Process and Evaluation Document (Group 3)

Domain Selection

We have chosen to develop interactive visualizations for music on Spotify. Our focus is on utilizing the top-charts of all countries from the past few years to create an engaging exploration experience for users. The goal is to support people in discovering new music they might enjoy. By visualizing the relationships between songs, artists, genres, and albums, users can navigate the interconnected world of music more intuitively. This approach aims to go beyond traditional search methods, offering a more immersive and exploratory experience.

Decision Maker

Our primary decision makers are music enthusiasts and casual listeners who are actively looking to discover new music that is like their music. By using our visualization tool, users can browse through the vast network of music connections, discovering songs that may not appear in their regular recommendations. Our aim is to provide users with an interactive, enjoyable, and insightful way of discovering music.

Use case & motivation

While music streaming platforms offer recommendations, these are often limited to algorithmic suggestions based on past listening behavior. Users seeking to actively explore new music beyond these suggestions have limited options.

Our visualization tool offers a fresh, network-based approach. By connecting songs, artists, albums, and genres through a visual graph, users can interactively navigate the music space. This network view allows users to follow connections between related songs, artists, genres or albums, offering a more involved discovery process.

Some possible tasks include:

- **Exploration**: Users are motivated by curiosity and can explore new music in an interactive way, going beyond algorithm-driven recommendations.
- **Control**: The ability to guide their own exploration process provides users with a sense of control, as opposed to passively consuming algorithmic suggestions.
- **Understanding**: Music enthusiasts learn more about the topology of music and can learn about the relations between different genres and music. The visualizations

offer a novel way to achieve this by showcasing song characteristics within the graph.

Data

Data sources

Our core dataset has been obtained from Kaggle. It covers the top music-charts of many countries since 2023-10-18. Entries are included per country, rank and day when a song is in the top-charts of that country on that day. It includes the song id, artist names (separated by comma's), song title, song musical features, rank, date and country.
https://www.kaggle.com/datasets/asaniczka/top-spotify-songs-in-73-countries-daily-updated

We extended this dataset with the Spotify API, which we did to retrieve the metadata about the measurements of songs and albums. These were necessary because the original data separated artists only by commas, which would cause mistakes in interpreting artist names that contain commas in their name (e.g. Earth, Wind & Fire). The kaggle dataset also missed the id's of artists and albums, which brought a risk of false associations when names are used more than once. The obtained metadata was saved to two JSON files. Both files contain a list, of which one contains all the songs (with associated albums) and another contains all the artists. The songs also contain the associated albums, which then also contains the artist ids.

Our extended dataset is ready for publication but was not published because we are currently unsure about the licensing of the data.

Data wrangling

We used a jupyter notebook to wrangle the data. The code can be found in project repository.

Data understanding

For understanding the attribute values (e.g. instrumentalness or loudness), we looked through the Spotify API documentation. We added these explanations to our own system in the attribute table.
https://developer.spotify.com/documentation/web-api/reference/get-audio-features

Missing data

For the original Kaggle dataset, we looked at which data contains missing values, which came down to the following:

(name, 0.002%), Deemed so rare that it was ignored.

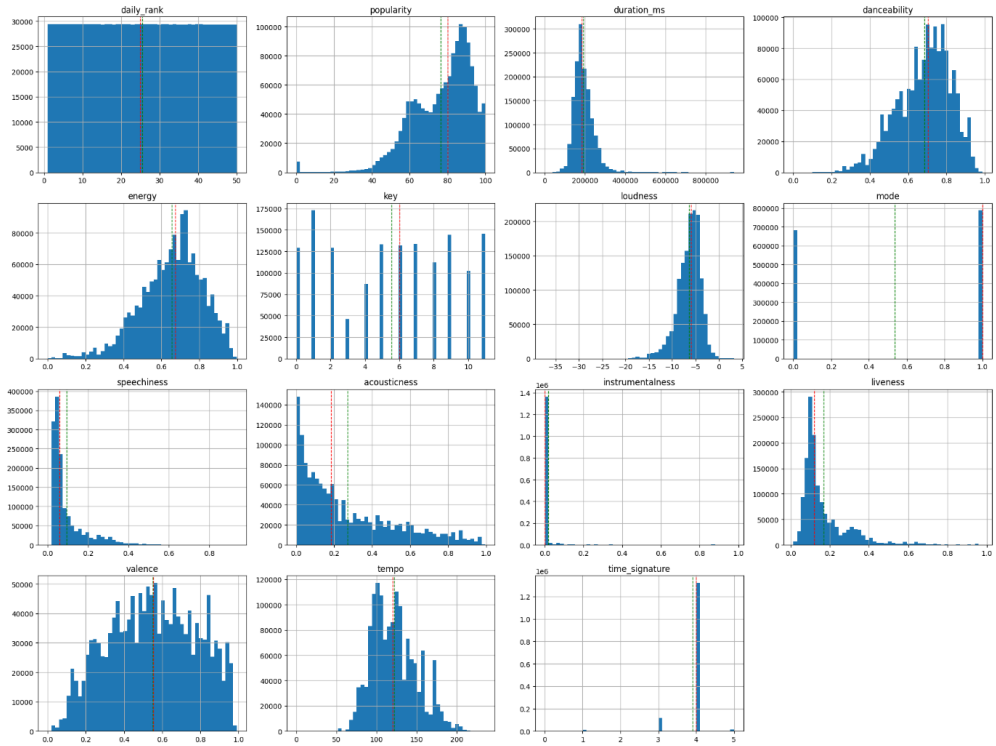
(artists, 0.002%), Deemed so rare that it was ignored.

