School Beats

(A Process Book)

By

Acquista Gabrielle

Gurung Ashish

Haim Aaron

Lisa Tahrifa Tarannum

ABSTRACT

There are various approaches to visualizing data. Especially with technological innovation, integrating multiple devices at varying degrees is the norm in our day-to-day life. Simply looking at the surrounding of an average household in the United States, data is visualized in various forms from subtle visual elements such as displays on the microwave and light-emitting diodes on network routers to the more obvious television, computers, and handheld devices. While exploring the visualization techniques prevalent in the Internet of Things, we also found the heavy usage of auditory feedback in user engagement. The beeping of a microwave is one of the most compelling examples of the use of auditory feedback in our everyday life. This document presents our exploration of integrating acoustic feedback in data visualizations where the acoustic visualization minimizes the burden of visualization on the visual components. Additionally, we also explore the benefits of leveraging contextual information to visualize the data and its potential to facilitate guiding questions and possible explanations during an exploratory analysis. In this work, we explore visualizing the fight songs from schools across the United States and how using a map instead of a scatter plot can provide contextual information that would otherwise be difficult to extrapolate from a scatterplot.

School Beats

1 OVERVIEW AND MOTIVATION

Music complexities and their construction contexts have a lack of supporting literature within the visualization world. Data visualization is a correspondence of artistic interpretation within a particular subject matter. Graphical charts and graphs can display the information in an understandable and engaging format for all users to enjoy. Music, on the other hand, is instead an auditory representation. It is an expression of emotion and technique combined to produce sounds through instruments. As such, the combination of both visual and auditory representations can be quite challenging to balance. However, the result is a well-executed combination that can bring a sense of astonishment to more than one of the senses.

For example, many different college fight songs are created for fans to cheer for their particular sports team. There are several song-specific features we can collect, such as word cliches (saying "Fight" or "Win") or the tempo of their specific song. We can also collect higher-level information about the schools, such as the school's location, the size of the stadium, the school's conference, and the length of the song. Analyzing the features such as the college's size or the number of seats in their stadium can give us insight into the fight songs' makeup. We believe that a data visualization to represent the acoustics(auditory) breakdown of songs and a visual display can allow users to decipher any underlying correlations while still being displayed in a balanced format. This ability to intuit a correlation between features and analytically explore the correlation enables users to have a constructive approach. This intuition guides the exploration instead of exploring the correlation between features and retroactively explaining the correlation after the fact. Using an effective visualization facilitates the ability to drive the analysis using intuition that can otherwise be underdeveloped using traditional data exploration approaches where the intuition develops over time with experience and errors users make.

As such, we are using data gathered from fight songs and higher-level information about the school and their stadiums to develop a visualization to help users explore correlations

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between the details of the colleges and the complexity/redundancy of the associated songs. This visualization will be the next step in providing auditory and visual representations not only in media but also in future visualizations as well.

