CS 171 Final Project Process Book

Team name: D#ata
Project website: https://maxnoahb.github.io/CS171-Final-Project-Spotify/
Git repo: https://github.com/maxnoahb/CS171-Final-Project/tree/master

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Abstract

Title: Music Around the World

What are we trying to do?
We plan to learn how the most popular music around the world differs today. We want to use Spotify metrics (listed below) to determine how different music characteristics vary by region.

Motivation:
We are all Spotify users and we're interested in seeing how our music listening trends may be similar or different from trends around the world. Listening to music is a universally loved activity, but the types of music people enjoy varies around the world. This makes for interesting, relevant data to explore and share.

Characteristics

- Danceability
- Duration (if we find something interesting)
- Energy
- Instrumentalness
- Key (if we find something interesting)
- Tempo (if we find something interesting)
- Valence (=happiness)

What goal do we have?
Our intended audience is the general population and casual music listeners. We want our audience to gain a broader understanding of contemporary world music culture. On the tech side of things, we want our visualizations to include: at least one interactive map; filtering option for region and be able to include extra detailed information for the specified regions chosen; filtering option for particular metrics (ex. energy) so users can compare regions by that metric specifically.

Planned datasets and where to acquire them?

- Spotify API
- Spotifyr (R Library) : We will use this library to access Spotify's "[Country] Top 50" playlists for all countries that have available data (~50-60 countries) and use the playlist's song characteristics for analysis and visualization.

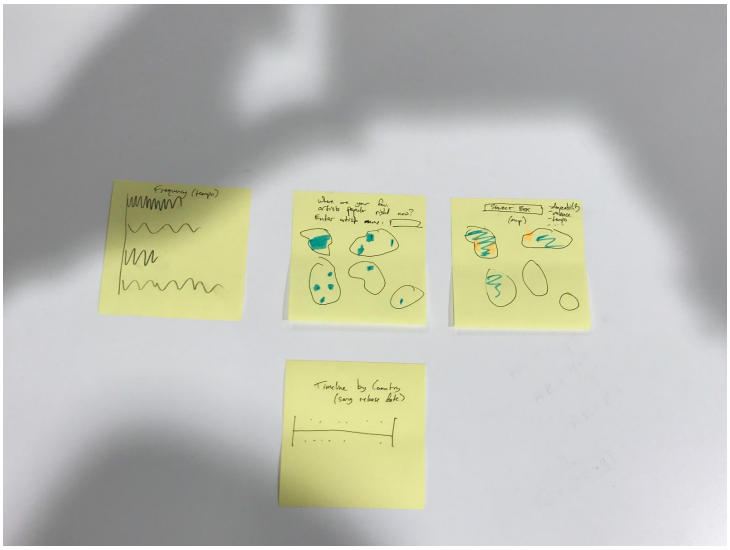
Week 2

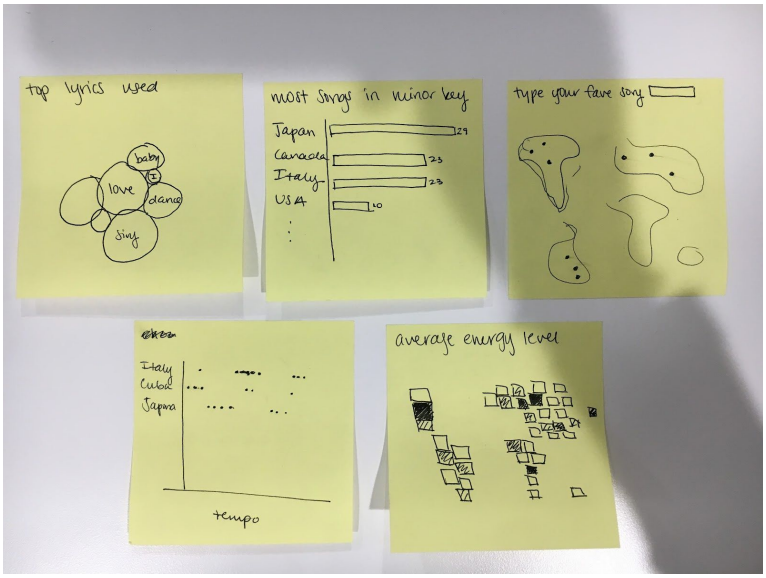
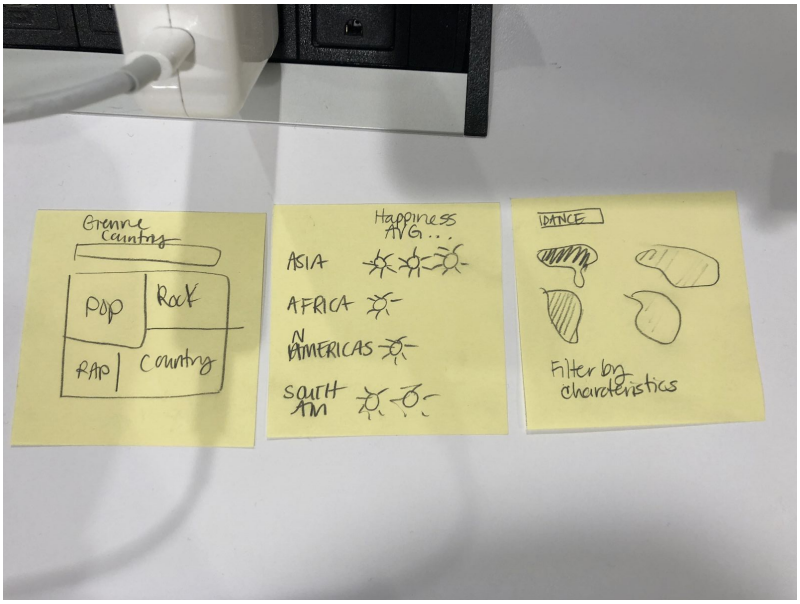
Outline:

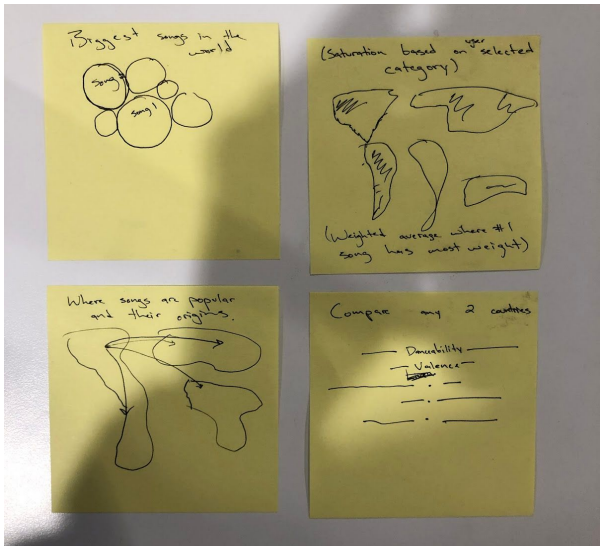
1. Analyze the client, audience, and specific goals.
    a. Client: music publication (e.g. Spotify blog, *Rolling Stone*, Pitchfork)
    b. Audience: general audience, geared towards music listeners
    c. Goals:
        i. Clearly express the difference in music listening habits and preferences between different countries across the world, including differences in:
            1. Liveliness of songs (tempo, energy, "danceability"),
            2. Tone of songs (major/minor, cheerful vs. sad),
            3. Instrumental composition (wordiness, instrumentality), and
            4. Lyrical composition (lyrical word usage and meanings).
        ii. Include facts and anecdotes relating to the data and larger trends (e.g. there's an article about how minor chords are used more in certain countries—can we see this in our data? If so, we can cite that to add interesting, smaller stories to our broader story)
        iii. Create a central, interactive map visualization that can be filtered by different data types
        iv. Make sure the audience has something specific to relate to in the visualizations/story
            1. One way we will implement this (we should think of more too) is to have a search box for songs and artists that will show up on a map or other visualization so people can see where they favorite songs are being listened
2. List at least 10 interesting questions your visualizations should be able to answer.
    a. Which countries have the most top songs in common?
    b. Which countries have the least top songs in common?
    c. How many of the top songs are lively and how does this trend change between countries?
    d. How many of the top songs are in a major key and how does this trend change between countries?
    e. Are top songs more wordy or instrumental and how does this trend change between countries?
    f. Are there noticeable trends in lyrical word usage or meaning in each country or overall?
    g. Are there any characteristics that most countries' top songs have in common?
    h. What is the characteristic that varies most between countries' top songs?
    i. Which countries have the most top songs within one genre? (e.g. which country has the most pop songs in their top playlist, most country songs, etc.)

