Disco Planet — COM-480 Project Report for Milestone 2

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I. Introduction

Modern means of communication and transportation have brought the world closer together. With many cities turning into melting pots, cultural, social, and personal motives drive people's curiosity to explore how diverse backgrounds and experiences intertwine and blur geographical borders. Since music plays a central role in cultural identity, our project strives to provide these insights by looking into the musical preferences of people around the globe.

II. Visualization Ideas and Sketches

Initially, we thought about visualizing musical preferences of different cities on a map.[1] After more thorough consideration, we concluded that 2d space might be too flat to disclose complex and surprising dependencies from the data in a sufficiently engaging and impactful manner. Having found additional inspiration on the Internet (Fig. 1), we envisioned our core visualization as a globe in 3d space.

For usability reasons, our visualization will be displayed in a web browser. As our project develops on the subject of music, we would like to use familiar metaphors to help viewers easier relate to and enjoy the experience. The Earth globe would resemble a disco ball, and the overall website design would have signs of a music player, allowing users to listen to different representative pieces. Overall, we expect to have three views to show various aspects of the dataset. Each view will progressively refine the visualization details based on zoom interaction. An elaborate discussion of each view follows below.

A. Globe View

The *Globe View* is the starting view, and the core part of the visualization meant for a broad audience (Fig. 2). It will showcase the planet in the middle of the page and a navigation panel on the left. The navigation panel will list the most popular music genres in the world and allow users to explore them one-by-one. By clicking on a genre, the internal glow from the planet will highlight the cities where the genre is widespread, and interesting statistical facts will appear on the right. Clicking or searching a specific city will show its musical profile in a pop-up and indicate N cities with similar musical preferences with gleaming arcs. As mentioned earlier, it will be possible to listen to different musical pieces by clicking on the "Play" button.

B. City Space View

The *City Space View* is meant for more inquiring viewers (Fig. 3). It will show a graph of the cities arranged using a measure of similarity. In particular, we are using the node2vec algorithm to create an embedding of each city and project these embeddings into the 2d space using a dimensionality reduction algorithm suitable for visualizations (UMAP). The user will be able to see how cities relate to each other in the abstract space and compare the positioning with the actual geographical map, which will be linked to the main space

[1]Detailed information on the project problematic and the dataset is available in our github repository.

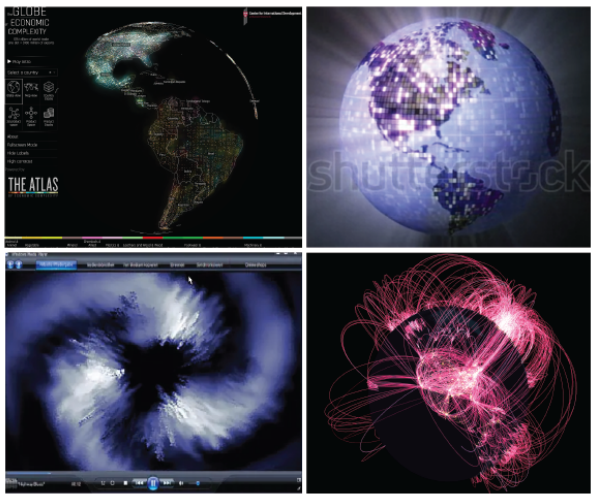

Fig. 1: Sources of additional inspiration. Top left and bottom right images are screenshots of actual visualization projects. Top right and bottom left are the metaphors that we want to reuse for our project.

view. Each city will be colored according to its geographical position, such that if two cities have close colors, they are close on the map. We implement such a coloring using a z-order curve. It will be possible to select the cities of interest on the map, and the corresponding cities will be highlighted on the graph. The user will be able to select a pair of cities and see what genres and artists are popular in both cities. Exploring music profiles of individual cities will be possible similarly to the Globe View.

C. Genre Space View

The *Genre Space View* is conceptually related to the City Space View, and will show the music genre clustering obtained with a graph community detection algorithm (Fig. 4). We are still experimenting with 2d and 3d representations of the space to see which works better. The user will be able to see which fine-grained genres comprise larger clusters by expanding the nodes and listening to representative songs.

III. Tools

The complete data set driving our project exceeds several hundred megabytes in size. It includes 33 thousand artists and more than 3 thousand cities along with the connections between them. Loading this amount of data in one request does not seem viable, which forced us to split the application into a front-end and a back-end.

A. Front-end

We use React to be able to decompose the app into smaller reusable components. Conceptually React becomes a scaffolding, Three.js serves as a renderer, and D3.js is used very granularly mainly for its brilliant helpers such as scale converters.
The 2d visualizations will be implemented on top of `html5` canvas with the help of D3.