(country, 1.363%), concluded to be missing when the top list was global, so data is not missing.

(album_name, 0.046%), some songs are without an album name, we determined that some singles were released as such. In such cases, an empty name will be used.

(album_release_date, 0.035%), some songs are without an album release date. As we do not use the album release date, it is not a problem.

Distributions of the data

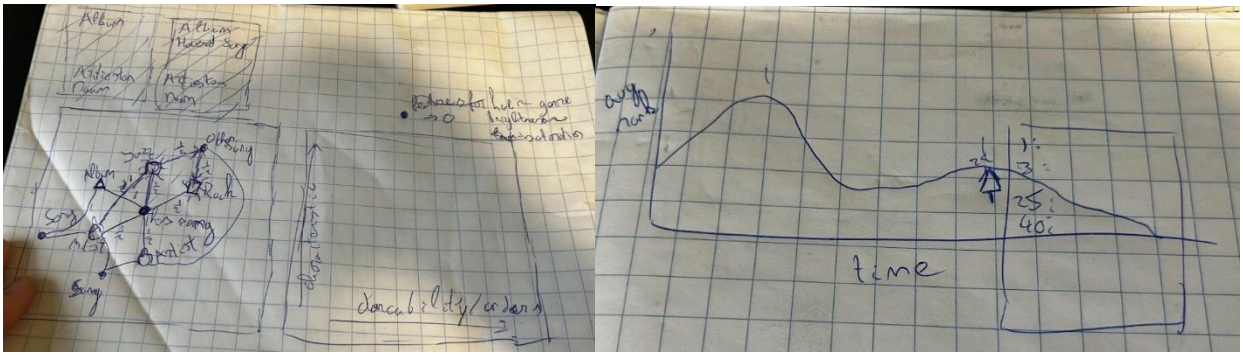


Interactions Sketches

Process

Initial Rough Sketches

Stijn



Veit

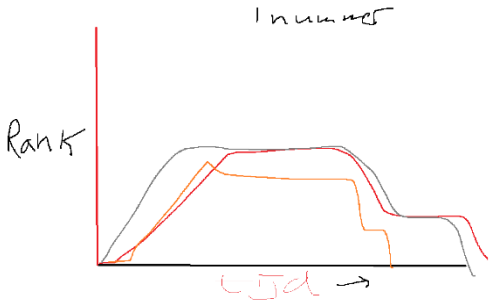
Legend Scale wher you are similar to in types of song

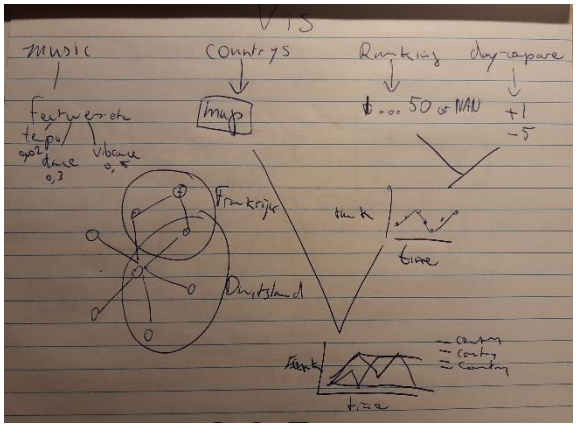
Presented data as name album... of selected song