    j. Do intra-continental countries share more trends than countries across continents?
        i. Are there other groupings?
3. Describe what kind of story you would like to tell. Come up with some candidates for your main messages.
    a. We want to convey the universality of music. Across tens of thousands of languages spanning every country in the world, music is a universal language, a human quality that transcends barriers. Every culture and subculture has its own relationship with music—different artists, trends, and messages. The four of us are deeply entrenched in American music culture, and it's easy to forget the idiosyncrasies that exist between the music cultures of different nations. With this project, we will highlight this essential principle;

Sketch:
Individually, create at least 5 different sketches for possible visualization to answer your questions.

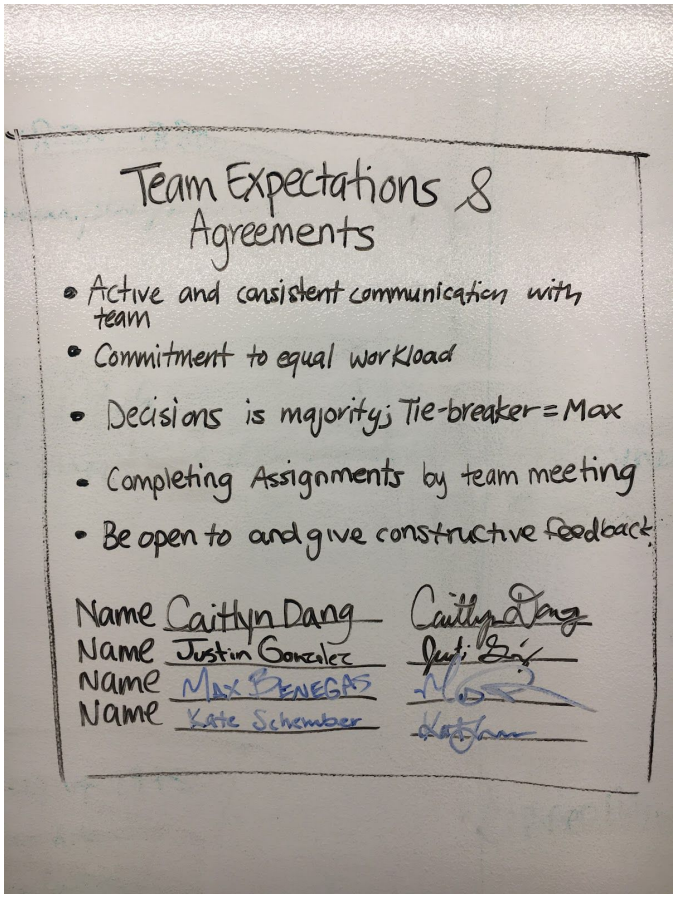
Max	

Kate	
Caitlyn	

Justin	

Project Plan

Group members who contributed: Caitlyn Dang, Justin Gonzalez, Max Benegas, Kate Schember



Definition of goals and tasks of the final project

Goals

1. Clearly express the difference in music listening habits and preferences between different countries across the world
    a. Liveliness of songs (tempo, energy, “danceability”),
    b. Tone of songs (major/minor, cheerful vs. sad),
    c. Instrumental composition (wordiness, instrumentality), and
    d. Lyrical composition (lyrical word usage and meanings).
2. Include facts and anecdotes relating to the data and larger trends
    a. For example, research/articles about how music varies (ex. How chords that are used changes from country to country)
3. Create a central, interactive map visualization that can be filtered by different data types
    a. Data types are the listed characteristics in goal #1
4. Make sure the audience has something specific to relate to in the visualizations/story
    a. For example, take the audience through a journey around the world with music

Tasks

Deadlines

Sunday, November 18th → Prototype 1 Due
Sunday, November 25th → Prototype 2 Due (95% of the project done)
Sunday, December 2nd → Project Due

1. Prototype 1 Tasks
    a. Meeting with TF Monday
    b. Aggregate data (Top 50 songs in each country, playlists created by spotify)
        i. For each country (61 countries), there is a list of 50 songs
        ii. Each song has the characteristics listed above in Goal #1
        iii. Prefer JSON, but CSV works
    c. Map out a story we want to tell
    d. Pick visualizations / Assign to each person
    e. Each person implement visualizations & creates their part of the story
    f. Put it all together in group meeting
2. Prototype 2 Tasks
    a. Meeting with TF Monday
    b. Edit story/visualization transitions
    c. Add extra interactivity
    d. Streamline cohesive design
    e. Troubleshoot any remaining issues
    f. User testing!
3. Before Project is due
    a. Make sure code is commented well
    b. More user testing

c. Tweaking small things/last minute edits
d. Should be ready to submit!

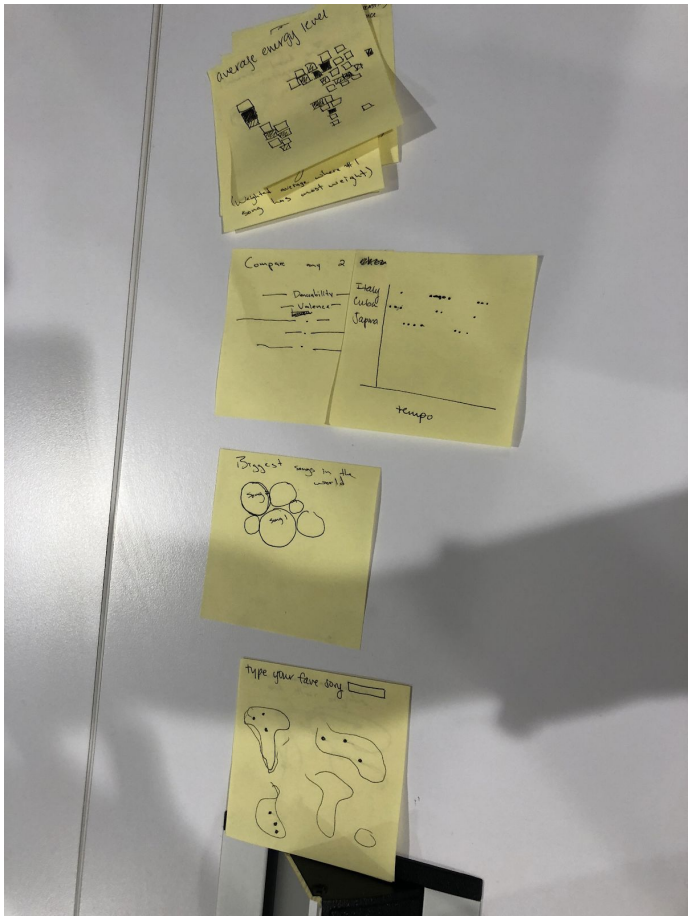
A description of your data and where you will get the data from (at least concrete ideas on where to acquire the data)
Spotify API

Spotifyr (R Library) : We will use this library to access Spotify's "[Country] Top 50" playlists for all countries that have available data (~50-60 countries) and use the playlist's song characteristics for analysis and visualization.