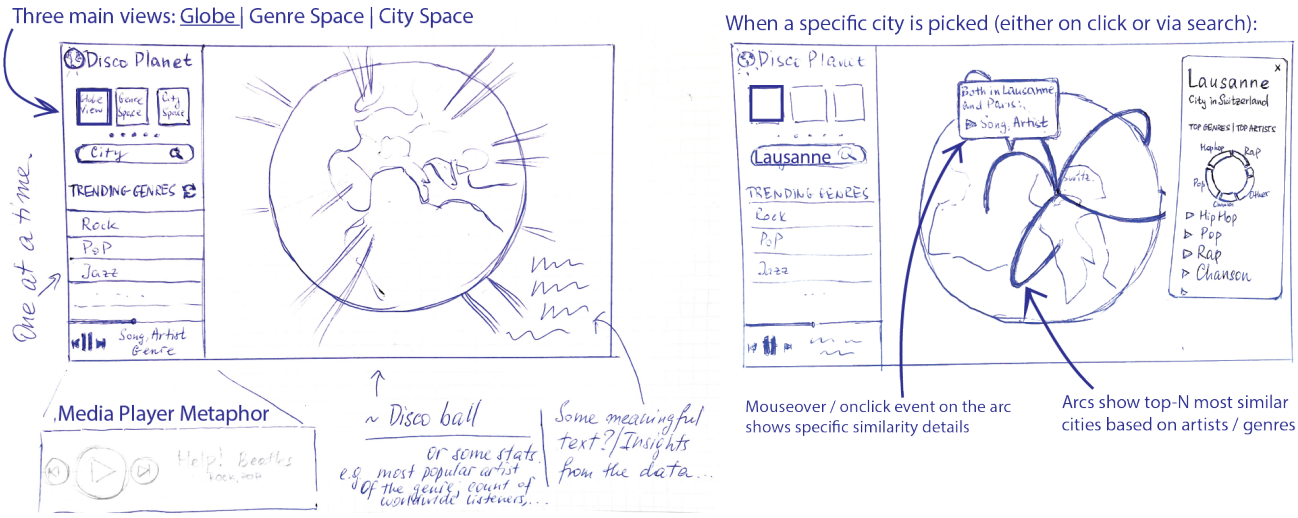

Fig. 2: Sketches of the Globe View, the landing page of our project.

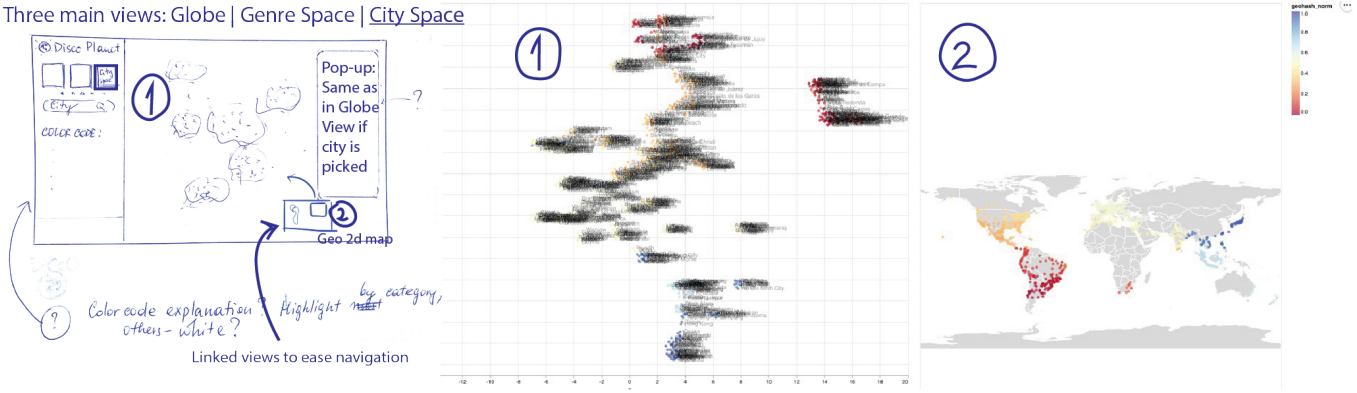

Fig. 3: A sketch and visualization prototypes (in Jupyter notebook) of the City Space View.

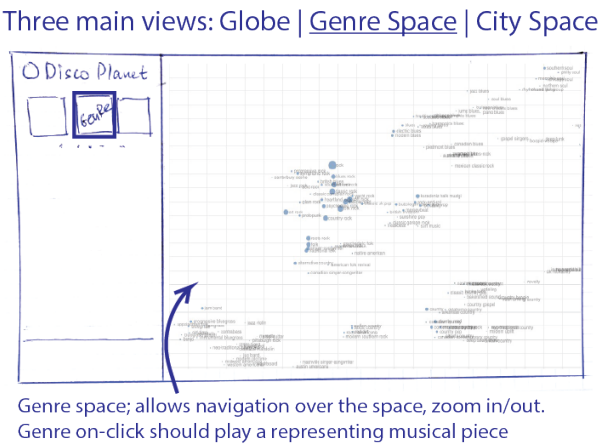

Fig. 4: A sketch of the Genre Space View.

B. Back-end

To be able to interact with the visualization smoothly, we introduced a GraphQL back-end service allowing for dynamic querying. The server-side consists of a Phoenix app written in Elixir, while the data are stored in a PostgreSQL database with the geospatial extension PostGIS.

C. Lecture materials

With respect to lecture materials, we find lectures 6 (color marks), 8 (maps), 10 (graphs), and 11 (sound viz) particularly relevant and useful for our project.

IV. Project Breakdown Structure

Our project falls into three distinct parts, i.e. *Globe View*, *City Space View*, and *Genre Space View*, allowing each team member to work individually on his/her interactive visualization. Several widgets, e.g. navigation panel and city genre profile, can be reused for multiple views.

We would like to make the user interaction with the visualization as engaging and interactive as possible. If time permits, we would like to allow users to specify their Spotify credentials for the website to query Spotify about their favorite artists to show the cities aligning with their musical tastes or start a radio station based on the music popular in a city.