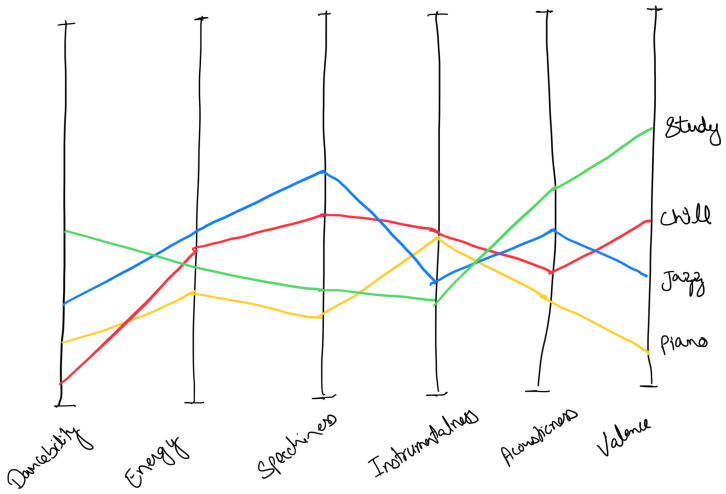
Radar Chart



Radar Chart Design Rationale

A radar chart is an easy way to visualize and compare multiple quantitative variables. This makes it ideal for this case as we want to visualize 5 different elements of the music genres. Each element can be represented on one of the axis, with values zero starting from the center.

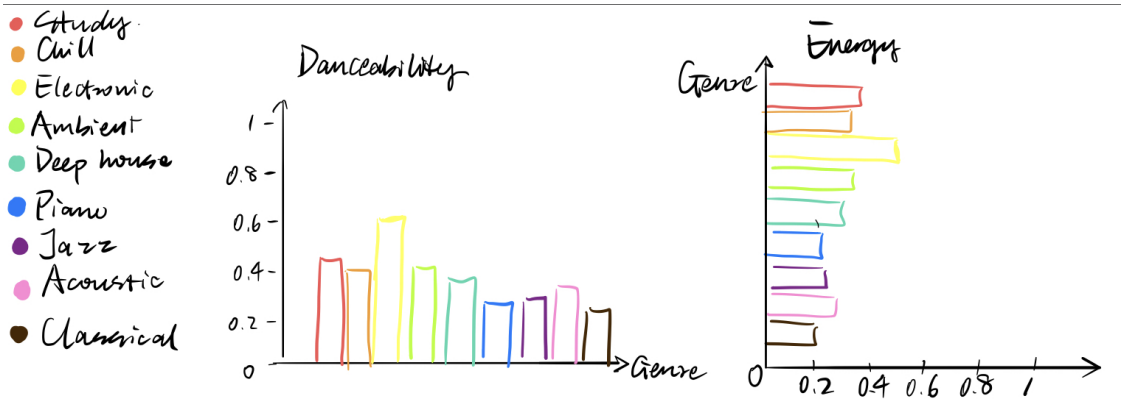
Parallel Coordinate Chart



Parallel Coordinate Chart Rationale

This chart allows for multiple comparisons in one chart. Users can compare the genres against each other and to the 6 characteristics of the songs/tracks. The distinctive color choices and few genres/categories aid in the comprehension of the chart. The convergence and divergence of lines help users understand how different genres relate and differentiate from each other.

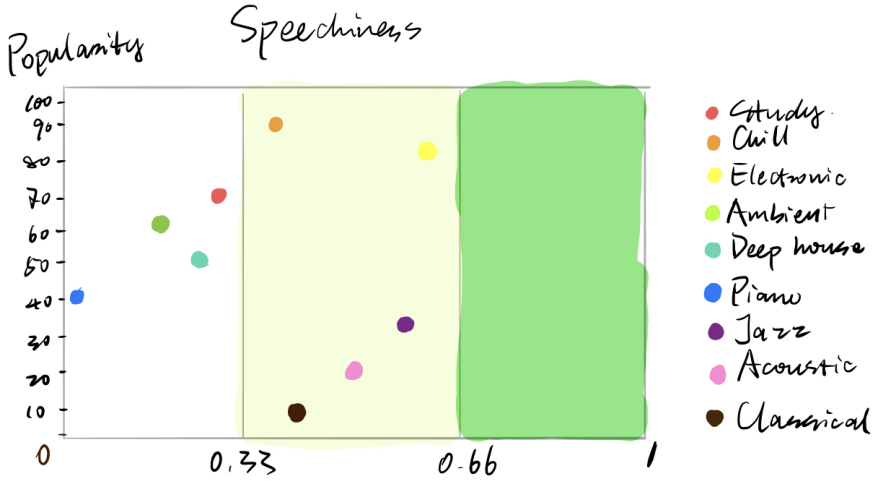
Bar Chart



Bar Chart Design Rational

Bar charts were chosen for the ease of readability and the ease at which length can be compared. Color was also used to help users distinguish between different categories. These visual encodings were chosen as they are two characteristics that human vision is very capable of perceiving (Few 37-41).The rainbow color palette and legend was convenient for sketches, but were not used in the final visualization.