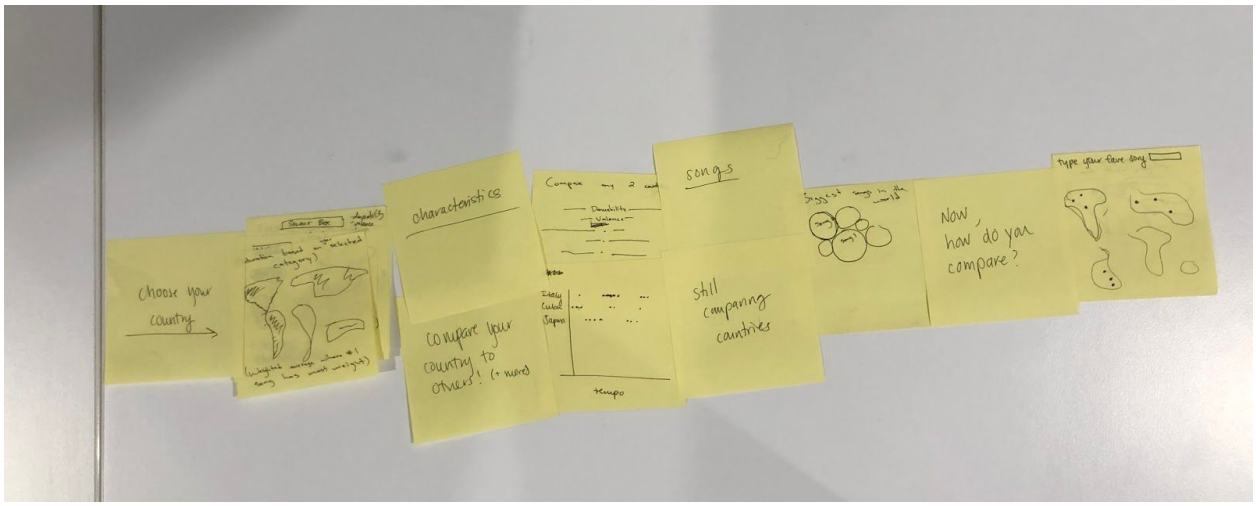
We have already aggregated our data.

At least 3 sketches of visualization ideas for your project

1. Saturation map with a dropdown of all the characteristics
2. Direct comparison between 2 countries
3. Biggest/most common songs
4. Favorite song/artist map

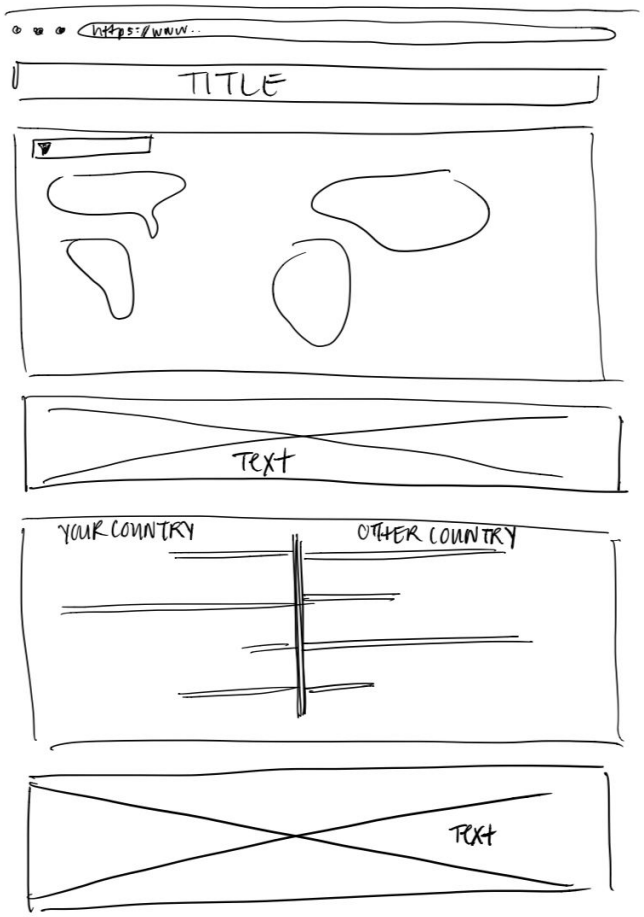


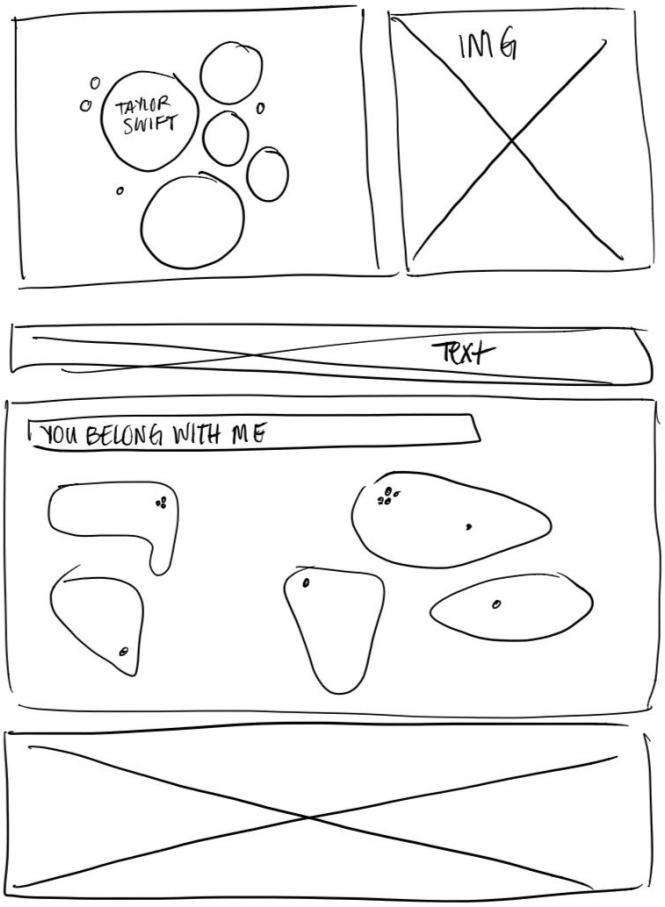
A sketch of an interaction storyboard



A sketch of your webpage layout/storytelling

Disclaimer about which countries have spotify





A project timeline (with milestones when you are planning to finish which feature)

Monday, November 12 - Wednesday, November 14:

- Map out clear story to tell
- Meet with TF (Michael) to discuss general plan and solidify story plan
- Make final decisions about which visualizations to include and more specific sketches of those
- Fix any issues with aggregated data
- Get data in a format we can all work from
- Break down visualization code work among group members

Wednesday, November 14 - Sunday, November 18:

- Implement visualizations
    - Each person must complete their assigned visualization to their best ability
- Rough drafts of story text
    - Each person must complete the text section and find images if necessary that relate to their assigned visualization
- Group meeting over the weekend
    - Put all code into one document
    - Style page
    - Add story transitions where necessary
- **Sunday, November 18: PROTOTYPE 1 DUE**

Monday, November 19 - Tuesday, November 20:

- Meet with TF to do user testing and general feedback on project progress
- Discuss what remaining issues there are and what edits should be made based on the user testing and TF feedback
- Assign specific jobs for each group member to complete for prototype 2

Tuesday, November 20 - Saturday, November 24:

- Fix remaining issues in visualizations
- Add extra interactivity elements
- Edit story and add transitions as necessary
- Make sure there is a cohesive design, make edits as necessary

Saturday, November 24 - Sunday, November 25:

- Send individual code to group and put together in one document
- **Sunday, November 25: PROTOTYPE 2 DUE** (95% of the project should be done for this submission)

Monday, November 26 - Sunday, December 2:

- Make sure all code is commented well
- More user testing
- Tweaking small elements, adding details, last minute edits

- Meet with group and ensure everything looks good
- **Sunday, December 2: FINAL PROJECT DUE**

A feature list (with must-have, good-to-have, and optional items)
Our visualization **must** allow the user to:
- View detailed data for the top 50 songs in each provided country
- Filter by various song metrics
- Easily compare data between countries

It would be **good** for our visualization to allow the user to:
- View detailed data for each song in our database
- Initially select their country or a country of interest and cater their experience/story to that selection

Some **optional** features that would be nice to have would allow the user to:
- Select a favorite song and see which country their music taste most aligns with
- View lyric data for the top songs in different countries
- See a song's country of origin and where it is currently most popular in the world