2 RELATED WORK

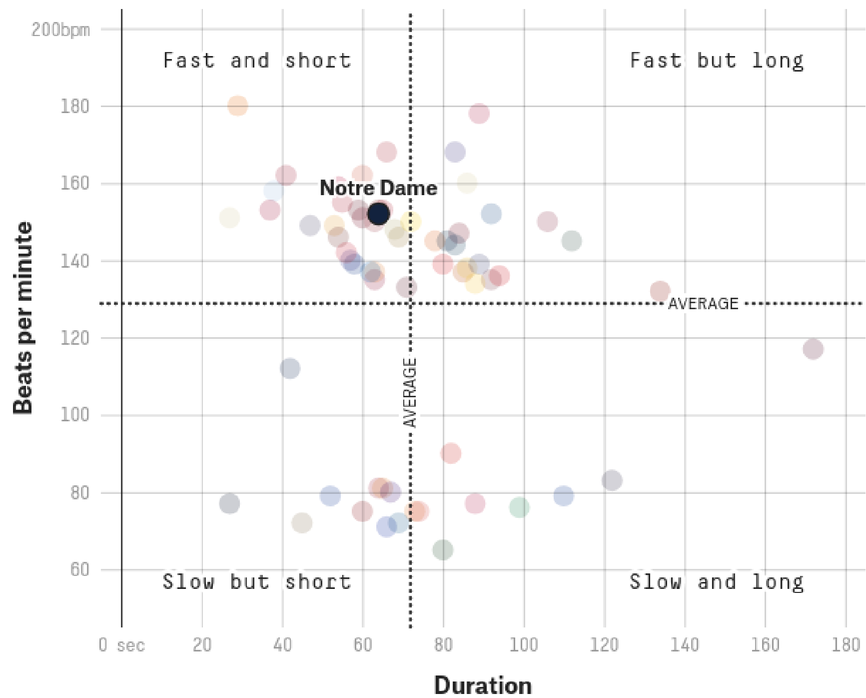

Fig. 1. Screenshot of the visualization from prior work that explored school beats.

Several prior works have explored music from various perspectives [1, 1, 3, 5, 6]. These work range from exploring the sense of belonging[1] to leveraging the sense of belonging to be used as a branding tool through songs [5]. Others have analyzed and explored the songs through using their lengths and the beats per minute(bpm) to find any underlying patterns [3]. This has also lead to the exploration of the usage of tropes in the fight song that ranges from using words like fight, win, victory to spelling out references[3]. Figure 1 shows an example of the visualization exploring the relationship between the length and the bpm of the songs. The viz also categorizes the data into four sections of fast and short, fast and long, slow and short, and slow and long. This visualization gives us some insight into the dataset; there appear to be two clusters where the slower songs clusters around 80 bpm and the faster songs cluster around 150 bpm.

Geographical information can often be effective in visualizations because it helps provide contextual information [2, 4]. We can extrapolate additional information from the geographical information, contextual component, that might otherwise not be readily available on the visualization and yet could be instrumental in explaining the underlying causal links that explain specific patterns and distribution about the data.

For example, let us take two globally know cities, “Boston” and “London”. If we analyze the cities using their geolocation, longitude, and latitude, then using the geolocation of these cities and the data from other locations worldwide at these latitudes, we can infer that temperatures in “London” are lower than temperatures in “Boston”. The latitudinal information indicates that summers are hotter in Boston and winters are colder in London; however, this is not the case as temperatures are higher during summer and lower during the winter in Boston as compared to London. Why is the temperature variance higher in Boston is an interesting question? There are a few possible underlying causes; the gulf stream or Nor’Easters. By referencing Figure 2Oceanography and climate researchers could break down this phenomenon; however, this disparity in temperature would probably be considered an anomaly in the absence of insight into these causal links. If we were to represent this information on a map, it facilitates thinking outside the box and leveraging the information on the map to provide contextual information. The map helps us eliminate several possibilities that would otherwise need exploring; questions such as Is Boston at a higher altitude? Are there mountain ranges around Boston? If we look at a map, we can see that Boston is a coastal city, i.e., at sea level; we would need to look at a geographical map to know if it has mountain ranges around it.

3 QUESTIONS

This is a template question that we can edit once we have met our technical achievements The primary objective of this project was to effectively visualize a deadset leveraging the a combination of visual and auditory stimuli. Some of the design question we had while working on this visualization were: How do we implement the auditory components to represent features.

