

# 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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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.

## Table of contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>Data</b>	<b>2</b>
2.1	Overview . . . . .	2
2.2	Data Tools . . . . .	3
2.3	Results . . . . .	3
<b>3</b>	<b>Discussion</b>	<b>5</b>
<b>4</b>	<b>Conclusion</b>	<b>7</b>
<b>A</b>	<b>Appendix</b>	<b>8</b>
A.1	Gathering Data from Spotify Using the spotifyr R Package . . . . .	8

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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.

The remainder of this paper is structured as follows. Section 2 discusses overview dataset including variables such as energy, album release year, loudness, valence, and album name, and it also includes tools used for data analysis and visualization. The results of the main findings of the analysis through visualizations is also included in Section 2, including Energy Over Time, Energy by Album, Relationship Between Valence and Energy, and Relationship Between Loudness and Energy. Section 3 interprets the results further with more consideration. Section 4 summarizes the key insights from the analysis, emphasizing the evolution of energy in Radiohead's music and the role of valence and loudness in shaping song intensity. Section A provides details on gathering data from Spotify using the `spotifyr` R package, including steps for retrieving and securely storing data.

## 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 A:

- **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
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 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 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 valence (positivity) and energy levels in Radiohead’s songs. Each blue dot represents a song, with valence reflecting the positivity of the