A description of team roles
Max
- Implement visualizations: main map
- Gather, clean, and update data
- Edit story
- Make final design decisions
- Style website

Justin
- Implement visualizations: country comparison chart
- Assist in writing story text
- Add website transitions
- Style website

Caitlyn
- Implement visualizations: most common songs
- Assist in writing story text
- Lead user feedback process
- Style website

Kate
- Implement visualizations: song search map
- Compile code for all visualizations
- Edit story

- Style website

Week 3

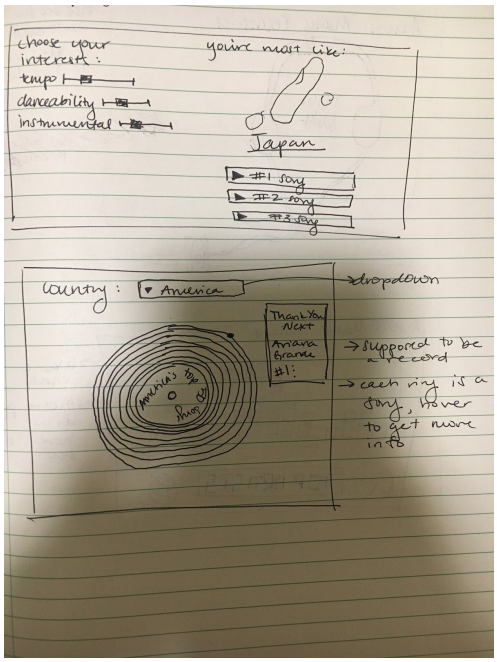
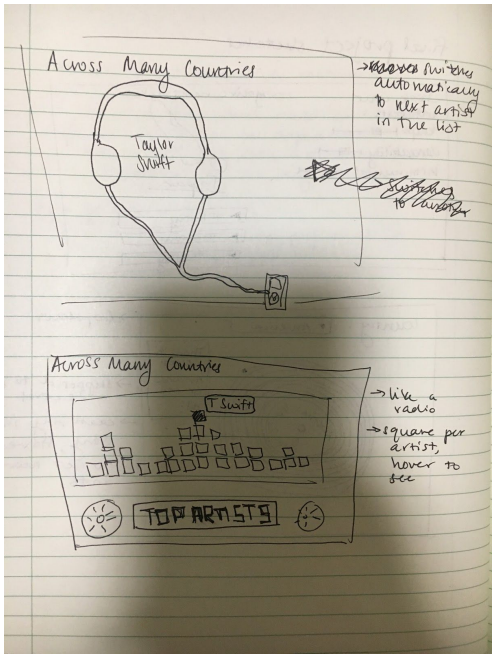
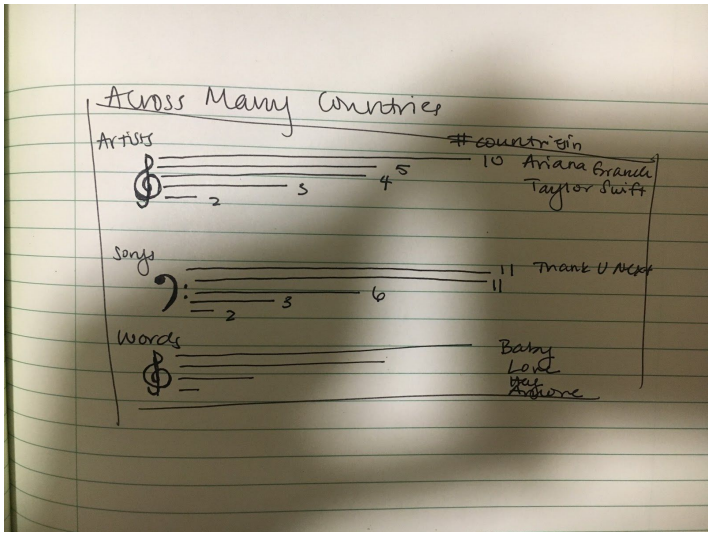
11/12 Meeting with Michael:

- Keep storyline in the focus always, work on the visualizations with this in mind
- Put reference section on the bottom of the website with link to the dataset and our names
- Floating navbar on the top to indicate where in the story you are on the website
- Use “slide deck” experience for the website (like example projects we’ve seen), not where you have to click to another page
- Look for contradictions to point out (e.g. Africa’s music is not mostly drum beat music like you might think)
- Personalization—make sure there’s something at the top that draws the user into the visualization, tailor the website to the user
    - Could potentially make a classifier to say something like “your music taste is most similar to x country”
- He is concerned 3000 songs is too small of a dataset
- Put emphasis on finding inspiring text to accompany the visualizations
- Use git

11/14 Meeting with another group:

- Pulling up your country and your sister country to compare
    - Pull up the countries that have similar traits as the country you chose
- As you click the a song, you can listen to the song (30 second preview)
- Make sure it’s clear that Spotify is most popular in the U.S., will not be as accurate of a story for other countries
- Look at what is unique about each country—what is France listening to that no one else is
- Map visualization looks most interesting
    - Want to see the songs that count as “lively” music
    - Want to listen to the song too
- See the whole list of all songs that are in the country’s list that you chose
- Fun facts
- Bubble chart
    - Songs, artist
    - Show number of countries for each

New sketches to improve our weakest two:

Kate	 choose your interests: tempo danceability instrumentals you're most like: Japan #1 song #2 song #3 song country: America dropdown Thank U Next Ariana Grande #1: → supposed to be a record → each ring is a song, hover to get more info  Across Many Countries Taylor Swift → switches automatically to next artist in the list Across Many Countries T Swift TOP ARTISTS → like a radio → square per artist, hover to see  Across Many Countries Artists #countries in 10 Ariana Grande Taylor Swift Songs Thank U Next Words Baby Love Anymore

Preliminary Storyline

“Music Around the World”

- General Overview
- About dataset, disclaimer (1 sent, concise)

[User selects a country, changes it to a different color]

Map Visualization

- Which countries have music with X attributes
- See general attributes
- Drop down menu for different attributes, shows density differences

MAP	DEFINE ATTRIBUTE

Comparison Chart

- Further contextualize the attributes
- Defaults to selected country
- Drop down menu for right side to select and populate.

[now user knows what attributes are]

Artist/Song Bubble Chart

- All songs, larger radius = imor international popular
- Your top 50 songs, larger radius = more international popular

Slider Radio

- Sliders for attributes, users choose their own preferences
- Updates with a particular country that is most similar to the user’s preferences
- Updates with an image of that country
- Ideally, updates with sound clips of the top three songs in that country

Prototype 1 Submission

Music Around the World

[Description of Our Dataset]

[Disclaimers]

The type of popular music differs around the world

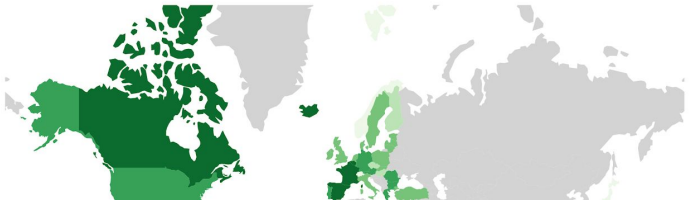
Filter by music attribute:

Danceability

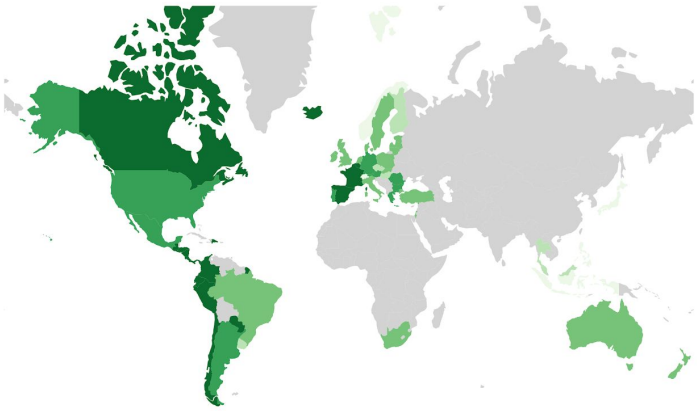
The danceability, energy, loudness, and valence of popular music differs across countries

[More text about what these attributes mean]

[Fun facts about these attributes?]