While hovering over country information on placing

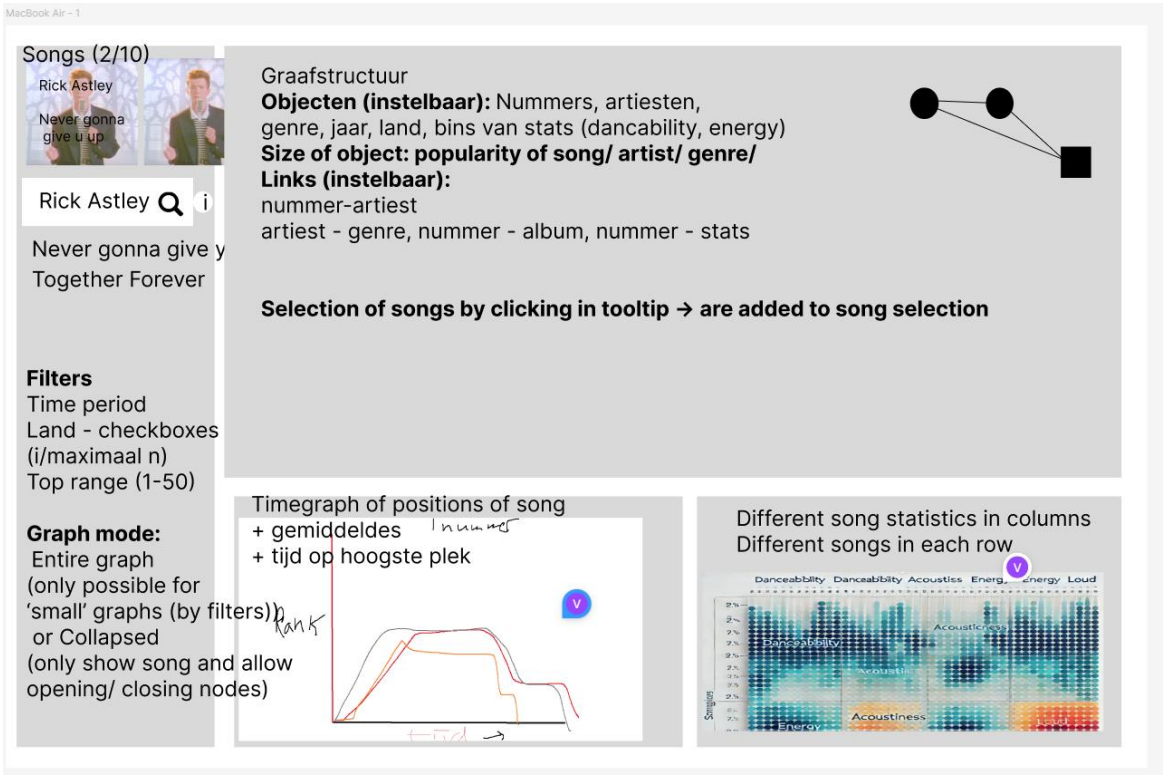
- Histogram of places
- Timeframe possible to set

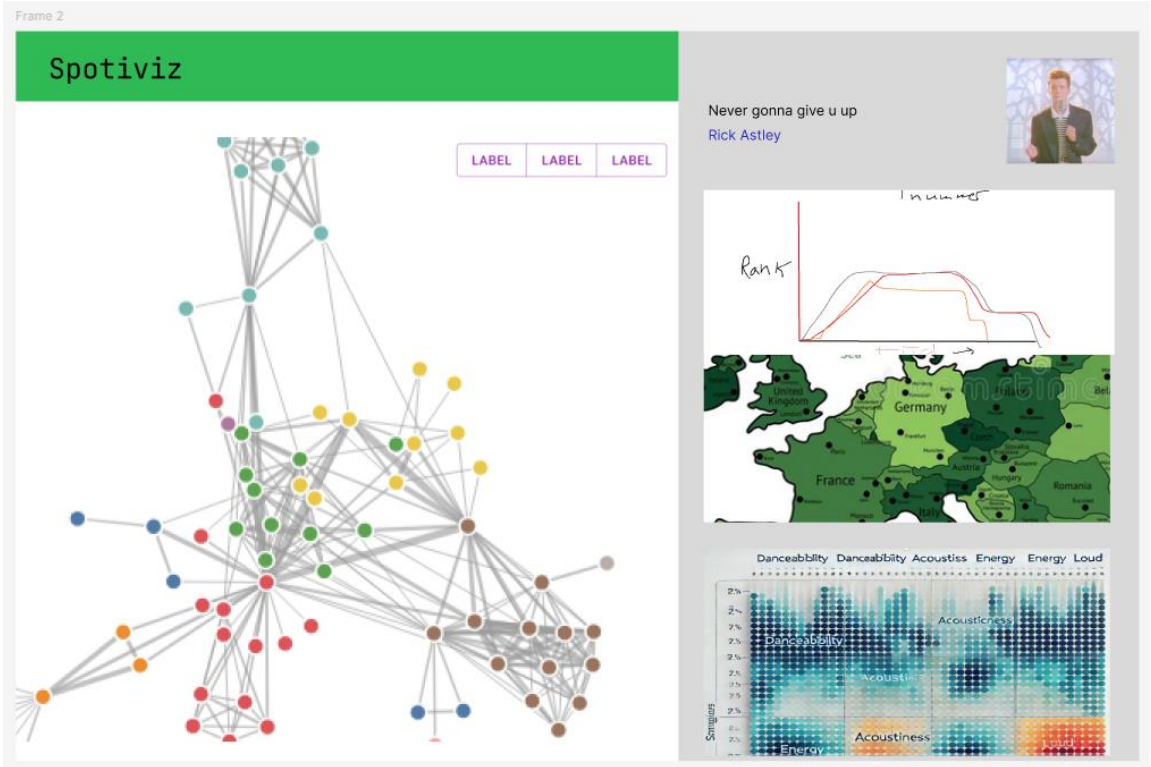
Ko


Rank
time


music
countrys
Ranking
day-capare
features etc
tempo
dance
Vibrance
Frankrijk
Duitsland
rank
time