Alternative Scatterplot



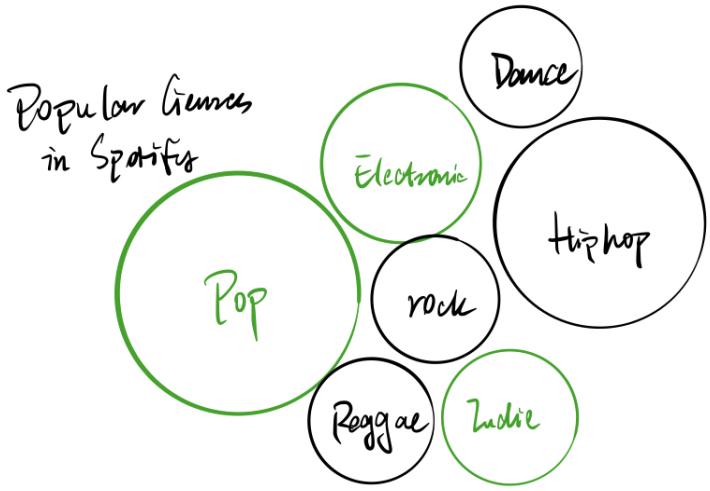
Alternative Scatterplot Description & Design Rational

This chart is what we call an “Alternative scatterplot”, which shows genres plotted with popularity and speachiness. It combines the ability to look at relationships between variables afforded by a scatterplot with the color intensity indicating levels of speachiness of a song.

According to the descriptions based off the API, the speachiness of a song is grouped into 3 categories based on the amount of spoken words they contain. A song/track that has a lot of speech in it would have a speachiness score between 0.66 and 1. A song that had a combination of speech and music would have values between 0.33 and 0.66 and a song that didn't contain speech and mostly contained music had values between 0 and 0.33.

A gradient green color was chosen to indicate these 3 levels of speachiness, as we used white/absence of color to indicate low speechiness (0-0.33), light green for genres with fewer presence of words (0.33-0.66), and dark green for high speechiness (0.66-1).

