Methods

I will look into future research later.

As previously stated, we relied on natural language processing methods to perform our analysis. The methods that were most useful for this research were keyword extraction and sentiment analysis. Both methods of analysis provided us with crucial insights, so the details of each seem pertinent to share.

Keyword extraction is largely aimed at identifying the most used words in different texts and utilizing those words to understand common theme or popular topics. [] We used the *tm* library in R to perform keyword extraction on the sonnets. This process involves first prepping the text by removing unwanted punctuation or numbers, eliminating stop words, changing everything to lower case. These transformations are necessary because when working with strings, you not only have to be precise, but you also must be exact. The cleaning process sometimes includes stemming the words, but we opted not to do that. Once the text is clean the idea is to create a table containing each word used in the text and the frequency with which it is used. To identify the top ten key words we sorted the words in the matrix by their frequency. (Good place to insert word cloud or key word table)

Once Shakespeare’s keywords were identified, the next step was to identify the keywords for each of the 45 music artists. This process was similar to that of extracting keywords from the sonnets except we utilized a loop to automate the process for each artist. Once keywords were identified we converted the frequencies for Shakespeare and all other artists into proportions, in order to standardize for comparison. To find the artists who were most similar to Shakespeare based on keywords, we checked for artist who had the highest number of matching keywords. Finally, then we ranked those by who used keywords in similar proportions to Shakespeare by calculating the Euclidian distance between the proportions of each of the matching keywords. (include keyword rankings table)

A similar sort of ranking was achieved from Sentiment Analysis, but the process has notable differences. The library *syuzhet* was used to perform Sentiment Analysis. There is a wide variety of paths one could choose from when performing sentiment analysis. Two that seemed viable for the purpose of this research were calculating an overall sentiment score and identifying the different emotions present in each text. [] The latter option proved to be more fruitful, as the analysis is more detailed. This process of classification based on emotion is known as NRC sentiment analysis. NRC Sentiment Analysis uses the National Research Council (NRC) Word-Emotion Association Lexicon to classify words in a text into eight categories of emotions. [] It is important to note that a word may be associated with more than one emotion. The eight emotions are **anger**, **anticipation**, **disgust**, **fear**, **joy**, **sadness**, **surprise**, **trust (include simple equation)**. [] The objective of NRC Sentiment Analysis is to calculate the frequency with which each emotion is conveyed. This is calculated by identifying the emotions associated with the unique words in a text and summing up all the instances of each emotion. [] (include sentiment analysis ranking table)

Once the NRC sentiments were calculated for both Shakespeare and the music artists, the frequencies were converted to proportions for accurate comparison. Using the proportions of each emotion, Euclidean distance was calculated for between each music artist and Shakespeare. The artists with the shortest distances from Shakespeare were considered the most similar to him, and therefore ranked higher in regard to comparison of the emotions conveyed in their works.

After comparing results from each analysis method, a final ranking was calculated. This overall ranking was calculated by summing up the rankings from both analysis methods. Because similarity to Shakespeare was assessed using Euclidean distance, lower rankings signify higher similarity to Shakespeare. This meant that the artists with the lowest overall ranking mirrored Shakespeare’s work emotionally more than other artists. (include all rankings table)

The NRC sentiments were utilized even further as predictors in K-Means Cluster Analysis. The objective of cluster analysis within the scope of this research is to utilize an unsupervised learning model [] to assess commonalities between the work of each music artist and Shakespeare. K-Means clustering works by ….. []