[Fun facts about these attributes?]

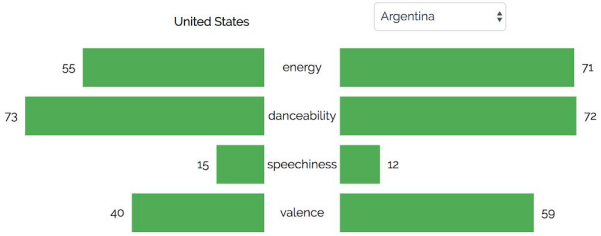


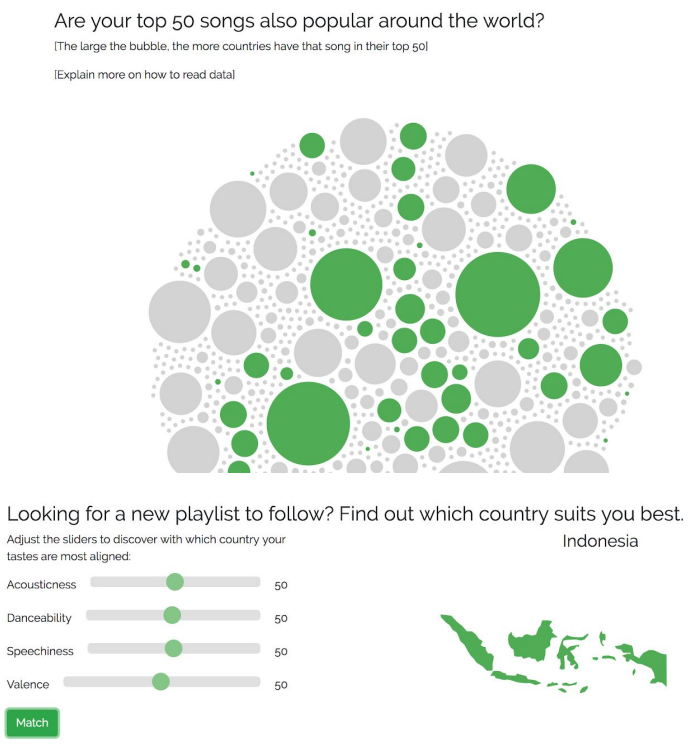
Take a closer look at how your country compares...

[Talk about the most similar/different countries]

[Explain the signficance, why do we care?]

Choose a country to compare to yours:





Reasoning behind our decisions this week:
We were focusing on making sure each of our visualizations worked, and getting an idea of how our story would flow between ideas. We wanted the story to go from broad to narrow, starting with general trends across the globe (choropleth map), then go down to the user choosing what international comparisons they want to make (comparison graph), then the users can see specific songs (bubble chart), and finally the user can consider their individual taste (slider chart). We felt that this order of the visualizations made sense. We didn't focus too much on style this week, but did decide to work with the green color from the Spotify logo. One design goal is to make it seem "Spotify official" and recall those visual themes. For next week, we still need to work on the functional details, such as adding tooltips to the map, allowing the user to choose a country that will automatically populate in the comparison and bubble graphs, and fixing bugs in the slider chart map feature. We decided we wanted a separate map at the top for the user to choose their country because the choropleth was already giving the user so much to think about at once. We also thought this extra map would be a great way to introduce the important disclaimer that our data is only from the 61 countries Spotify serves.

We implemented all four visualizations, each one needs more work:

- Add another map at the very top that shows only which countries have spotify, allow the user to pick their country there
- Map
    - ~~Need to add legend~~
    - ~~Add country clickable feature~~
    - Transitions/CSS
    - Make color scale darker?
    - ~~Outline the country the user selected in the map above~~
- Comparison Chart
    - Still needs to update based on the map country clickable feature
    - Add relevant text about that part of the story
    - Maybe change the design to be more fun/music-related
- Bubblechart (Innovative Design)
    - Make it clear what the radius mean (a key?)
    - Possibly have the popular song names floating already so the reader knows they are looking at songs
    - Add artists to tooltip
    - Add filtering feature to only show green bubbles and more info for those songs (and sound clips??)
- Sliderchart
    - Still needs to populate with an image of the country (worked on this for a long time—it's an issue with centering the country in the path)
    - Still needs to populate with the top three songs for this country (ideally, with sound clips for these)
- Storyline (Innovative Design)
    - Put in real text
    - Add relevant fun facts
    - Add Images
    - Spotify logo somewhere
- Overall styling
- Come up with better title

Notes:

- Please see visualization for innovative design implementation
- See above for storyline, also drafted in webpage

Prototype 2

Our Project

Music is a universal language. It brings us joy, recalls memories, encourages us to dance. Our music listening habits reflect our lives: what time of year it is, what mood we're in, what language we speak, how energetic we may be.
This is why we're interested in exploring music data. ...

Our Data

For this project, we're using Spotify data. With 191 million active users across 61 countries featuring over 40 million songs, Spotify is one of the most popular music streaming services in the world.

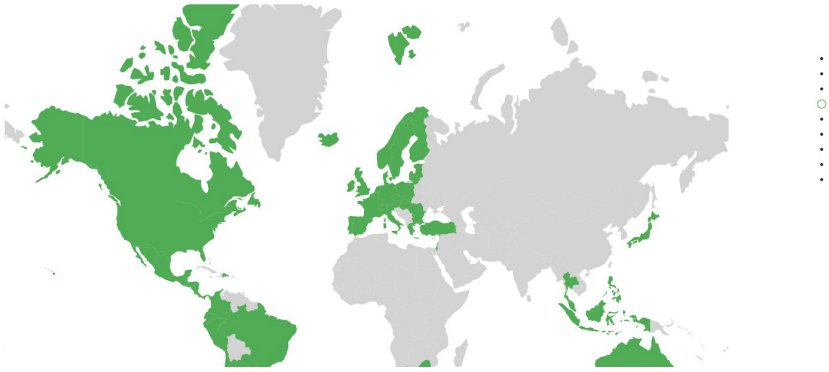
Embedded in each song's metadata is information about the song's energy, valence (happiness), tempo, key, danceability, and much more. Each of these characteristics has a rating from 0 to 1 and the numbers help Spotify understand its users. We're focusing on these metrics to explore similarities and differences in popular music around the world. Our songs are gathered from the Spotify-generated "Top 50" playlists of each of the 61 countries Spotify serves (e.g. Argentina's Top 50, etc.).

This data is a snapshot of these playlists as of November 2018. As Spotify reaches a broader audience, it can tell us more and more about the world's music tastes. **For now, we can only gather information about the 61 countries highlighted on the map below.**

Visit Spotify's website for more information as we take you through a musical adventure across the world.

To begin, choose the country you're from to personalize your experience. You can return to this page and change the country at any time.

Please choose a country with Spotify



How does music differ across countries?

From the danceability of their playlist to the acousticness of their music, we can visually **see how popular music differs** in audio features across the globe.

To compare the the "Top 50" playlists across the world, we **averaged the metadata** across all 50 songs for each playlist. With each audio feature **(danceability, valence, speechiness, loudness, and acousticness)** ranging from 0 to 1, we can visually see how each country's "Top 50" playlist differ in audio features.

Filter by music characteristic

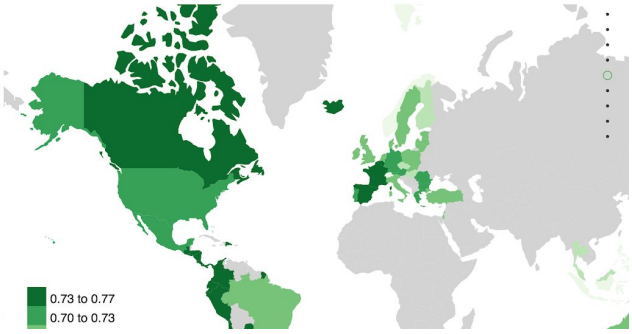
Danceability

What do these audio features mean?

