Spotify:
Relationship Between Danceability of a Song and Number of Weeks on Chart

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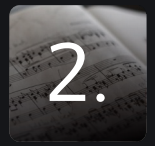
Agenda: Overview

Introduction
Hypothesis



Ideal Experimentation

Data
Understanding

Model
Analysis

Conclusion
Limitations

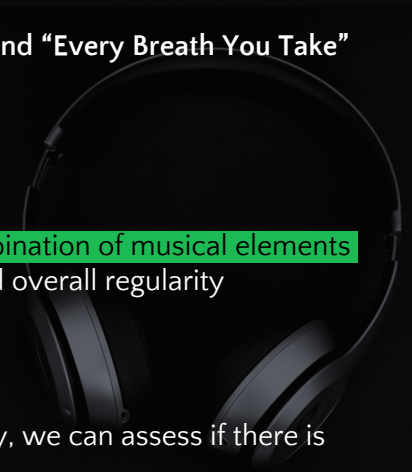
Q&A

Introduction: Hypothesis

What is the similarity between "The Next Episode" by Dre Dre and "Every Breath You Take" by The Police?

Both have a dancibility score of 0.8+/1

How suitable a track is for dancing based on a combination of musical elements including tempo, rhythm stability, beat strength, and overall regularity



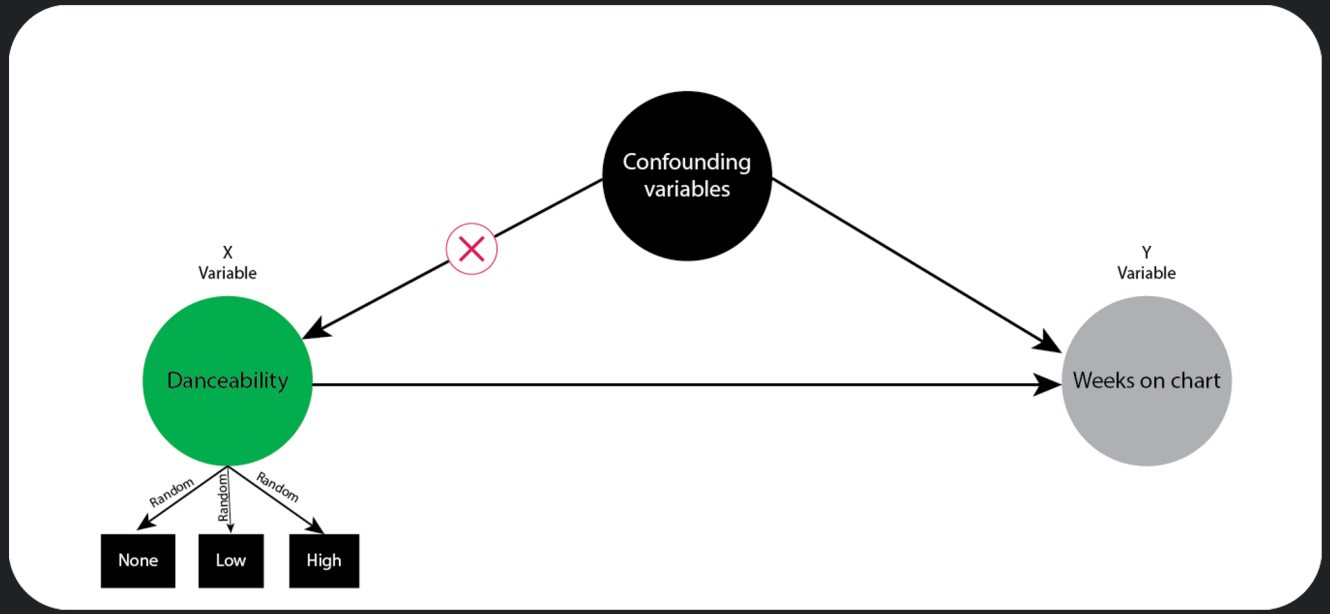
- Danceability > Popularity > Stays on Chart for Longer?
- By assessing each song at a more granular level by musicality, we can assess if there is something specific to each song that enables its popularity.

Null Hypothesis:
There is no relationship between danceability score and the length of time a song spends on chart.

Alternative Hypothesis:
There is a relationship between danceability score and the length of time a song spends on chart.

Ideal Experiment

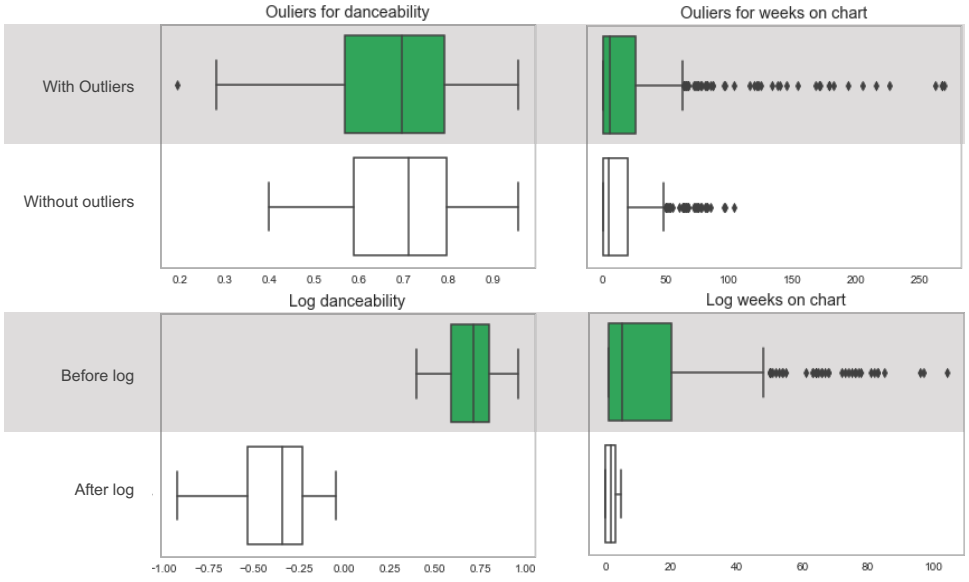
We will use Between-subjects (independent measures) design where songs are randomly assigned a level of danceability (none, low, or high) and follow that level of danceability throughout the experiment.