Bubble Chart



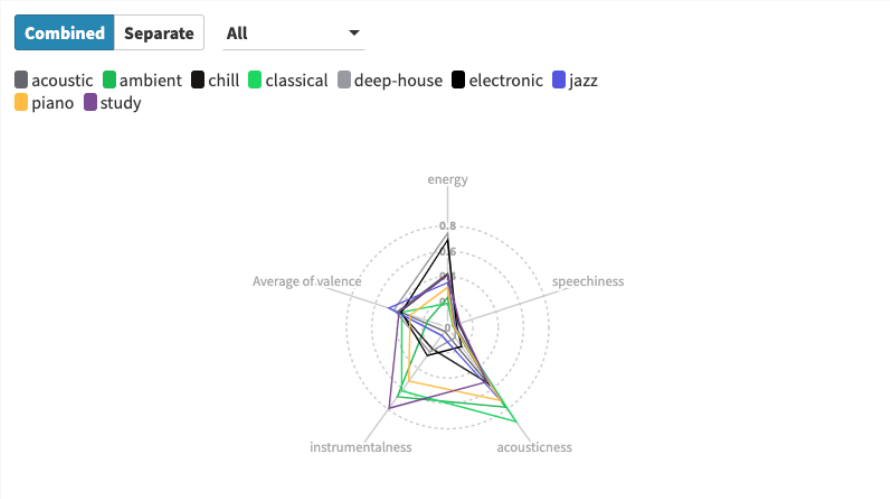
Bubble Chart Design Rational

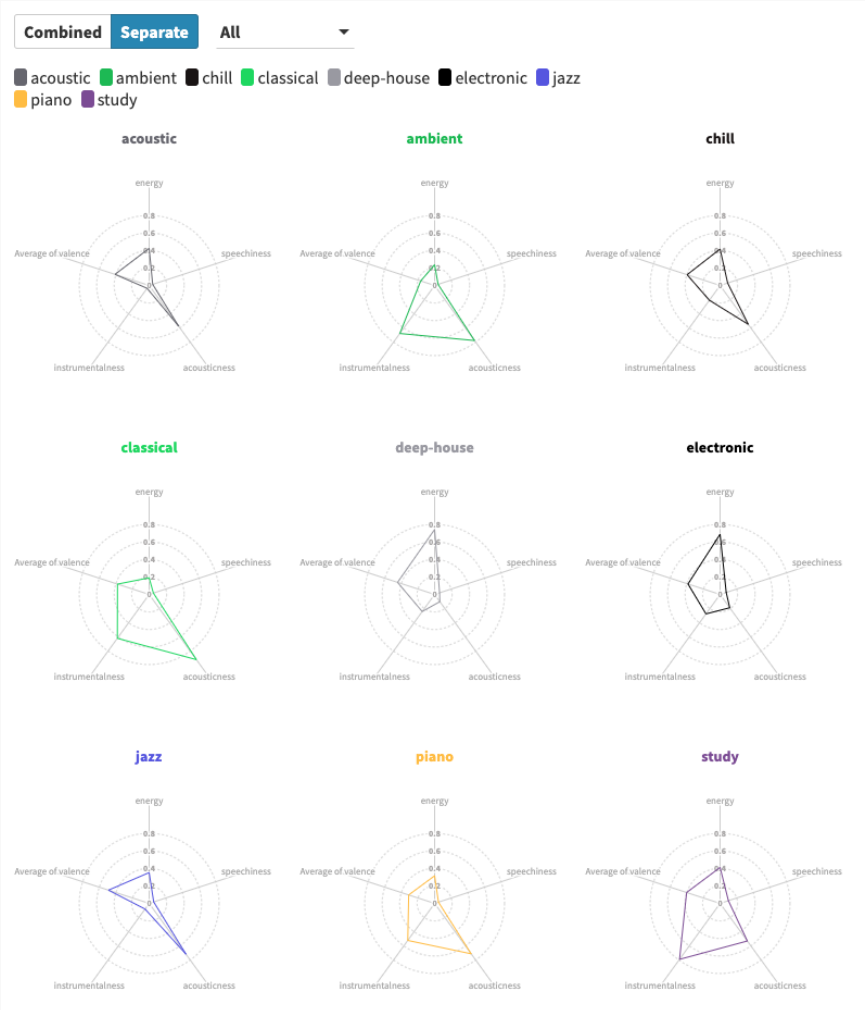
The different colors designate effective genres for studying with green indicating good. The size of the bubbles indicates the average popularity score of music in these genres. However, size is one of the difficult visual encoding elements to determine. Since some bubbles are similar in size, judging the difference is difficult and the clarity of the message the visualization conveys is reduced. A bar chart would be a more effective way of allowing users to make comparisons using length which is an encoding element that humans can more easily judge.

First Visualizations

We transformed the sketches above into digital visualizations made with Tableau and Flourish. We wanted to show these digital graphs in user testing to determine our final visualization based on user feedback and suggestions.

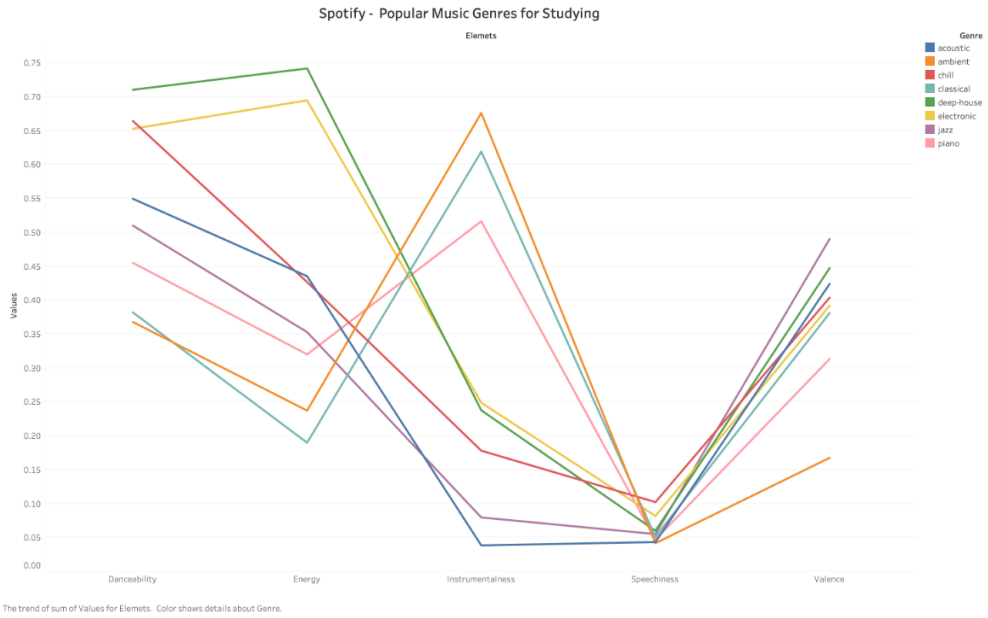
Radar Charts (Collapsed and Expanded)