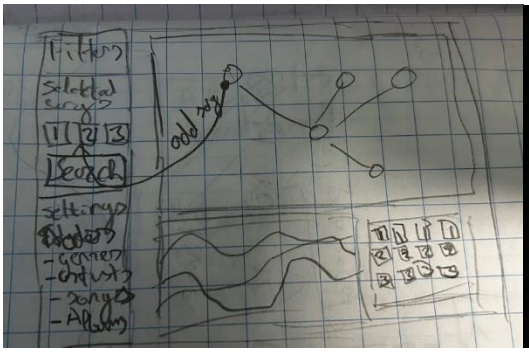
First concept

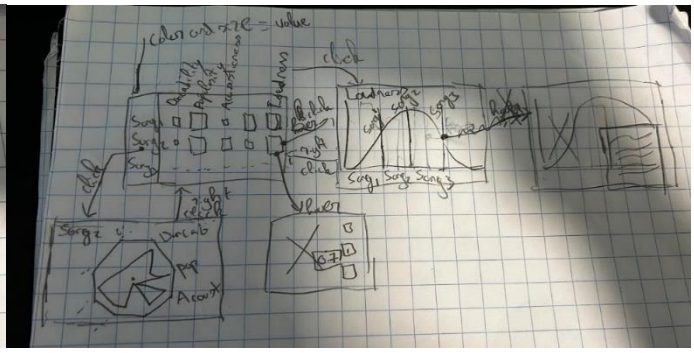


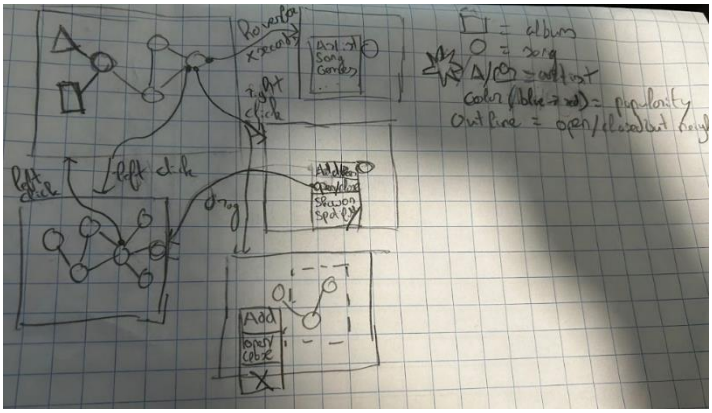


Second round of interaction sketches

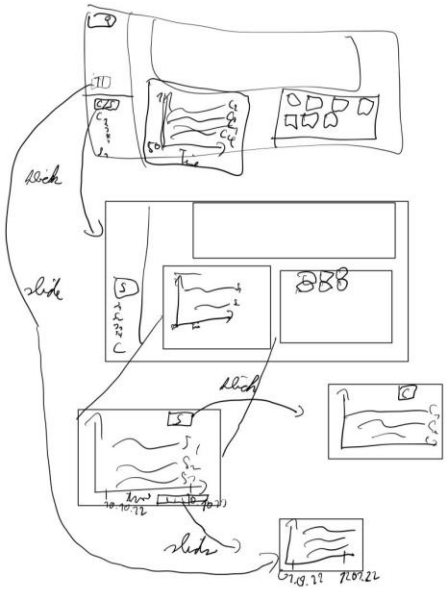
Stijn

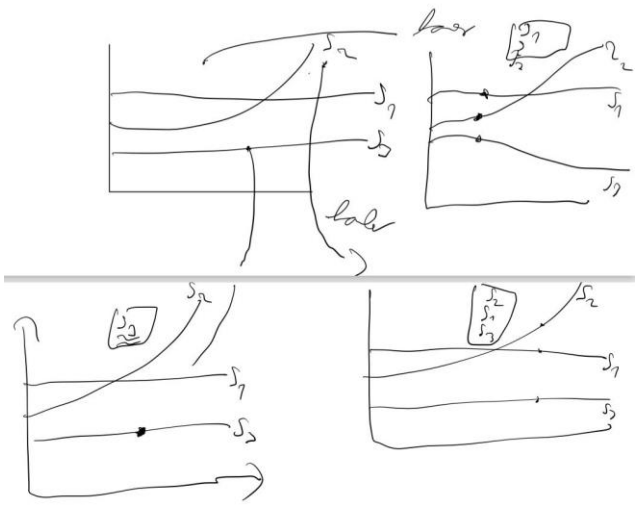




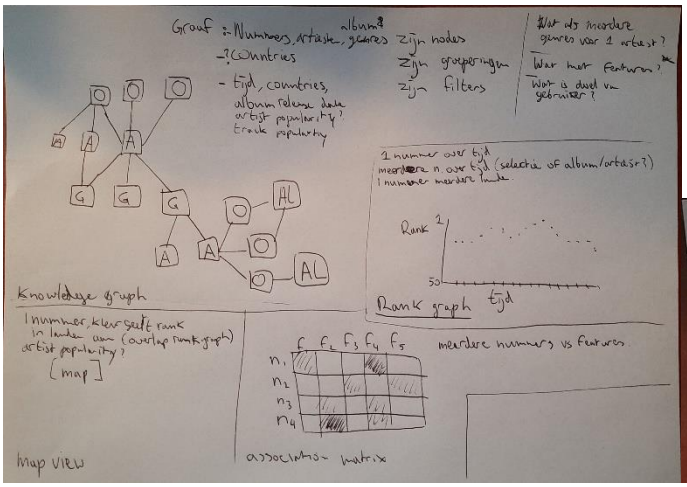


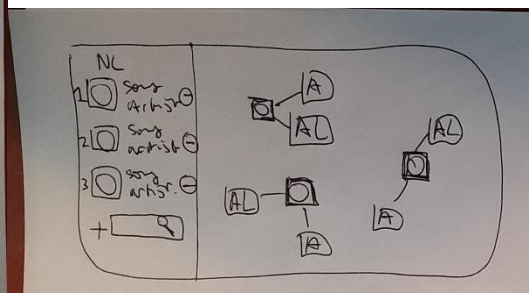
Veit

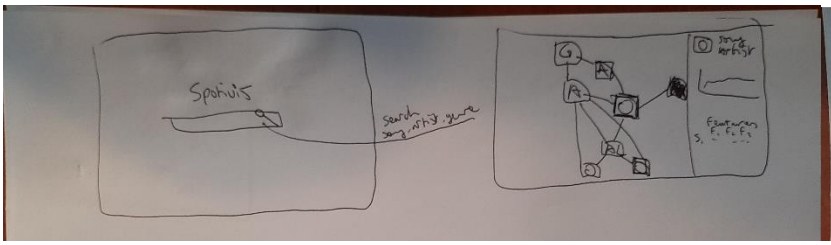


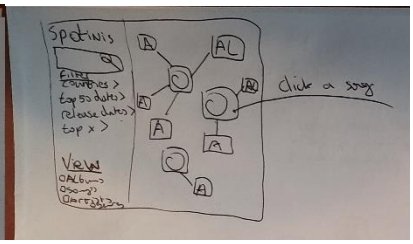


