Exploring the Evolution of Energy in Radiohead's Music*

Energy Levels Fluctuate Post-2000 with Positive Correlations to Valence and Loudness Across Albums

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October 11, 2024

Radiohead's music shows notable variation in energy, valence, and loudness across their discography. This analysis examines the trends in energy levels over time, the distribution of energy across albums, and the relationships between energy, positivity, and loudness. The results indicate that energy levels fluctuate significantly around post-2000 and post-2015, with louder and more positive songs tending to have higher energy. Understanding these patterns provides insights into the band's evolving artistic approach and the diversity of their musical output.

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*Code and data are available at: [https://github.com/YawennnnnnTan/Spotify-Data-Analysis/tree/main]

1 Introduction

Radiohead, one of the most influential bands in modern music, has consistently pushed the boundaries of rock and electronic music. Their discography spans a wide range of styles, from the guitar-driven sound of The Bends to the experimental, electronic textures of Kid A and A Moon Shaped Pool. This report seeks to explore the sonic evolution of Radiohead through an analysis of key audio features, specifically focusing on energy, valence (a measure of emotional positivity), and loudness, using data sourced from Spotify's API.

The goal of this analysis is to identify trends in Radiohead's music, such as how energy has changed across their albums and how other factors like loudness and valence relate to these energy levels. By visualizing these audio characteristics over time and across different albums, we can quantify the musical shifts in Radiohead's work and gain insights into the progression of their sound.

2 Data

2.1 Overview

The dataset is shown in Table 1, as you can see it contains a total of 5 variables and see the details of these 5 variables below and see how to gather data in Section 5:

- **Energy**: Represents the intensity and activity level of a track, with higher values indicating more energetic songs.
- **Album Release Year**: Indicates the release year of the tracks from 1993 to 2021.
- **Loudness**: The average decibel level of a track, reflecting how loud or quiet a song feels. The values are usually negative value, with higher values denoting louder songs.
- **Valence**: Measures the positivity of a track's emotional tone. The values are usually between 0 and 1, with higher values denoting happier or more uplifting songs.
- **Album Name**: Identifies the album to which each track belongs.

Table 1: First 6 entries of Radiohead Dataset

Energy	Album Release Year	Loudness	Valence	Album name
0.463	2021	-11.412	0.0629	KID A MNESIA
0.428	2021	-15.520	0.1590	KID A MNESIA
0.754	2021	-8.552	0.3880	KID A MNESIA
0.302	2021	-11.644	0.1900	KID A MNESIA

Table 1: First 6 entries of Radiohead Dataset

Energy	Album Release Year	Loudness	Valence	Album name
0.146	2021	-21.357	0.0577	KID A MNESIA
0.757	2021	-9.931	0.5730	KID A MNESIA

2.2 Data Tools

All data analysis and visualizations were conducted using R (R Core Team 2023) and use here (Müller 2023) package to read data. Data was obtained from Spotify using the (Thompson, Edney, and Wasey 2023) R package. Visualizations were created using the ggplot2 package (Wickham 2016), with data manipulation carried out via dplyr (Wickham et al. 2023) and tidyr (Wickham et al. 2019). PDF file is generated by knitr (Xie 2014). Guidance on storytelling with data was drawn from Telling Stories with Data (Alexander 2023).