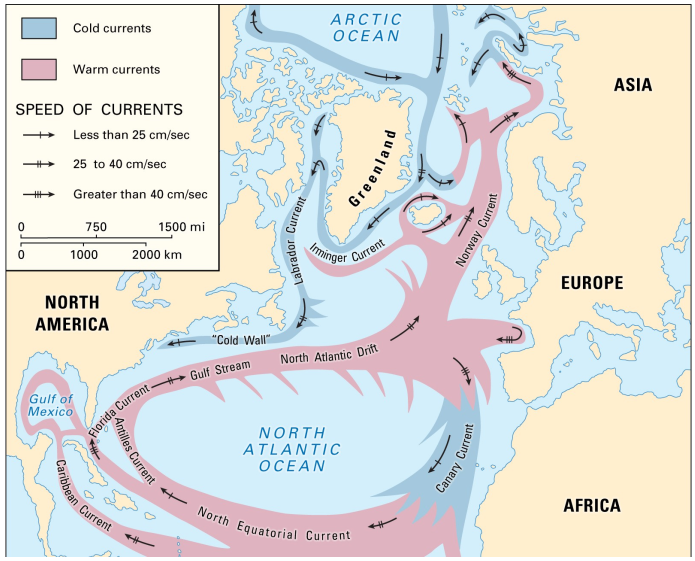

Fig. 2. A breakdown of how the ocean currents influence the temperatures of different parts of the world.

(1) Does implementing auditory feedback to represent tropes(features of fight songs) increase the user experience?
(2) Does the use of contextual information about the data facilitate the ability to gain deeper insight into the data? Insight that might not be represented in the dataset and cannot be directly inferred?

4 DATA

The dataset contains information about 65 schools with features such as the size of their stadiums, the conference the school plays in, the name of the song, the writers of the song, the school's official song, beats per minute, length of the song. The data set also had the information about using keywords in the lyrics such as fight, victory, win/won, rah, reference to school colors, men, mention opponents, etc. We extracted the data from [3]. Additionally we extracted the stadium size of all 65 schools in our data set and we also extracted the longitude and latitude for the 65 schools to be drawn over the map for our visualization.

5 DESIGN EVALUATION

Prior works have explored the dataset and visualized it using scatter plots, as shown in Figure 1. To further examine the data, we extracted the stadium sizes for all the schools. We explored the correlation between the features of the fight songs, and the correlation is represented in the heatmap in Figure 3. We found the features “stadium-size” and “length of the fight song” correlated with each other with a positive correlation between the length of the fight songs and the size of the school stadiums. This is indicative of the larger schools having longer fight songs.

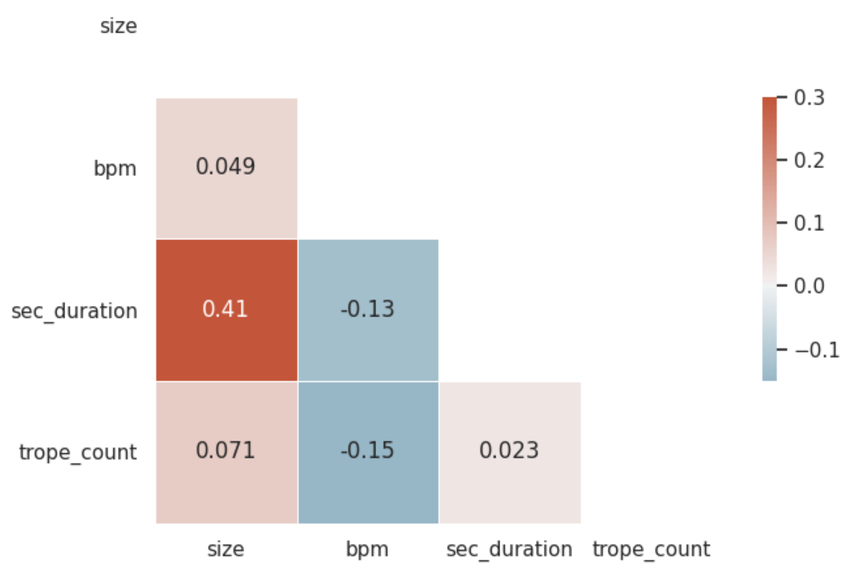

Fig. 3. We found a positive correlation between the length of the fight songs and the size of the school stadiums.