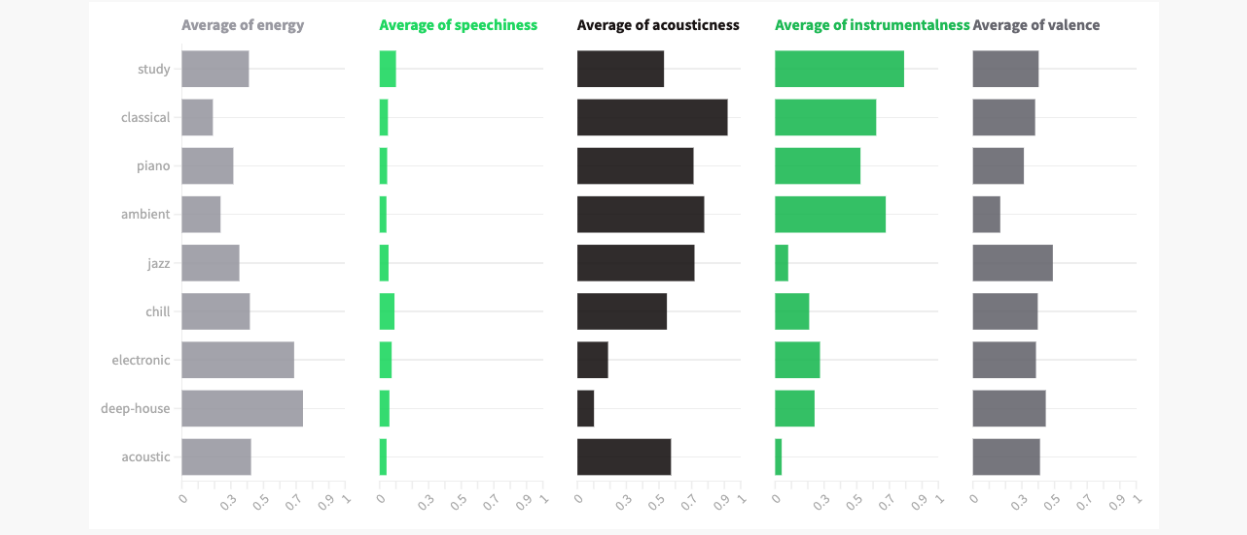
Since we are displaying the characteristics for different genres, based on our first sketch, we also added the expanded version of radar charts for clearer representations of each. We tried to incorporate Spotify's color palette as our visual encodings for genres, but it did not work too well due to the number of genres we were including. The expanded radar charts eliminated the overlap but it's still difficult to make comparisons between genres.

Parallel Coordinate Chart



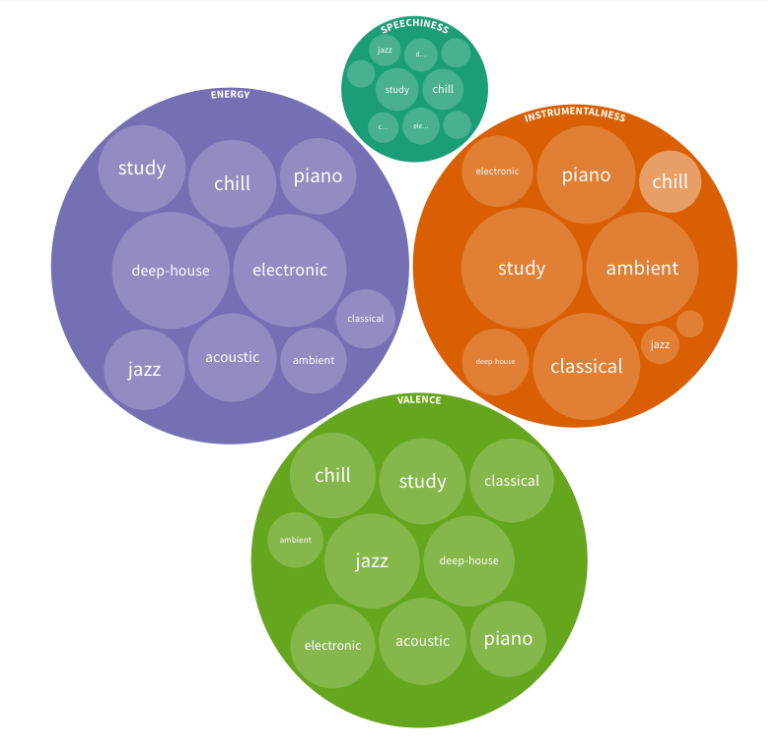
The chart is a direct digital transformation of our sketch so the rationale for its choice is identical. “Parallel Coordinates Plots are ideal for comparing many variables together and seeing the relationships between them” (Ribecca).There are more categories of genre than our sketch and now it's more difficult to read as lines are overlapping.