Ko


Graaf
Knowledge graph
Rank graph
tijd
Map VIEW
associatie matrix

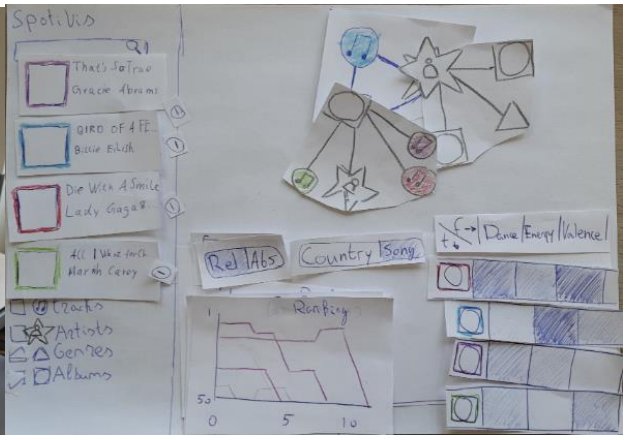

NL

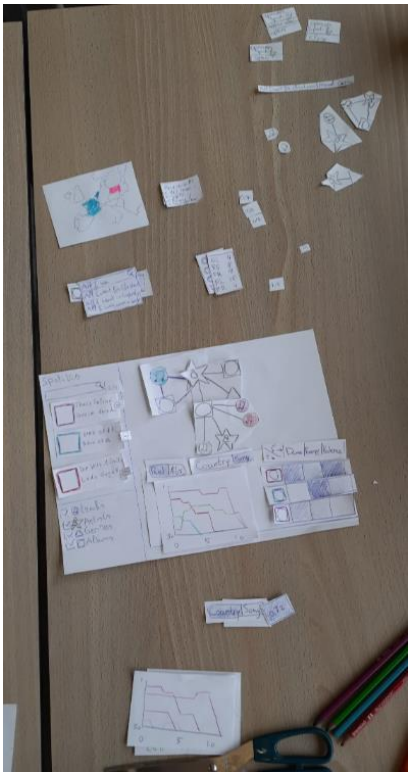

Spotivis


Spotivis
View
click a song

Design Outcomes

Paper prototype (used in evaluation session)





MoSCoW rough prioritization

Must Have

- Card or Rank Chart: To be evaluated next week.
- Selected Songs: A min-max system with songs that reappear in the views.