We explored integrating the stadium sizes into the data and plotted the information extending the scatter plot in Figure 1 with our visualization using Flourish Studio. Flourish Studio is an online data visualisation tool. Similar to the findings in Figure 1 we found the data to be distributed in two clusters when we analyzed the length of the songs with the bpm of the songs. Figure 4 shows a screenshot of us exploring the data using scatterplots with quadrants. As can be seen in figure 4 we explored extending the visualization to

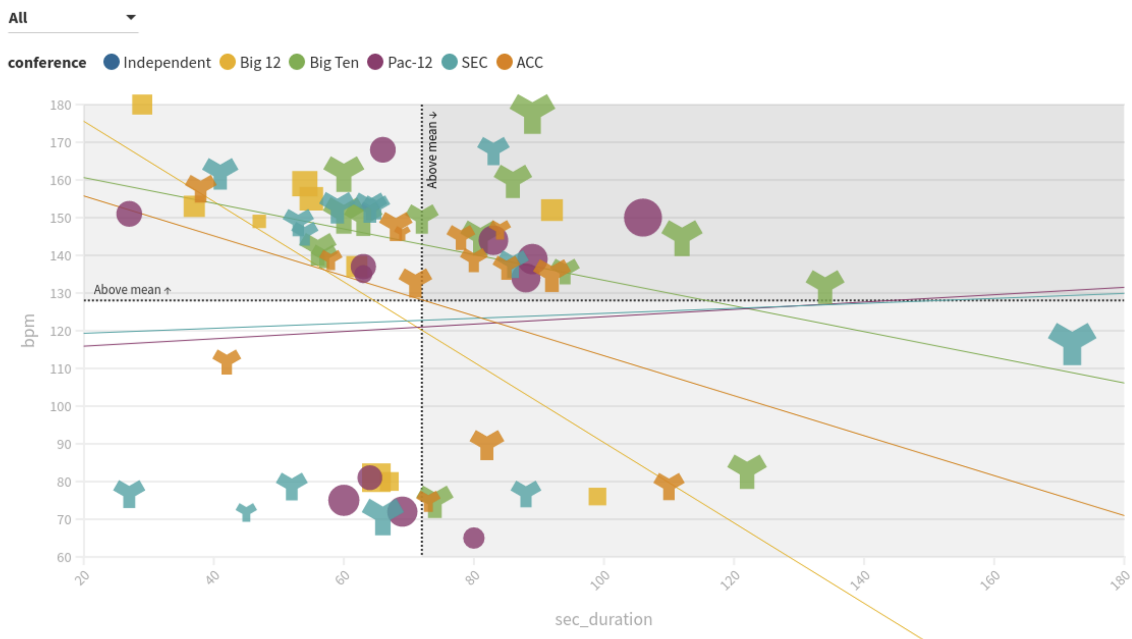

Fig. 4. Exploring the dataset using additional information about the school.

include additional information about the fight songs.We integrated the schools' conference and the size of their stadium into the visualization.