Bar Graph



Based on the sketch of the bar chart, we selected the horizontal representation and transformed it into a multi-bar chart. The average of each audio feature was displayed on the x-axis and the y-axis represents the 9 genres. We also included Spotify’s color palette for this graph, which included grays, greens, and black.

Integrated Bubble Chart



The original bubble chart was transformed into a version in which bigger bubbles (audio features) contain smaller ones (music genres) inside. The design intended to highlight the audio features (Energy, Instrumentalness,Valence, and Speechiness) that genres share and allow one to choose genres based on their personal preferences. If a user enjoys deep house, they might think about trying electronic music since both genres are high in energy and low in instrumentalness. It also grouped the genre by characteristic allowing one to search by characteristic as well. This chart used the encodings of enclosure, color and size to group similar elements together and indicate the size to indicate relatedness and importance.

User Testing

User Test Description

A think-aloud study was conducted. Five (5) users were asked to review a few visualizations. The tests combined elements of a comparing alternative design study as we showed the users multiple charts and asked them to use different charts and indicate their preferences (Albert 60). Each user was shown a radar chart (collapsed and expanded), bubble chart, parallel coordinate chart and bar graph.

Users were asked to provide comments on their observations, and to complete one task to confirm they comprehended the visualization. The questions listed in the User Testing Script (below) were asked to users. One (1) task based question was asked to users after they answered the open ended questions. The task based questions came after open ended questions so that users could make their own insights on the visualizations without being influenced by the tasks. Since tasks can “... force users into a line of thought that they might not otherwise take” (North 7).

User Testing Script

	Question	Success/Criteria
1	What do you think this visualization is about?	Mentions music, genres and music that is good for studying.
2	What Genres would you choose to study based on any of these visualizations?	Mention at least one of the following Genres: Study, Ambient, Classical
3	Are the audio features mentioned in the visualization something you will consider when choosing what music to study to?	Bring up at least one of the audio features mentioned.
4	Which genre would you listen to if you wanted songs that were **instrumental, had some energy**, and **little to no speech**. (if not apparent, what information or chart did you use to make that decision?)	classical, piano and ambient,study. there might be others depending how they interpret the question.
5	What do you think these terms mean? Speachness & Valence	User provides a description indicating songs with high speachness have lots of words. Valence indicates the positive (happiness/sadness of songs) Higher # = happier.
7	Is there anything that you find confusing when looking at these visualizations? Any suggestions on improvement?	The visualizations all look clear and understandable. Or they provide feedback we can use to make a more useful chart and experience for them.

User Testing Participant Descriptions

	Participant #1	Participant #2	Participant #3	Participant #5	Participant #6
Age	25, master's student	22, undergrad	19, undergrad	25, master's student	27, masters student
Pronouns	she/her	she/her	she/they	she/her	he/him
Major	MSIM	Speech & Hearing Sciences	Prescience/ Informatics	MSIM	MSIM