2.3 Results

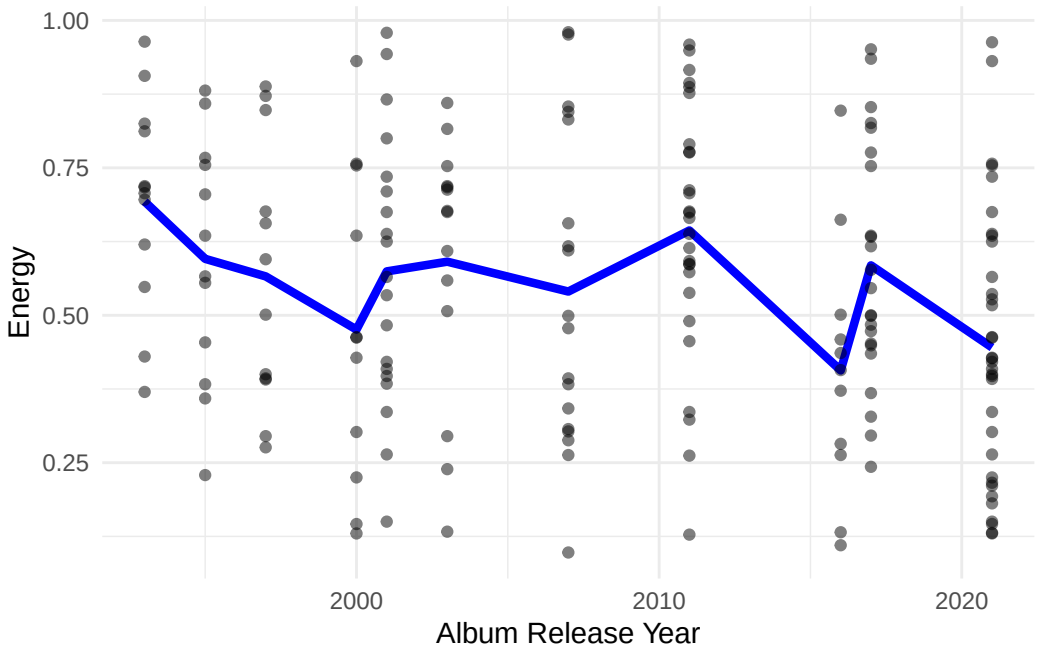

Figure 1: Energy Levels Over Time in Radiohead's Music

Figure 1 shows the trend of average energy levels in Radiohead's songs over time, based on the release years of their albums. The blue line represents the average energy of songs for

each release year, while the black dots indicate the distribution of individual songs' energy levels. Overall, from the mid-1990s to 2000, the energy levels in Radiohead's music gradually decreased, reaching a low point around 2000. Afterward, energy levels began to rise, but fluctuated over the following years. Post-2010, the energy levels show further fluctuations, indicating significant variation in the energy of their music across different years.

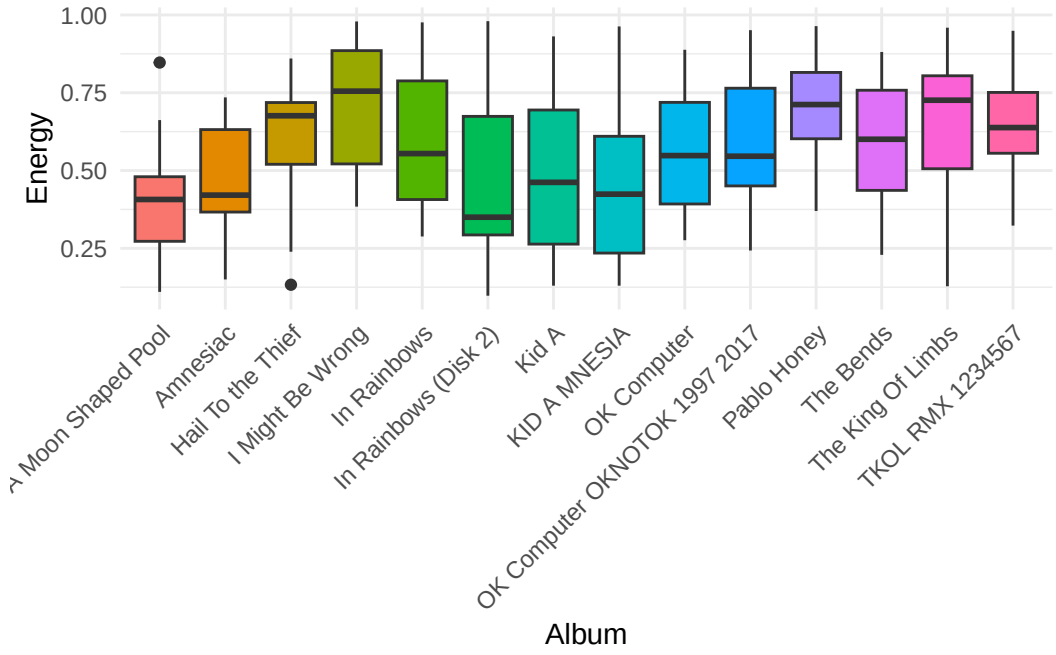

Figure 2: Energy Distribution Across Radiohead's Albums

Figure 2 illustrates the distribution of energy levels in Radiohead's songs across different albums. Each boxplot represents the energy distribution within an album, with the box showing the median and interquartile range, while the whiskers indicate the full range of energy values. There are noticeable differences in energy levels across the albums. For example, albums like Hail to the Thief and I Might Be Wrong generally feature higher energy songs, while albums like A Moon Shaped Pool and Amnesiac exhibit lower energy levels.