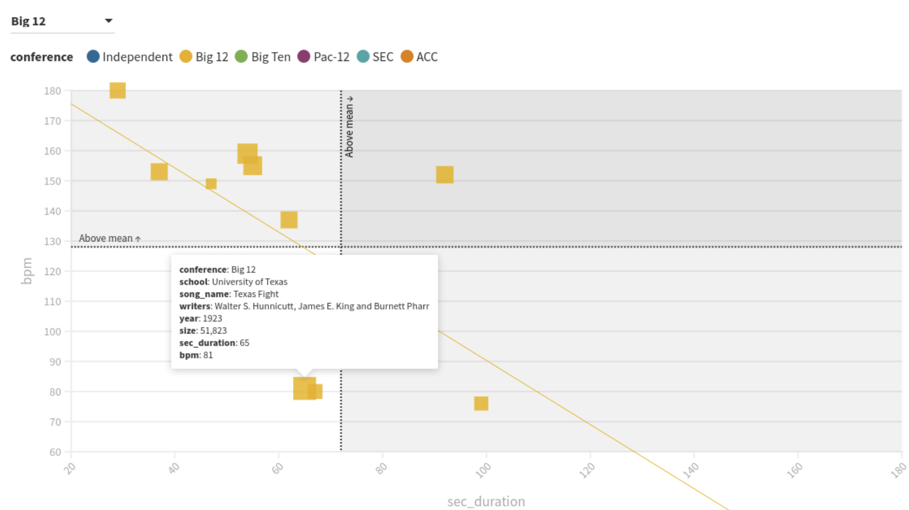

Fig. 5. Using trend lines to explore the the dataset in specific conferences.

Further, we also analyzed the conferences individually using trend lines to explore specific conferences' trends and determine outliers in the distribution. Figure 5 shows the relationship between the length of the songs and the bpm for the "Big 12" conference. However, simply removing certain schools because they behave as outliers don't reveal any deeper insight into the kind of analysis we are trying to conduct. Our objective is to develop a deeper understanding of various fight songs and deconstruct them into meaningful categories. Still, we could not contextualize the data so that the visualization could help provide deeper insight or guide the analysis in new directions. There are different types of visualization approaches we can take for analyzing the fight songs. To achieve this, we decided to visualize the data using the map of the united states to help provide context using the geolocation of the school. We hypothesize the culture of the city and state the schools are in would influence the school's culture and, consequentially, influence the fight songs. Henceforth we explore the benefits of visualizing the school using maps.

6 IMPLEMENTATION

We started with the goal of adding contextual information using maps and audio feedback. The aim was to explore the ability to provide cultural context using maps and explore the practical approaches to leveraging audio feedback to visualize data. We explored aspects of visualization and went through several iterations of designing the visualization. We went through brainstorming sessions that focused on the features we wanted to implement in the visualization. One of the most contentious aspects of the visualization amongst our team was using two visual elements vs. a single visual element in conjunction with the audio element. After much arbitration and brainstorming session, we settled on a single visual element to work with the auditory representation. The desire to utilize a single visual representation was motivated by the desire to purely rely on the representation of certain features simply using the audio feedback. We found this design challenge to be both more interesting and challenging than adding a second visual component representing some of the data now visualized purely through audio feedback. We decided to set up the dual graphical representation of the data visualization as our backup if we were to fail setting up the audio visualization. Figure 6 shows the sketch of the design we decided to implement. The visualization uses a map to represent the geographical location of the schools.

Hovering on the school allows access to the audio visualization and the tooltip that presents additional information on the school. There are also filters applied to the visualization where the users can filter the schools based on their conferences and tropes in their fight songs. As it must be evident by now, one of the main challenges with the project was the audio visualization of the tropes in the fight songs. As we elected to visualize the data purely through audio feedback, it presented a different technical and cognitive challenge for the project. Initially, we needed to layer the audio files and play them in unison, where each tune represents a particular tropes in the fight song. We ran into technical issues because the audio player consistently went out of sync, and some files played a few seconds before or after other files while getting looped. This visualization was also a complicated cognitive challenge. Each new addition of an audio layer increased the complexities of generating harmonious audio files that do not sound like random noise and yet can be distinguished from each other when combined. This challenge grows in complexity in a nonlinear fashion with the addition of each new layer.