User Testing Results

#	Question:	Participant #1	Participant #2	Participant #3	Participant #4	Participant #5
1	What do you think this visualization is about?	Different genres of music, The viz is showing the showing the type of characteristics of the musics, don't know what the genre is deep house	Looks like a trend (there's a drop at speechiness), but it shows characteristics of studying music genres	Music. Based off the bubble chart	Visualization about different genres of music, and how they are related to each other	It's comparing different song genres on certain factors like energy, valence etc.
2	What Genres would you choose to study based on any of these visualizations?	Personal preference: don't like music with a lot of lyrics, prefer piano, wanted to try chill before but thought it has a lot of words, now might consider listening	Chill, because every characteristic for this genre is at the center. No exact preferences on the features	(didn't seem to understand the question.) She said the parallel chart looked like it had popular items. Lines are confusing.	I think I would prefer ambient or deep-house as they align more with my taste.	I will prefer listening to classical and ambient music as I prefer high acousticness music while studying.
3	Are the audio features mentioned in the visualization something you will consider when choosing what music to study to?	For acoustic music, danceability is 0.35, energy is between 0.40~45, speechiness and instrumentalness are lower than others, high on valence	Energy, i like high tempo music, i usually study to music with words	(Also seemed not to understand the question) mentioned classical music or music with acoustic music in it. Later in another question answered energy. Also said piano and chill have different stats.	Yes definitely low speechiness and high instrumentaln ess. I find it difficult to focus while listening to music with words.	Yes, I would consider these while selecting a playlist for studying. I would like to check the energy and valence of each genre.
4	Which genre would you listen to if you wanted songs that were **instrumental had**, **some energy**, and **little to no speech**. (if not apparent, what information or chart did you use to make that decision?)	Need more clarification on what the audio features are Thought speechiness is something that relates to whether its is good to play in the background when you talk.	(based on parallel), deep house and electronic. (for radar chart) number of genre are too many, prefer the multi-radar chart and parallel chart. The bar graph is not	Said either instrumental or energy and little speech (seemed like understood task and what to look for as repeated the elements- it took a little time, but was talking saying both deep house and	Okay, this one is though but I cannot read the first chart at all(radar chart). I can answer this using bar chart, but bar chart is more easy to read and understand.	I think piano, classical and ambient genres fall into this category. The interviewee looked at the parallel chart for long before coming to a decision. When he checked the bar graph he was able to quickly tell the answer.

			informative to this participant.	Piano. (When asked said they used and pointed to the Radar (expanded) chart to answer.	Line chart is too crowded and the lines are thin as well.	
5	What do you think these terms mean? Speachness & Valence	Lowest speechiness, maybe ambient can help focus on studying. Prefer songs with no words(get distracted) Bubble chart: gives trypophobia vibe, deep-house and electronic have high energy, the size within circles are a bit hard to compare, will look for genres high in instrumentalness Size of the font can be the same	Speechiness: amount of lyrics, Valence: positiveness of music that gives you good feelings. (the participants is specialized in hearing sciences so she knows)	How much speech in song. Didn't know what Valence meant.	I think speechiness is related to workes or lyrics in the songs, but not sure what does it means exactly. I have no idea about valence at all.	Speechiness is related to the words or lyrics present in the song, while the valence is about the mood of the song.
6	Is there anything that you find confusing when looking at these visualizations? Any suggestions on improvement?	Radar: the similar colors are kinda confusing, prefers radar to parallel, line graphs can show differences, gap is too big it makes u think more about why there is such a big difference, the radar chart helps more with focus on comparison, but it looks dense If i want to skim thru the visualization, i will prefer the collapsed one, separate is suitable for describing the details The bar chart: can show the	The sizes of the bubble chart is confusing, not sure what these are comparing to which, it seems like there's a clear recommendation on music genres based on audio features, but she's not sure what the preference is. The bubble chart sets too much decision bias, it looks like it's telling me to only consider these audio features when i make my selection.	(Hesitated when answering) - said parallel was confusing combined so many lines together. Rader so many lines too. Said liked the visualness of radar.	Yeah, I do not understand these elements of music, it would be good have brief description of them before I check the visualizations. I feel the bubble graph is really good but almost all the bubble are of the same size and the text is so small that I cannot read it properly. Also, why is the size of	Yeah, I think the color code used in both the visualization should be same, so that it becomes easy to relate the two graphs. The speechiness bubble in the third visualization is not visible, you can increase the bubble and font size.

		difference, clearer to see the values, but i will not care so much about numbers			bubbles is different.	

Positives

- ★ Participants are able to identify the audio characteristics they are looking for when choosing the right music genre to study with.
- ★ Participants are able to tell which factors (Acousticness,Speachiness, etc.) are included in the visualization.
- ★ Most participants point out that the bar chart is easier to understand (but one finds it less understandable compared to other charts).
- ★ Participants will consider trying out some of the genres listed.