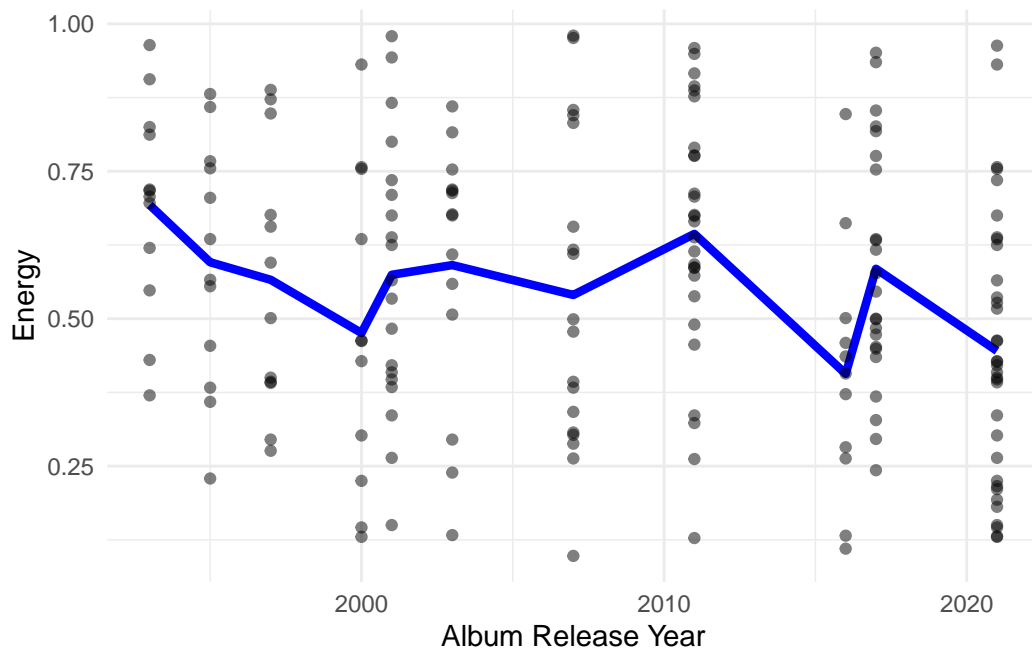


Figure 1: Energy Levels Over Time in Radiohead's Music

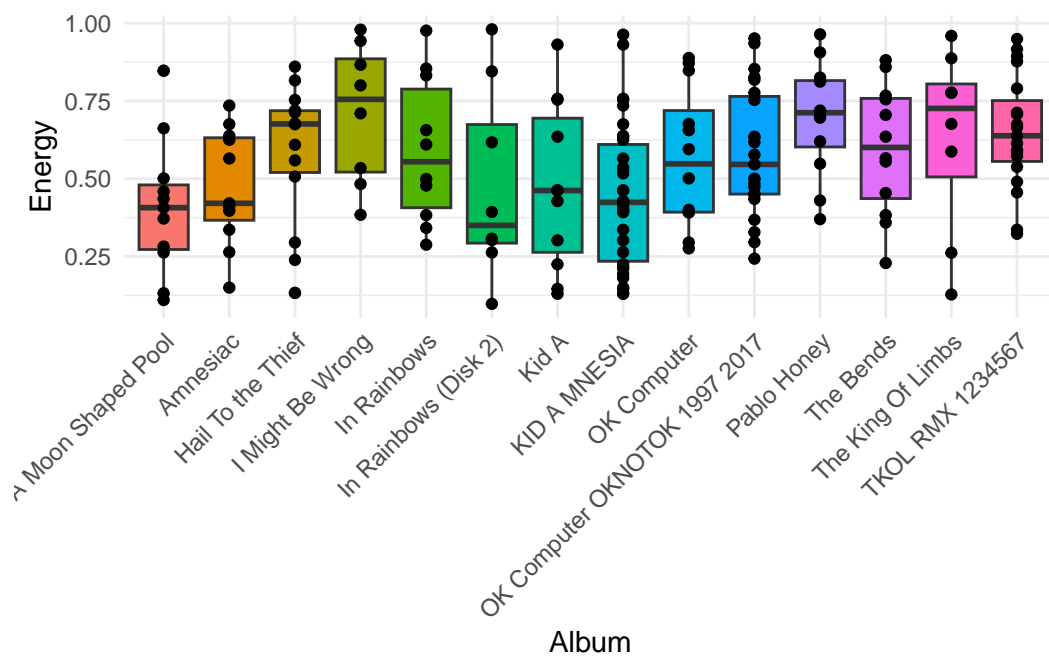


Figure 2: Energy Distribution Across Radiohead's Albums

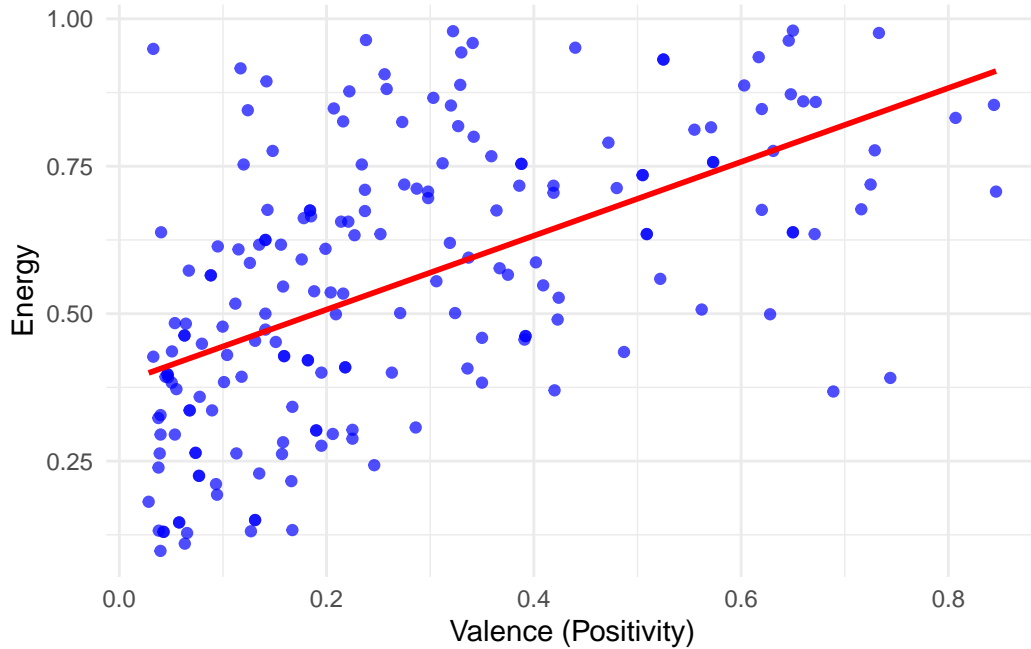


Figure 3: Relationship between Valence and Energy in Radiohead's Songs

emotion and energy capturing the intensity of the song. The red regression line indicates a positive correlation, suggesting that as the valence increases, the energy of the song tends to rise as well. This implies that Radiohead's songs with more positive emotions generally have higher energy.