- Search Bar Design: Using Ko's design for the search bar and song interface.
- Selected Songs Visibility: Always visible.
- Interaction Between Visualizations: Highlight one song across all visualizations when hovered over.
- Network Graph Edges: Edges between song-artist, artist-album, artist-genre, and song-album.
- Network Graph Node Types:
    - Artist: Head/figure/star.
    - Song: Circle/CD.
    - Album: Square with channel indicator (e.g., color ~ hue) for the type.
- Network Graph Context Menu: Accessible via right-click.
- Network Graph Click Action: Open nodes when clicked.
- Features-Songs Table:
    - On hover over a feature in the matrix, adjust graph color (preferably luminance) and line chart.
    - Sort by values.
    - Gradient coloring for values.
    - Display value on hover/in the table.
- Default Selection: Include a set of interesting songs by default.

Should Have

- If Using Line Chart:
    - Add a toggle button for country/song.
    - Tooltip showing values of the day, ordered from best to worst (point on the line chart).
    - Time span selection for the displayed period.
    - Option to view the line chart from the relative release date or absolute time.
- Scrolling and zooming in the graph.

Could Have

- Features-Songs Graph: Display distribution on hover.
- Network Graph Settings: Configure which nodes are visible.
- Configurable Network Graph Nodes: Must have at least two visible nodes.

- Settings: Filter by release date.
- Countries visible in the graph.
- Future Optimization: Determine the maximum number of nodes to display.

Evaluation

Evaluation plan

The evaluation plan below was constructed loosely and was intended to provide only limited structure in interviews. It provided some questions that we wanted answers to, but the unstructured nature of the interviews also gave rise to other insights.

During interviews

- Keep notes! Preferably on a laptop on a per-question basis.
- Make think-aloud: make them say what they are doing and thinking
    - Traditional think-aloud, where one speaks during the actions
- Groups: 1 2 4 5 7 8 10 12 13

Tasks

1. Find more information about a particular song "All I want for christmas" you like by entering it in the system.
2. Find out how the songs were ranked in the charts in the selected country/countries.
3. Tell in which country your selected songs performed best.
4. Find songs that are of the same artists in the graph.
5. Decide if the song is good for a dance party.
6. Judge similar songs on how much you would like them
7. Visualize danceability (seen in the matrix) in the graph to see how it differs over different nodes.

Design questions

1. Is it clear when a song is not in the top 50 in the line chart?
2. In discovering new music, would you prefer a map of the popularity of the songs or rank graph over time?
3. Would you like to use moving and zooming in the graph?
4. Did the visualization help you find new music?
5. Did you experience any problems/ come up with any suggestions throughout using the system?

Anything else

Evaluation samples

Round 1 (Veit as notetaker):

Group 13

Used relative ranking

- First search for it (was fast)
- “What is the ranking?”; When we ask to tell about the ranking of a song
- “Is the line plot only for the song?”

3. Was difficult. Purple of country is: “is it the same as in the country list?”
4. Darker color is easy to distinguish for the danceability

General comment:

- Legend for shapes is to far away from the graph view - “I would expect it somewhere closer, probably right on top in the graph window”

Round 2 (Ko as notetaker):

Used relative ranking

Participant from group 8.

When tasked to get more info about ‘all I want for christmas’, they immediately identified the search bar, clicked it and started typing. They clicked a search suggestion and the interface updated with the new song.

When tasked to see where a song is ranked in the charts, they needed some time to search but used the ranking chart. After hovering and noticing the hover pop-up, they found it's ranked 4th in NL.

Next, they are tasked with seeing in which countries a song is performing best. They try to click the country in the hover pop-up that was still opened from last task and nothing happens. They try to interpret the graph better but get confused about the numbers at the bottom of the ranking and what that means (unsure wheter it was set to relative or absolute). They click the country toggle and the view changes. They hover over a line and the pop-up window opens with insights. User tells us they are lost and don't know what they're looking at.

When tasked to find the best song for a dance party, the user quickly identifies the word dance in the feature matrix. They very quickly notice that more saturated colors indicate a higher value and assume this means performing best.

Next they are tasked with finding a song from the same artist as already selected. The user tries to search for lady gaga in the search field. They are directed by us to the graph. Tries to click artist (unsure whether they knew which artist is who). They assume the songs that pop-up are her songs.

General findings: Matrix and the country chart(?) seem clear, but the ranking chart unclear. Also it is difficult to distinguish what the knowledge graph represents: they couldn't find out what the different items in the chart meant, and how the colours over the entire interface are connected. The user only notices the legend now and suggests it should be nearer the graph. When asked if rel and abs were clear they answered no. After interacting with it they understood better.

They indicated the interaction could potentially give insights. Of the visualisations, the matrix was liked the most.