Negatives

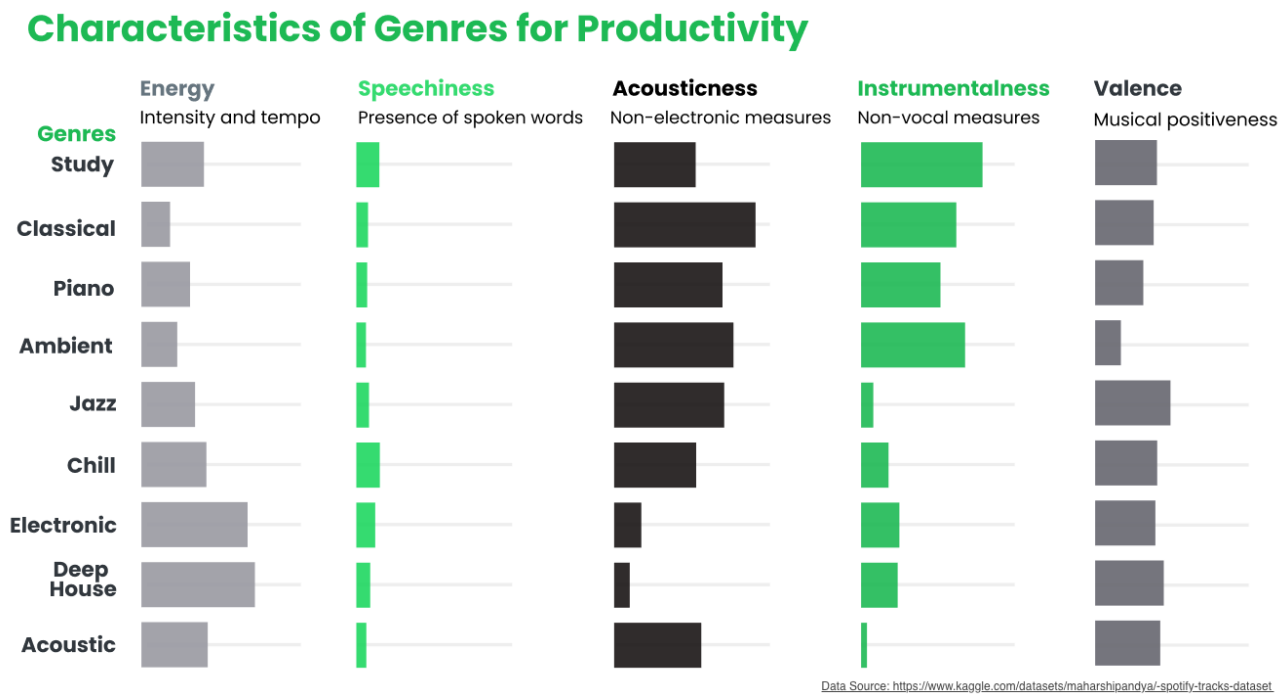
- Participants need clarification on the meaning of audio features/terms, such as Valence and Speechiness, in the visualization.
- Parallel chart was a runner up, but the users assume that it is showing some trends of genres. Some individuals interpreted it as a time series, and there were too many categories and lines and colors overlapping for it to be effective. It might have worked if we reduced the amount of information and categories presented in the chart, or only highlighted one or two categories.
- Some users find the choice of bubble chart difficult to interpret.
- Users are not sure about our purpose of using bubble charts for recommendations.
- Users seem to not understand the values stated on the y-axis of the parallel line chart
- Users said that since we included multiple genres, the radar chart is visually confusing especially since the lines overlap.

Changes Made Based on User Testing

- ★ Bar chart was chosen as most participants pointed out that the bar chart would be easier to understand.
- ★ Added clarifications/ descriptions of genres and audio features/characteristics in the visualization.
- ★ Removed the values for average characteristics since the numbers seem irrelevant to users
- ★ Maintained our use of Spotify-themed colors. The similarity in greens did not really affect users' interpretation on the visualization.
- ★ Removed the x-axis of the bar chart - We experimented with an axis with no labels and tick marks for low, med and high, but our comprehension wasn't improved with or without so we excluded. With more time we would test our design on additional users.

★ Scaling the Speechiness by 1.5: Most of these song genres don't have many spoken words so it's really difficult to see low values. A scaling of 1.5 was used to allow users to make easier comparisons of songs with low Speechiness across the genres.

Final Visualization



Final Visualization Rationale

Changes made to the final visualization were nearly entirely made based on the results of user testing. These separate bar charts were chosen as opposed to a grouped bar chart or stacked bar chart as individuals might make cross comparisons within a genre which would not be helpful and there was no part of the whole relationship. A bar chart was also chosen as most participants found it easier to understand, and we could cleanly present more information.

We also made minor adjustments to the chart by defining characteristics directly under the terms. This solved our users' problem of not understanding terms. The position was intentional. Located directly underneath users didn't need to make any additional effort to lookup a term to understand the chart. We also removed the word ‘average’ on every term to reduce the visual clutter and indicated this in a note on the one pager. The data source was also added to the visualization so users can source the data.

Encodings of color, position, and length were used to allow users to make comparisons down columns of characteristics as knowing which genres had more of a specific characteristic is more effective. The horizontal layout was also used to aid in readability and these comparisons.