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.

Valence describes 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).

Speechiness detects the presence of spoken words in a track. The more



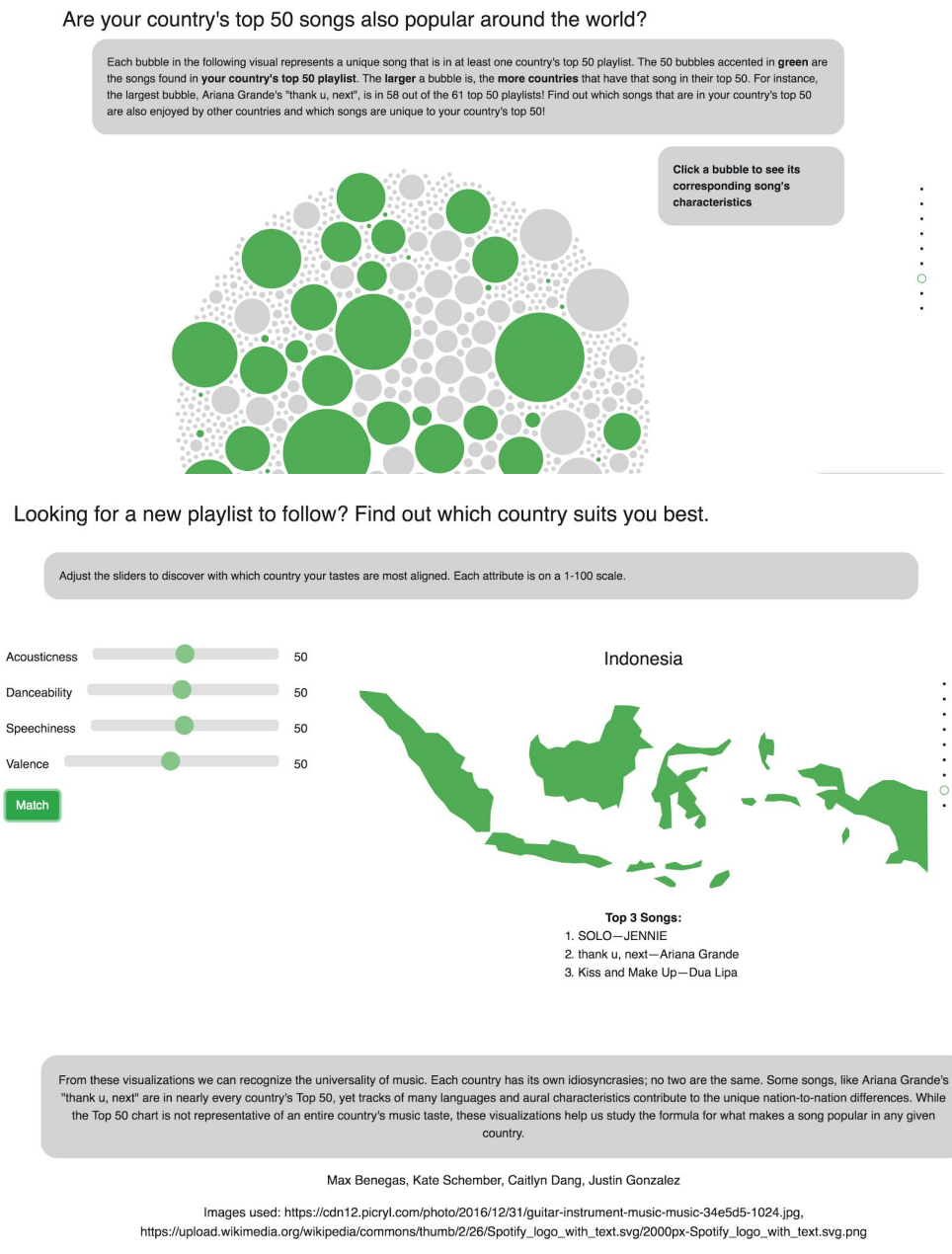
Take a closer look at how your country compares...

Now that you've seen the broader trends around the world, let's look at how your country compares to others around the world in more detail. Can you find the country that's most similar to yours? Most different? Perhaps you've been travelling lately, or just have dreams of future travels. How do the countries you want to visit compare to your own in average music taste?

There may be deeper value in considering these comparisons than you think. While the average American Spotify listener may be quite different from the average Indonesian Spotify listener, the energy and valence of the most popular songs for those countries are very similar. Take Reggaeton as an example. According to Spotify data, reggaeton's share of music on Spotify grew 119% from 2014 to 2017, compared to pop's growth of 13% and country music's growth of 4%. Following that trend, more songs from around the world borrowed reggaeton's catchy beat, including the massive Ed Sheeran hit "Shape of You." This suggests that the world may share more music tastes than we recognize.

Take a look at how your country compares to others to see what trends to look out for:

Choose a country to compare to yours:



Reasoning behind our decisions this week:

We implemented the functional improvements we needed from last week. We also added some basic styling to start considering more how we wanted the website to look. We chose to implement a pagination format to the page to improve the user experience. We agreed this made it more professional, as well as helped the user focus on specific pages and have clear separations between the sections. We worked on adding text related to either the specific visualizations or the broader story. All of the visualizations needed some explanation about their purpose, the Spotify attributes they use, and how

the user can interact with them. The text relating to the broader story is all meant to tell the user why this data matters and why they should care about it.

Main accomplishments:
Intro Map (Kate)

- Created map at beginning of page and implemented functionality to click a country and update the comparison and bubble charts

Choropleth Map (Caitlyn)

- Legend is working
- Transitions implemented

Comparison Chart (Kate)

- Added transitions triggered by dropdown menu
- Added styling
- Added text for that section

Bubble Chart (Justin)

- Improved tooltips
- Added onClick functionality to show each song's individual data
- Added more story text and context

Slider Chart (Max)

- Map area of the matching country is now showing up when button is clicked, with proper centering
- Top three songs for the matching country also show up

Overall Design (Everyone)

- Added story text
- Added pagination slide format using fullPage.js

Feedback (11/28):

- On the process book:
    - For each prototype: write what we did, how we feel about the progress, what decisions we made and why, add some screenshots along the way to show progress
- Too much text

    - On the “Our Project” page: change into the bullet points or something else more visually interesting to immediately get a sense of the main three ideas
- Add more simple graphs to replace text
    - “Our Data” we can change the “Spotify has x million users” to be a bar/line/area graph of the number of users over time
- Scrolling: create an easy way to navigate from page to page nonlinearly (navbar)
- Make sure people know that they can go back and change their country at any time
- For each attribute, be clear about what it means: include sound clips of really quiet and really loud songs, really danceable and really not danceable, etc.
- Make it clear how we chose the similarity calculation in the similarity graph
- Make sure we cite our data source at the bottom along with images

Remaining work before final submission:

Justin:

- Bubble chart:
    - **TODO**: find a way to toggle opacity of other bubbles on click
- **TODO**: add navbar at the top (see https://cs171-data-at-large.github.io/#home)
- ~~**TODO:** overall styling (final decisions on color pallete, font, etc.)~~
- ~~**TODO:** add bar chart/other chart showing # of Spotify users over time~~

Caitlyn:

- Choropleth map:
    - ~~**TODO:** Add country name as tooltip~~
    - ~~**TODO:** Fix issue where you can’t zoom or drag when mouse is over a country~~
        - Update: Conflicts with tooltips
    - ~~**TODO:** Make it clear to the user that map is zoomable/draggable~~
    - ~~**TODO:** Make layout more accessible for smaller screens (some pages getting cut off)—fine if not responsive, just play with the margins~~
- ~~**TODO:** Reduce amount of text and make story more comprehensive~~
- ~~**TODO**: Fix country name bug (Switzerland is Taiwan, Uruguay is Vietnam)~~

Kate:

- Bubble Chart:
    - ~~**TODO:** Make layout more accessible for smaller screens (some pages getting cut off)—fine if not responsive, just play with the margins~~
- Slider Chart:

    - ~~**TODO:** Make layout more accessible for smaller screens (some pages getting cut off)—fine if not responsive, just play with the margins~~
- Intro/Choropleth Chart:
    - ~~**TODO:** Make layout more accessible for smaller screens (some pages getting cut off)—fine if not responsive, just play with the margins~~
    - ~~**TODO**: make intro graph smaller, zoomable~~
- Comparison Chart:
    - ~~**TODO:** Make layout more accessible for smaller screens (some pages getting cut off)—fine if not responsive, just play with the margins~~
- ~~**TODO:** add bar chart for reggaeton info~~

Max:

- Slider Chart:
    - ~~**TODO:** Fix the bug where country does not show up until the second time the button is clicked.~~
    - ~~**TODO:** Figure out how to query the Spotify API and allow the user to play a 30-second preview of the top three songs that are now listed upon click.~~
        - Update: we can't do this
    - ~~**TODO:** add an info button to show how we calculated the similar countries~~
    - ~~**TODO:** align all sliders~~
- ~~**TODO:** add new slide towards the beginning explaining what each of the attributes mean, play example soundbites of extremes for each attribute~~
- ~~**TODO:** cite our data source at the bottom~~

Everyone:

- On the process book:
    - For each prototype: write what we did, how we feel about the progress, what decisions we made and why, add some screenshots along the way to show progress
- Film Screencast, link it in webpage (at the bottom)
- Edit README file

User Testing

Cara: Government major & in Radcliffe Choral Society

- "Really pretty"
- Our Project
    - ~~TODO: "recalls memories" sounds weird~~
- Chose the country

    - US
    - ~~TODO: Not clear you can zoom in map~~
- Choropleth
    - Interesting that the US loves to dance
    - She only focuses on her country really
- Comparison
    - Plays with ~2 other countries
    - Clicks US to see if it was accurate
- Bubble
    - “All top 50 songs”
    - “Orange is my country”
    - “Bigger the bubble, more countries”
    - Overall easy to understand
- Slider chart
    - “Oh this is cool”
    - Not sure what numbers to choose
    - The hover of songs would be helpful to hear
    - Tries to change speechiness but matches doesn’t change
    - “Oh I’m Vietnamese!”

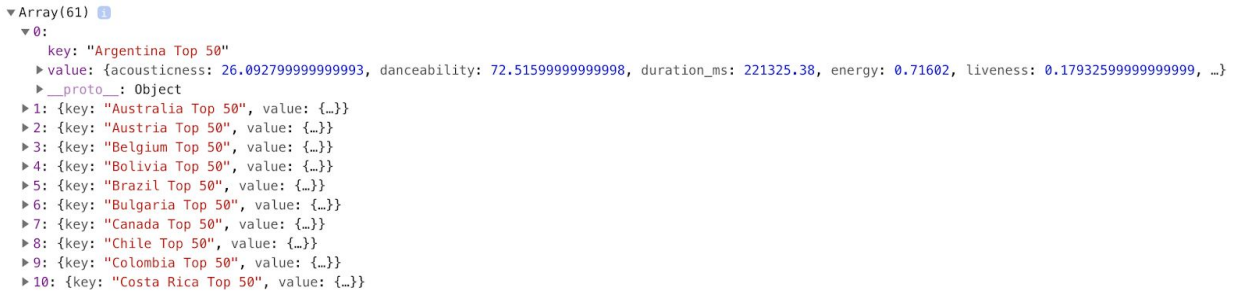
Reasoning for our final changes:
We weren’t totally happy with our styling, so we decided to use the gradient color schemes that Spotify does. This made a big difference in the overall feel of the page. We also changed the comparison chart to be a music staff with notes as data points. This made the chart more visually interesting and it engages with our theme. We added a line graph to show the number of Spotify users over time and added a bar graph to show the relative growth of reggaeton to supplement some of our text and make it more visually interesting. We also created a new page with sound clips of examples of each attribute we use (high danceability, low danceability, high valence, low valence, etc.). We also narrowed down the attributes we use to be consistent in all our visualizations and be the five we found to have the most interesting variance among countries. We edited some text based on user feedback and changed some pagination breaks and margins so everything fit nicely on a small computer screen.

Final Chapter

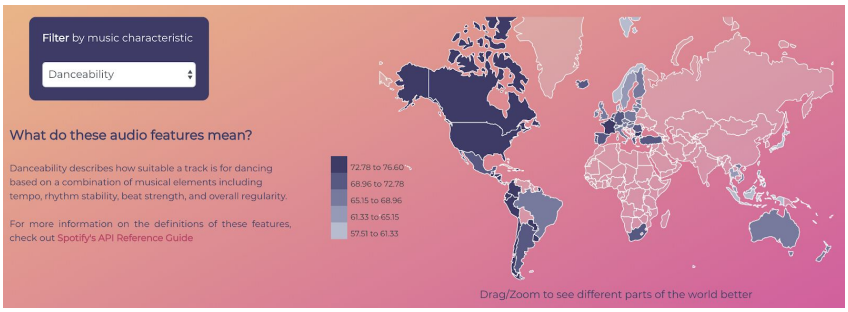
- Overview & Motivation

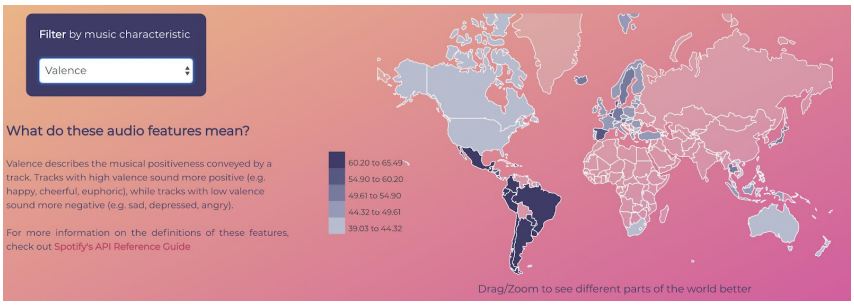
    - Listening to music is a universally loved activity, but the types of music people enjoy varies around the world. This makes for interesting, relevant data to explore and share. We hope to draw insights from the data and tell a compelling story on how music differs around the world. By the end of our story, we hope to provide our audience with a sense of which countries have similar music tastes as them. As Spotify has become such an internationally popular music streaming site, and one all four of us use too, we thought this was a great source of data to use to accomplish our goals.
- Related Work
    - Our design was inspired by Spotify's gradient playlist cover.
        - We wanted to make our website seem "Spotify Official"
        - See https://spotify.me/en
    - Our choropleth map was inspired by work we did in class
    - We were inspired by the implementation of pagination on previous 171 project winners
    - The technology over the generations website that we looked at in class one day also inspired us to consider how we could make our website relatable on a personal level
- Questions
    - Original: How does music differ across the world?
    - Originally we wanted our visualizations to show the audience how music changes country by country. Over the course of the project, we began to narrow the questions to:
        - Big Picture: How does music differ country by country?
        - How does country A compare to country B? (e.g. My Country vs. Argentina)
        - How much song overlap is there in the "Top 50" playlists, and how does my country's "Top 50" playlist compare?
        - What country matches my music taste?
- Data
    - Source: Spotify API (https://developer.spotify.com/documentation/web-api/)
    - Source: Spotifyr (R Library) : We will use this library to access Spotify's "[Country] Top 50" playlists for all countries that have available data (~50-60 countries) and use the playlist's song characteristics for analysis and visualization. (https://www.rcharlie.com/spotifyr/)
    - Scraping: We collected all 61 countries playlist from the Spotifyr Library and created a audio_features.csv