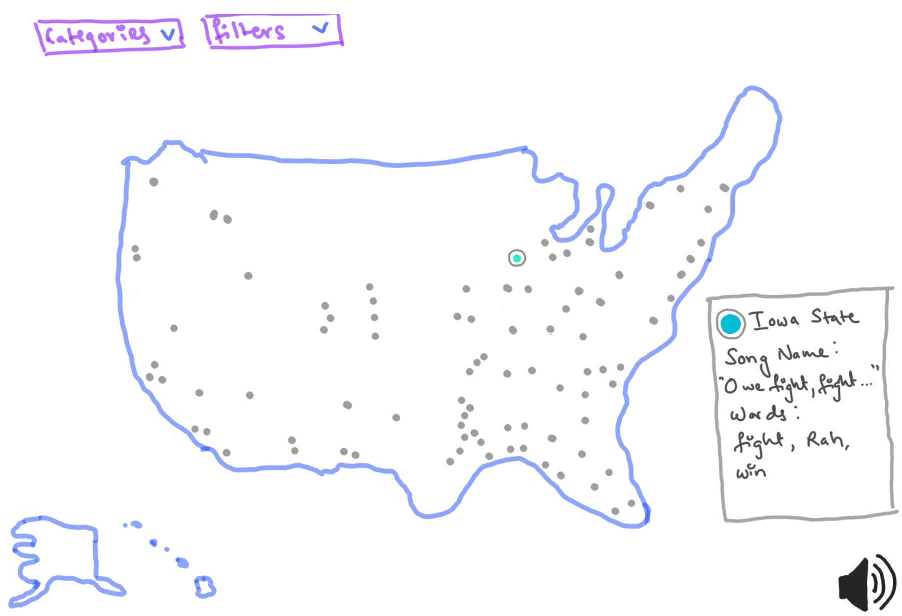

Fig. 6. Final design sketch planning out our final implementation for the visualization.

Figure 7 shows the design of the tooltip, audio controller and the input fields to enable filtering on the visualization. The tooltip represents displays the additional information that facilitates the ability to explore the data further and make connections once the high-level inferences and correlations are established using the map. The data from the tooltip can help implement the filters on the dataset that can be used to identify other songs with similar features in their fight songs. We can independently use the data to explore the schools in different conferences. One of the affordances that we wanted to provide through the visualization is the ability to disable the data points that could be considered unnecessary during the analysis. We implemented this by adding filters on the visual component, and we disabled the audio element by adding the functionality to mute the audio.

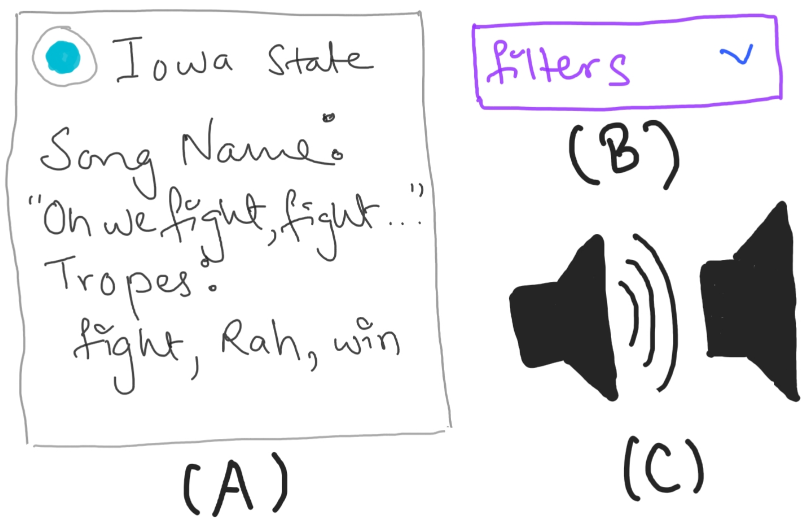

Fig. 7. (A) design of look and feel of the tooltip, (B) design of the input filtering controllers, and (C) design of the audio controllers.

7 EVALUATION

We implemented the visualization for the map of the United States of America. We used the longitude and latitude of the schools we had collected to plot them on the map—the size of the school's stadium determines the size of the component representing the school. Hovering over the schools displays the tooltip that shows additional information about the school. The audio associated with the tropes for each school is played whenever the associated data point is hovered over.