Figure 3 illustrates the relationship between energy and valence (positivity) in Radiohead's songs. Each blue dot represents a song, with the X-axis showing valence (the positivity of the emotion) and the Y-axis showing energy levels. The red regression line indicates a positive correlation between the two variables, suggesting that as valence increases, the energy of the song tends to rise as well.

Figure 4 shows the relationship between energy and loudness in Radiohead's songs. Each green dot represents a song, with the X-axis indicating the loudness (measured in decibels) and the Y-axis indicating the energy level. The red regression line reveals a strong positive correlation between these two variables, where louder songs generally tend to have higher energy.

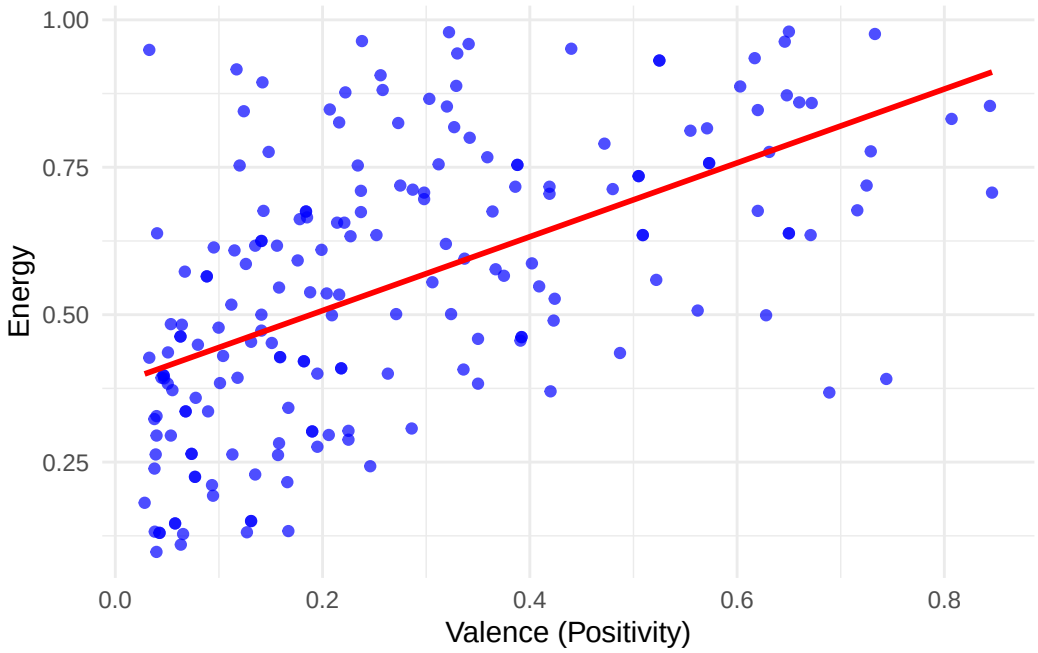

Figure 3: Relationship between Valence and Energy in Radiohead's Songs

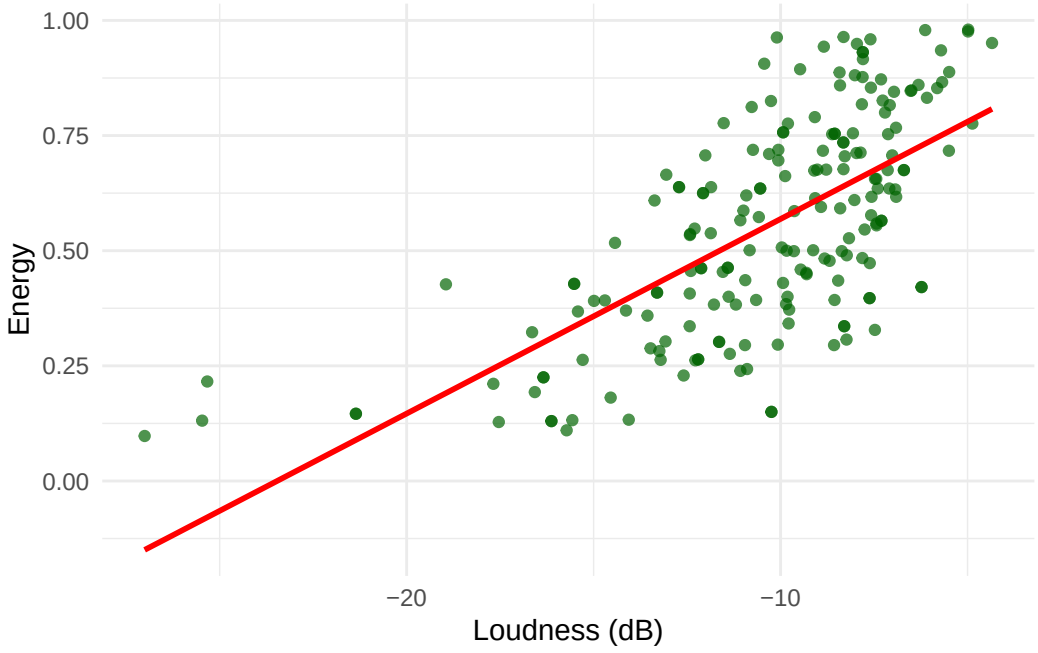

Figure 4: Relationship between Loudness and Energy in Radiohead's Songs

3 Discussion

In analyzing Radiohead's music through the lens of energy, valence, and loudness, clear patterns emerge that offer insight into their artistic evolution. The fluctuations and relationships between these variables reveal how the band has continuously pushed creative boundaries while maintaining a dynamic and diverse musical style.

Figure 1 reveals that the energy levels in Radiohead's music do not follow a steady upward or downward trend, but instead show a complex, fluctuating pattern. Particularly after 2000, the energy levels alternately rise and fall, which may reflect the band's stylistic diversity and experimentation over time. The low point around 2000 could be linked to the band's exploration of more introspective and emotionally rich music during that period, while the later fluctuations in energy may signify their experimentation with different musical forms and emotional expressions in subsequent albums. This dynamic pattern underscores the versatility of Radiohead's music and highlights their evolving creative approach across different phases of their career.

Figure 2 shows significant variation in energy levels across Radiohead's albums, which may reflect the band's stylistic exploration and experimentation over the years. For instance, the lower energy levels in A Moon Shaped Pool and Amnesiac suggest a tendency toward more quiet and introspective music in those albums. In contrast, higher energy albums like Hail to the Thief may indicate more intense and outwardly expressive musical compositions. These fluctuations in energy highlight Radiohead's musical diversity and their evolving artistic direction throughout their career.