On the country map: The user assumes it's a map and tries to click a country. A pop-up appears with the current ranking in that country. This is also what the user assumes. They try to click a song in this ranking, but nothing happens. After hovering poland, they also understand the feedback in the hover window.

Round 3 (Stijn as notetaker):

The participant originated from group 5. The top-position chart utilized absolute timestamps for this round.

The participant was asked to enter a song into the system. Search was clear, song was added.

The participant was asked to talk about the song ranking, whereafter the participant determined the song to do okay. The participant elaborated by saying that the rank was halfway the top 50. The tooltip component on hovering helped solve any further confusion.

The participant was asked to talk about the ranks of one song in multiple countries. The participant found this chart unclear as there was notable confusion about which song is selected in the country chart. There did not seem to be any selection method for a specific song.

The participant was asked to choose a song that is fitting for a dance event. After the participant was prompted to do so, they immediately jumped to the attribute matrix and gave the correct answer. They explained that the darker color meant a higher danceability.

The participant was asked to find the same songs of an artist. The participant started looking over the dashboard and tried to toggle the checkboxes in the left-bottom. The participant preferred to deselect everything but artists and did initially not understand that the filters were linked to the graph. After some clicks and their effects to the UI, the link between the graph and filters became clear. They then clicked the artist in the graph, which then showed all songs from that artist.

The participant was asked to compare Relative ranking vs Absolute ranking in the top chart position line plot. They found that “relative” was unclear and suggested making it clearer with labels. After the session the idea behind “relative” was explained, which the participant examined to be of interest.

The participant noted that by trying to click on nodes in the graph, different nodes appeared and disappeared. They found that rather intuitively.

Round 4 (Ko as notetaker):

The participant originated from group number 2.

Searching for a song and adding it to selection went smoothly. After, when asked what insights they can gain from what they see they said the matrix is clear, the song has high valence. From the rankchart it seems the song was popular in november (in absolute view). In the knowledge graph, they see a link and assume the song linked to another node means they are alike (red: so seems unclear what nodes meant). When asked if nodes were clear they understood only after being shown the legend.

When looking for the rankings of of a song in countries (rank chart), they do not understand they need to click the country toggle. After explaining, they still do not understand the chart, and don't understand the relation to countries. They only see the purple lines.

When tasked to find a song with the same artist as the blue song, they click the blue song in the knowledge graph. This then expands into new nodes. Red: how is the song blue (so in a selection but not expanded)? They click the album. They saw a second artist popping up and were confused, but then understood it might be a featured artist. We could not represent more songs in the album because we didnt have the right papers

When tasked to find a song for a party, they immediately consult the matrix. They see dancability and valence is high for a song and pick that one. Participant does not know exactly what the categories mean, and expects some more information when on-hover on these names.

General remarks: The colours are hard to distinguish for a colourblind person. Also, the user really likes the expanding nodes in the knowledge graph.

Round 5 (Ko as notetaker)

The participant is from group 4. NOTE: this was a very short and chaotic session, online through a phone camera. This introduced a lot of noise. Not the best quality of results.

When trying to explain what they are looking at, they think the feature matrix is a view showing top albums. They see the ranking chart, but are unsure what is being ranked (what the lines represent). In the rank chart, they do not understand the x-axis labels (in absolute view, labels like 25/11, 30/11 were interpreted as being a frequency perhaps).

When asked to add a song to selection, they do not know how and we have to direct them to the search field.

When asked what the knowledge graph represents they indicate the main branch (?) is artists, songs and albums.

When asked what they expect clicking on an album icon in the knowledge graph would do, they indicate they expect to get a selection (?)

Round 6 (Stijn as notetaker):

The participant originated from group 12.

Their initial observations were three selected songs, a search bar and filters in the left-bottom. He initially thought that the filters would be used for filtering search items (whereas they apply to the graph).

The participant was confused about the difference between relative and absolute timestamps for the top positions chart.

The participant clicked on the nodes and expected the graph to become smaller. This happened.

The participant wanted to add a song and indicated that they wanted to search. The search was clear and adding a song worked well. After adding, the participant noted that the colors of songs were used to relate the songs throughout the different visualizations.

In the matrix table, the participant noted that darker colors were used to represent higher values. The participant was asked to identify the song that is best for dancing. He identified the correct song.

The participant looked at the graph and had some confusion at first. The shapes and icons were hard to understand. They did not know that the filters in the left-bottom were to be used together with the graph. After being informed about the filters, the participant put together the pieces and started to list the associations found in the graph.

The participant was tasked to find all songs of an album. He clicks on an album and thereby opens the album, showing all its related songs.

He hovers on the name to see the node name and artist.

The participant is tasked to add a song from the graph to the selected songs (shown in the menu). The participant is unsure and tries to drag the item to the selected songs container. He then tries to use the right mouse button to add it, whereafter a context menu is opened. It then became clear to him how this works.