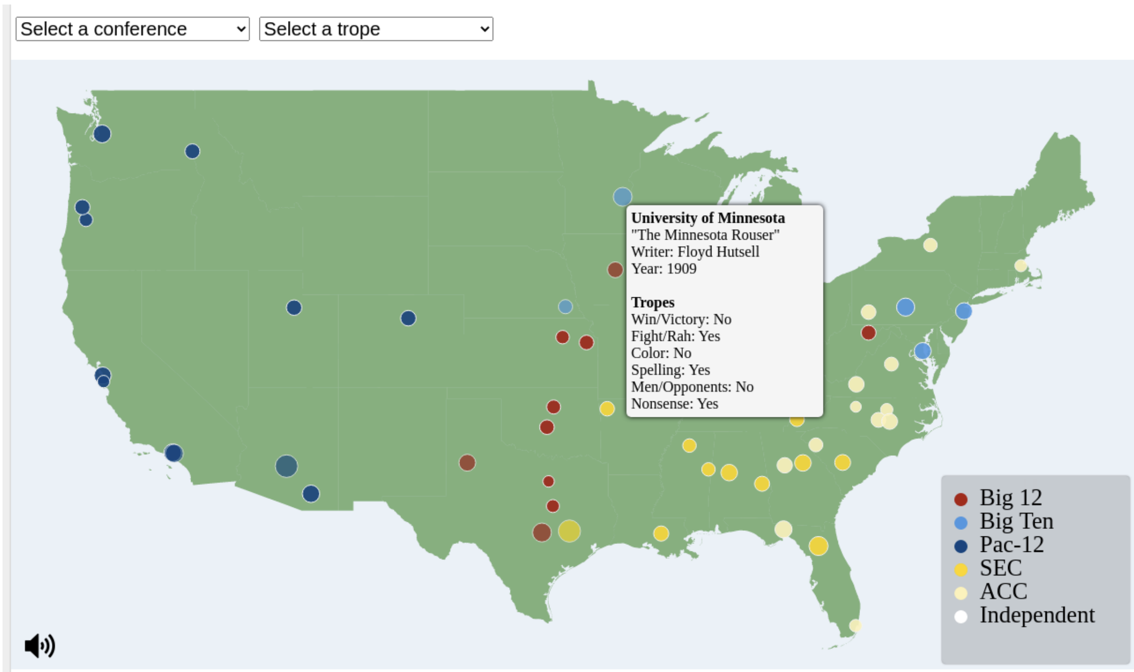

Fig. 8. The implementation of the visualization using map.

Figure 8 shows a screenshot of the visualization where all the schools are displayed on the map. As you can observe, the geographical representation provides us additional information on the conferences. The Pac-12 schools is a west-coast conference, whereas the other conferences are in the mid-west or east-coast region. The analysis of the map also suggests that there are several schools in the coastal cities; however, most larger schools are relatively inland, farther from the coastlines. The comparatively higher number of schools and conferences on the eastern half of the map provides a fascinating insight. Why are there more conferences and schools on the east coast? We are looking at schools with superior athletics/sports programs. Historically the people who emigrated to the USA first settled on the east coast. The settlers needed schools for their families, and schools had students who needed sports. Sports means competition, and the competition lead to the formation of conferences. This is why there are more conferences on the east coast and midwest than on the west coast. It's important to point out that this does not indicate that there are more schools on the east coast than the west coast but simply that there are more schools on the east coast with historically successful athletics programs.

The visualization works well as a minimal viable product. It works nearly flawless with a few minor bugs associated with filtering content and audio playing. As for the audio playback, due to some security and timing portions implemented by modern-day browsers, audio playback is slightly delayed between tracks. The audio playback could be redone using a queuing system that preloads the next song to be played and sewn on to account for the minimal delay. However, this would probably be a patchwork solution. As for the filtering content, it could be expanded into a cross-chart filter to provide a greater analysis on the current dataset. Finally, the overall page could use a bit more polish to make the website look a bit more modern.

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