Figure 3 reveals a positive correlation between energy and valence in Radiohead's songs, indicating that more positive and upbeat tracks tend to have higher energy levels. However, the scatter of the data points also shows some variability, with certain low-valence songs maintaining relatively high energy and vice versa. This variability reflects the diversity in Radiohead's musical style, where emotional expression and energy do not always follow a strict pattern. The combination of both high-energy, low-valence songs and low-energy, high-valence songs highlights the band's complexity in blending different emotions and energy levels across their music.

In Figure 4 the positive correlation between energy and loudness, as shown by the red regression line, suggests that Radiohead's louder songs are also more energetic. This relationship is intuitive, as songs with higher decibel levels typically convey a sense of intensity and dynamism, which aligns with higher energy levels. However, it's important to note that while the overall trend points to this correlation, there is still some variability, with a few quieter songs exhibiting moderate energy levels. This might reflect instances where Radiohead employs different production techniques to maintain intensity without relying solely on loudness.

4 Conclusion

This analysis shows how Radiohead's music changes in energy over time. The shifts in energy, especially after 2000, reflect the band's ongoing experimentation with different styles. The positive connections between energy, valence, and loudness suggest that these elements play a key role in shaping the feel and intensity of their songs. Overall, the findings highlight how Radiohead's music continues to evolve, offering a mix of emotions and sounds that keeps their work engaging and unique.

5 Appendix

5.1 Gathering Data from Spotify Using the spotifyr R Package

In this appendix, we explain how we gather data from Spotify using the (Thompson, Edney, and Wasey 2023) R package. First, we create a Spotify Developer Account by logging in on the Spotify Developer website. After accepting the Developer Terms of Service, we create an app, which provides us with a Client ID and Client Secret—credentials necessary for accessing Spotify's API.

To store these credentials securely in R, we use a Renviron file, ensuring our Client ID and Client Secret are loaded whenever we use R without exposing them in our scripts. Once stored, we restart R and install the (Thompson, Edney, and Wasey 2023) package. With (Thompson, Edney, and Wasey 2023), we can retrieve data on artists, albums, and tracks, including audio features like tempo and energy. After collecting the data, we save it locally for future use, making it easy to reload without querying the API again.

Following these steps allows us to efficiently gather and manage Spotify data, keeping our credentials secure throughout the process.

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