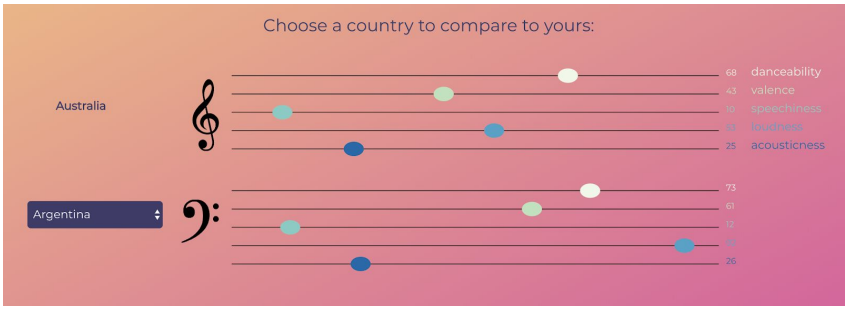
- Cleanup: We took the average of all the audio features per country and created a new dataframe that looks like this:

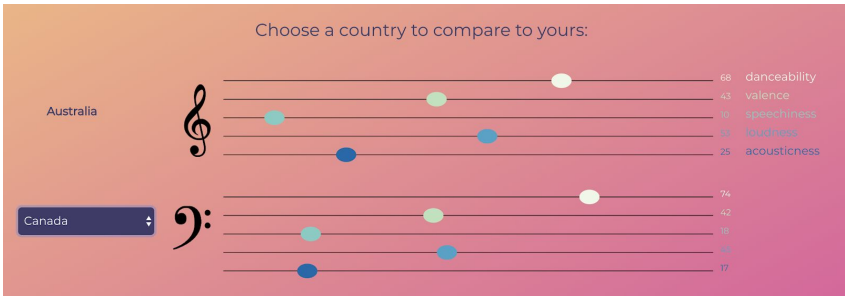


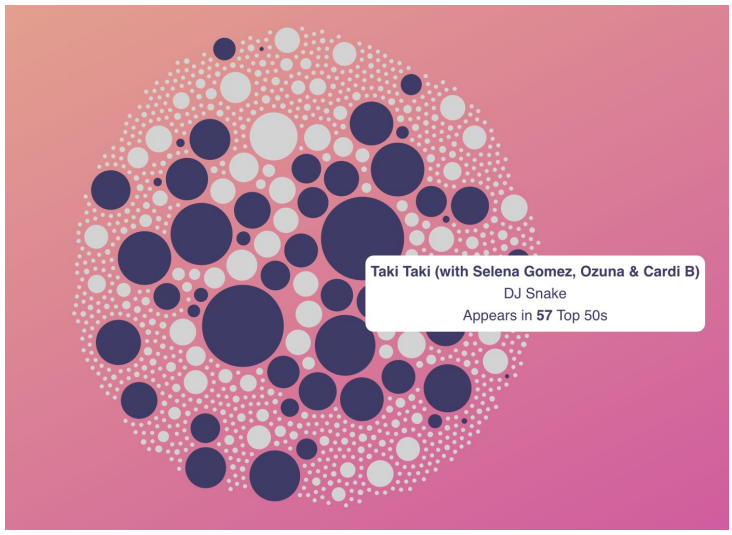
- Exploratory Data Analysis
  - To initially visualize our data, we used a lot of bar charts to compare countries, songs, etc. We learned that we can gain more insights with have a more dynamic graph. For example, we wanted our users to do more than just compare. As a result, we created a dynamic choropleth graph that gives the audience a visual context, and also to dive deeper into specific audio features. In general, these insights pushed us towards creating more interactive and dynamic visualizations that our audience can play with.
- Design Evolution
  - Web Page Design: Initially we began with a static webpage with a simple color palette (Spotify's green). After learning more about making a webpage more seamless, we added smooth transitions across pages, to help tell a story. We change the entire "theme" of the web page to make it more visually appealing. The contrasting and bright, happy colors draw the user's eye.
  - Colors: We used the color wheel we talked about in class to choose which colors complement each other.
  - Visualizations: We used contrast as a visual channel for the choropleth map. For the comparison chart, we used the position of the music notes as a visual channel as well as contrast in the colors so it's easy to compare the speechiness of both, the valence of both, etc. For the bubble area chart, we used area as a visual channel and color as a method of grouping songs in your country. Throughout the page, we align our elements well and repeat the same color scheme on all the pages. We learned all of these techniques from the CRAP principles.
- Implementation
  - Choropleth Map Intent: User will change attributes in dropdown, and the map will change accordingly, showing broad trends across the globe on one screen.

- Functionality: We implemented a choropleth map with a dropdown menu for the different attributes. This was similar to our midterm project.
  - 

  - 

- Comparison Chart Intent: User will change the comparing country and compare specific attributes to their chosen country. This provides an opportunity to look more closely at all the attributes for two specific countries at once.
- Functionality: this automatically populations the top staff with the country chosen in the first map. The dropdown is selected and the dots and labels transition to new values.
  - 

  - 

- Bubble Chart Intent: User will recognize that blue bubbles are their own country. The user will hover over the bubbles to see which are the more popular song. This is where the user can see specific songs in their playlist.
- Functionality: this automatically updates based on the first map. Information pops up with a tooltip when hovered over and in a text box to the left when clicked with information about the attributes. The bubbles are draggable.
  - 

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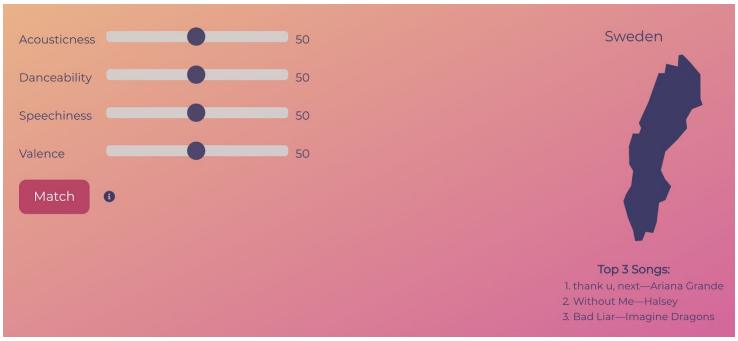
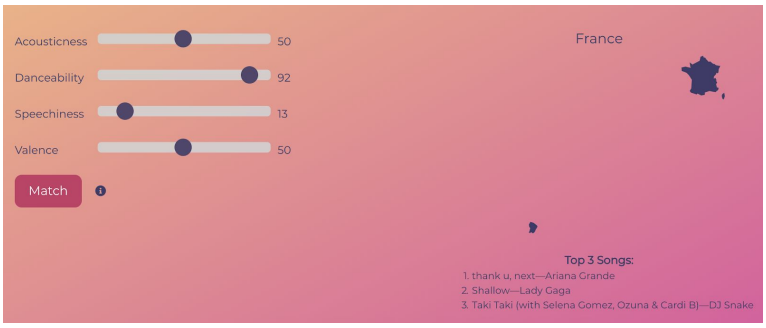
- Slider Chart Intent: User will move the sliders based on their chosen attributes, and a country close to those averages will be matched. This adds a personal connection to the website.

- Functionality: Each slider can be changed and when “Match” is clicked, our code finds the country with average attributes that has a minimal difference between the chosen settings.
  - 

  - 

- Evaluation
  - What did you learn about the data by using your visualizations?
    - Audio attributes vary similarly by region/continent (see this in the Choropleth Map)
    - We learned that many countries have similar Top 50 songs (Bubble Chart)
    - A singular attribute isn’t necessarily a defining feature that sets a country apart from others. (Slider Chart)
  - How did you answer your questions?
    - We answered our questions with a funnel approach. We began with a broad perspective on how music differs, and then we continued to look at our other graphs as we made them to see more detailed information.
  - How well does your visualization work, and how could you further improve it?
    - All of our visualizations perform well based on its original intent.
    - We wished we were able to utilize the Spotify API to listen to specific songs. However, we needed to write in server side javascript, which we were not able to do.

- We would also have liked to access the user's spotify account to compare it to the world, but there were additional issues (i.e. not enough data)
- It also would have been interesting to look at the changes over time, but Spotify does not keep its old "Top 50" playlists, it just updates them. If we were to continue this project for a few years, we could periodically download the new data and save it to show the changes over time.