Figure 4 shows the relationship between energy and loudness in Radiohead's songs. The red regression line running diagonally across the plot highlights a clear positive trend: as loudness increases, energy levels tend to rise as well. This suggests that Radiohead's louder songs are generally more energetic, which aligns with the expectation that dynamic and loud compositions often carry higher energy. The spread of points around the regression line shows some variability, but the overall correlation remains strong, as evidenced by the concentration of points close to the red line.

### 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.

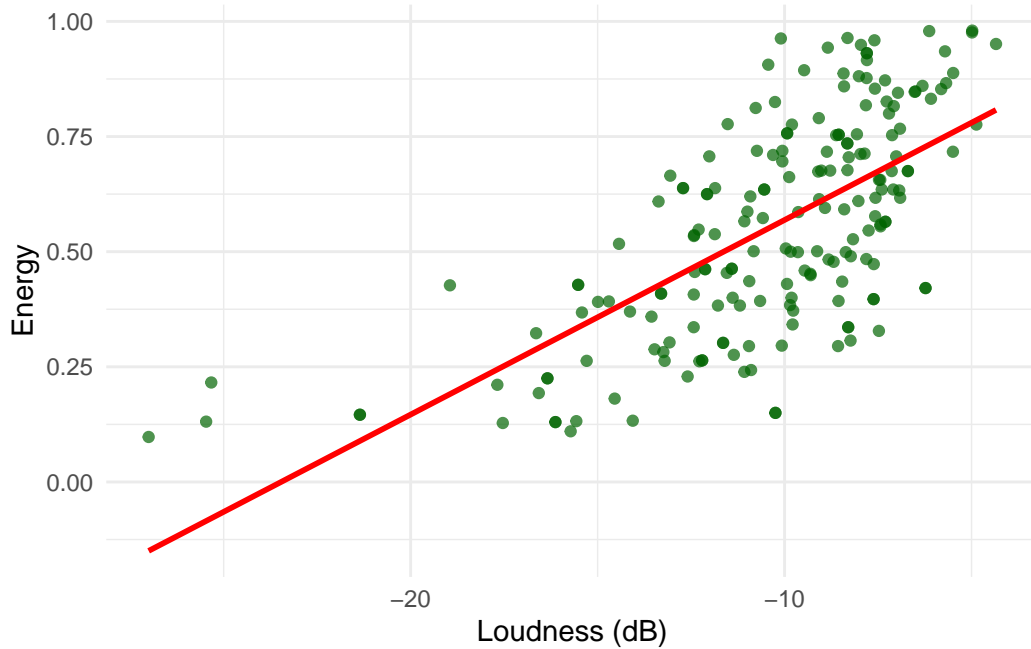


Figure 4: Relationship between Loudness and Energy in Radiohead's Songs

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.

## A Appendix

### A.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 Renvron 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.



## References

- Alexander, Rohan. 2023. *Telling Stories with Data*. Boca Raton: CRC Press. <https://tellingstorieswithdata.com/>.
- Müller, Kirill. 2023. *Here: A Simpler Way to Find Your Files*. <https://CRAN.R-project.org/package=here>.
- R Core Team. 2023. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. <https://www.R-project.org/>.
- Thompson, Charlie, Mark Edney, and Jack Wasey. 2023. *Spotifyr: R Wrapper for the 'Spotify' Web API*. <https://CRAN.R-project.org/package=spotifyr>.
- Wickham, Hadley. 2016. *Ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag New York. <https://ggplot2.tidyverse.org>.
- Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Golemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. <https://doi.org/10.21105/joss.01686>.
- Wickham, Hadley, Romain François, Lionel Henry, Kirill Müller, and Davis Vaughan. 2023. *Dplyr: A Grammar of Data Manipulation*. <https://CRAN.R-project.org/package=dplyr>.
- Xie, Yihui. 2014. "Knitr: A Comprehensive Tool for Reproducible Research in R." In *Implementing Reproducible Computational Research*, edited by Victoria Stodden, Friedrich Leisch, and Roger D. Peng. Chapman; Hall/CRC.