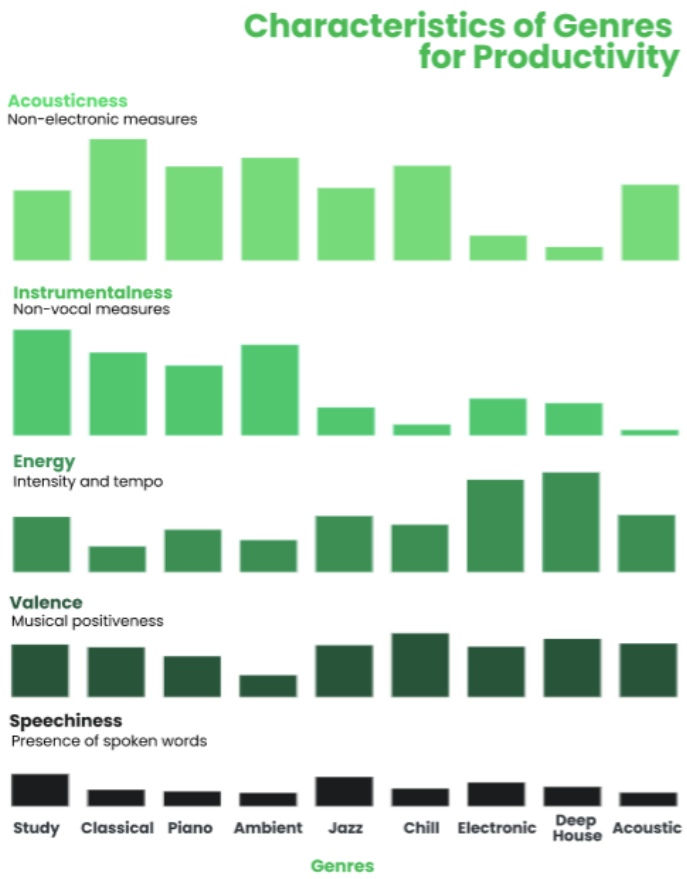
Color choices were based on Spotify's brand color scheme and to help naturally group characteristics of each genre. We thought users might make associations between Energy and Valence since they share a similar gray color, but the color intensity was different enough that this was not an issue during user testing. We also experimented with a gradient color scale from black to light green, but the above design was the most visually appealing.

We decided not to put numbers on the chart as the exact details were not important to our users. Making comparisons of the lengths of the bars was accurate enough to deliver the message to users. Similarly, we removed the x-axis as it wasn't helpful and it added complexity and unnecessary detail. We experimented with an axis with no labels, and tick marks for low, med and high, but our comprehension wasn't improved so it was excluded.

Speechiness was also scaled by a factor of 1.5. Most of these song genres don't have many spoken words so it's really difficult to see low values. A scaling of 1.5 was used to allow users to make easier comparisons of songs with low Speechiness across the genres.

Based on class feedback, we consider flipping the chart vertically so the bars of the bar chart might look like an equalizer. While it did look visually appealing, it required more labeling to be useful and the color associations we no longer present and it was harder to make comparisons. We reverted back to our original horizontal design.

Here is example of it shown vertically:



Final One-pager Rationale

Our approach of designing the one-pager was to make a brochure with easily readable text and a simple visual design so that our audience is able to skim through and understand the content easily. The format we chose was portrait.

For the color choice for icons and graphics, we followed the Spotify brand color palette, which consists of greens, grays, and black. Since we were suggesting music choices based on Spotify's music genres, we used colors so users familiar with Spotify might naturally associate our visualizations with the platform. We used Poppins font since it is a similar font to what Spotify uses on its app. Since we did not want the audience to assume that this one-pager is made by Spotify, we included some creative touches such as using the color purple and adding icons for genres that did not come from Spotify's designs. We also incorporated Spotify's logo in the one-pager title instead of using it as part of the header design.

As for the layout of the one-pager design, we started with some information about the dataset and the message we were delivering. For the upper half of the one-pager, we used an infographic of the top 9 popular music genres for productivity on Spotify. The goal of the infographic was to provide explanations on the selection of genres for our study and some basic descriptions to these terms to the audience. The icon choices for each music genre were based on the characteristics and definitions of these genres.

Our final visualization and its takeaways were the major components of the lower half. Except for the visual encoding elements displayed through the visualization, we used music note icons in purple to indicate the genres and audio features that we were highlighting in our description of the takeaway, which were Ambient, Deep House, and Speechiness.The intention of using the color purple was for this text to stand out so we deviated from Spotify's color palette.

We used headings to divide sections and text to explain key takeaways and provide further information. The use of enclosure, size and position were used to indicate relatedness and importance of text, elements and icons. The text color was also an important consideration in the design. Darker text emphasized its importance and lighter text separated it and also indicated its lesser importance.

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