The participant asked about the A/B side of the album, referring to the front- and backside of a vintage LP. He is informed that this is not possible because Spotify data is used.

The participant uses the top-position chart and clicks on country mode. This confuses him, as he thinks that the country is not popular anymore. It does not seem clear enough that this data is still about the songs within the selection. Furthermore, the different opaqueness of the lines does not suggest that these lines are different countries

Our visits

We visited: group 2 (football), 13 (anti terrorism), group 4(stocks/ funds), group 8 (crimes in utrecht), group 10 (disney)

Evaluation outcomes

From the evaluation session we have determined the following:

1. The ranking plot definitely needs work. Users experienced a lot of confusion.

    a. Especially the mode in which different countries of a specific song are selected seemed unclear. Users seemed confused about which specific song was shown for the countries and had a hard time determining that different lines represented different countries. We have chosen to make this a nice to have, which can be added if time permits it. However, instead of a toggle, it would be triggered on clicking a specific song.
    b. The switch between relative and absolute start dates also turned out to be confusing. Only after being told about the meaning and functioning by us would it be clear. Most participants did, however, note that it was an interesting metric, but found that phrasing was unclear. Better phrasing/ wording should be used.
2. The filters of the graph were not associated with the graph, which caused confusion about the shapes used in the graph, as these are only explained in the filter list. It was not considered by users to apply only to the graph. To address this issue, the filters will be moved closer to the graph on the right side, and it will be prioritized as legend.
3. The matrix plot with colors representing attribute values of songs was clear to most. We will add labels and explanations to the individual attributes but think that the idea of the plot is clear from the onset.
4. Interactivity within the graph was generally clear.
    a. Clicking on a node to open it seems to agree with what people expect.
    b. The context menu that can be opened by right clicking a node was less clear and required a suggestion to the user. As such, we think it is important to display this option.
5. One participant that visited was color blind (not able to separate between green and red). Thus, he found it hard to separate songs of different artists. This problem was fixed by displaying the name of the song/ artist on hover. It would be better to allow multiple color blindness modes, so that people can switch the colors used for the songs.
6. The sketches were not accompanied by any labels, and participants missed information about the sketches. These will be added in the final design.

Evaluation of our chosen method

During the first few weeks we designed an interface using Figma, which allows creation of protypes by linking views. However, we later decided to pivot to a paper prototype, as it

would provide flexibility and more interactable. We note the following pros and cons of this method:

- The paper prototype was more flexible because it allowed for adjustments during the evaluation session. One example of this is how we added clearer labels during a two-minute break, allowing rapid evaluation of new ideas.
- Participants were able to quickly draft new ideas and suggest concrete changes, something that is hard to do in Figma in a short timeframe.
- It fostered interaction because any combination of paper was possible, which we found to work better than Figma. This because interactivity within Figma does not scale well as new views are needed for every distinct option.
- We found that handling interactions by participants was a lot of work, it required adding, moving and removing papers from the interface. This increased the mental load for the interviewer, which takes away effort spent on the interview conversation.
- Some UI elements were not clear in paper-form, as it was hard to draw according to web-standards.

Updated rough MoSCoW prioritization (which lead to tickets)

Must Have

- Selected Songs: A 0-10 scale with songs that reappear in the views.
- Consider a potential reduction of the max value.
- Search Bar Design: Using Ko's design for the search bar and song interface.
- Selected Songs Visibility: Always visible.
- Network Graph: Colors for the selected songs.
- Legend with all types of nodes.
- Network Graph Edges: Edges between song-artist, artist-album, artist-genre, and song-album.
- Network Graph Node Types:
    - Artist: Star.
    - Song: Circle/CD.
    - Album: Square with a circle.
    - Genre: Triangle.
- Network Graph: On hover, display song, artist, genre, and album details.
- Network Graph: On click, open nodes.
- Features-Songs Table: Gradient coloring for the values.

- Default Selection: Include a set of interesting songs by default.
- Line Chart: Display using absolute date.
- Scroll and zoom in the graph (if not too much work).

Should Have

- Interaction Between Visualizations: Highlight one song across all visualizations when hovered over.
- Features-Songs Table: Sort by values.
- Features-Songs Table: Display value on hover/in the table.
- Line Chart:
    - On hover over one line, show a tooltip with rankings in countries for that song.
    - Option to view the chart from the relative release date or absolute time.

Nice to Have

- Settings: Filter by release date.
- Network Graph Context Menu: Accessible via right-click.
- Network Graph Settings: Configure which nodes are visible.
- Features-Songs Table: On hover over a feature in the matrix, adjust graph color (preferably luminance).
- Line Chart:
    - On hover (not on one line), show a tooltip for the day with values ordered from best to worst.
    - Time span selection for the displayed period.
- Features-Songs Matrix/Table: Display distribution on hover.
- Countries visible in the graph.
- Future Optimization: Determine the maximum number of nodes to display.