Data: Preparation

1. Combining the Datasets (using artist names and song names)
2. Create a Dummy variable for TikTok (if the song is on TikTok or not)
3. Remove Extreme Outliers
4. Transform the data (Some of the variables are right-skewed → LOG)

Rows of Data:
496 → 447



Data Description: Main Variables

Variables	Type	Description
LOG.weeks_on_chart	Numerical	log of number of weeks on chart
LOG.danceability	Numerical	log of how suitable a track is for dancing based on a combination of musical elements
tiktok	Categorical	1 for a song that appear on TikTok; 0 otherwise
streams	Numerical	total number of streams of the artist (in Billion)
loudness	Numerical	the quality of a sound that is the primary psychological correlate of physical strength (range: -60 to 0 db)
LOG.energy	Numerical	log of a perceptual measure of intensity and activity

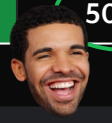
Interested outcome dependent variables

Interested independent variables

control variables

Descriptive Statistics

	Streams (Billion)	Weeks_on_chart (Week)	Danceability (0-1)	Energy (0-1)	Loudness (-60-0 Db*)
mean	16.808	14.852	0.691	0.646	-6.268
std	13.893	20.504	0.133	0.157	2.340
min	1.423	1.000	**0.398**	0.189	-16.169
25%	5.408	1.000	0.587	0.542	-7.454
50%	13.347	5.000	0.709	0.657	-5.883
75%	25.714	20.000	0.794	0.769	-4.604
max	**50.162**	**104.000**	0.954	0.959	-2.171

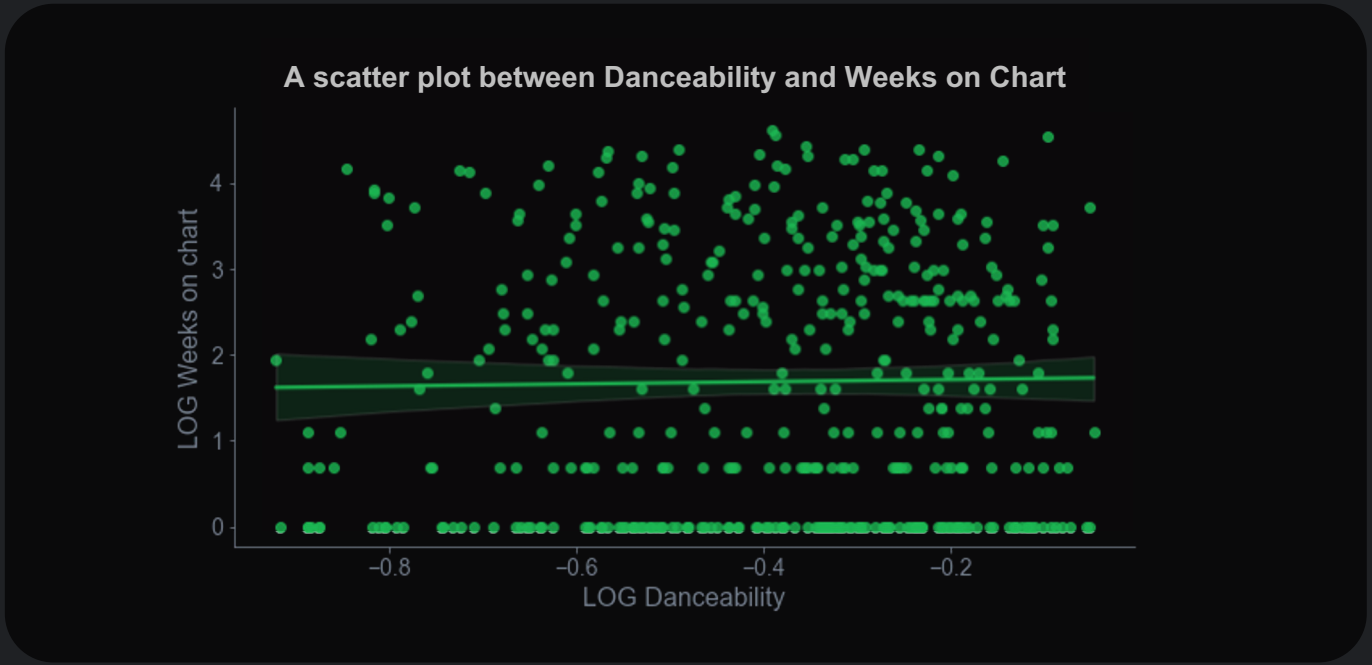


** Spotify standardization metric for ideal loudness on their platform, 0 is the loudest

Data Visualization

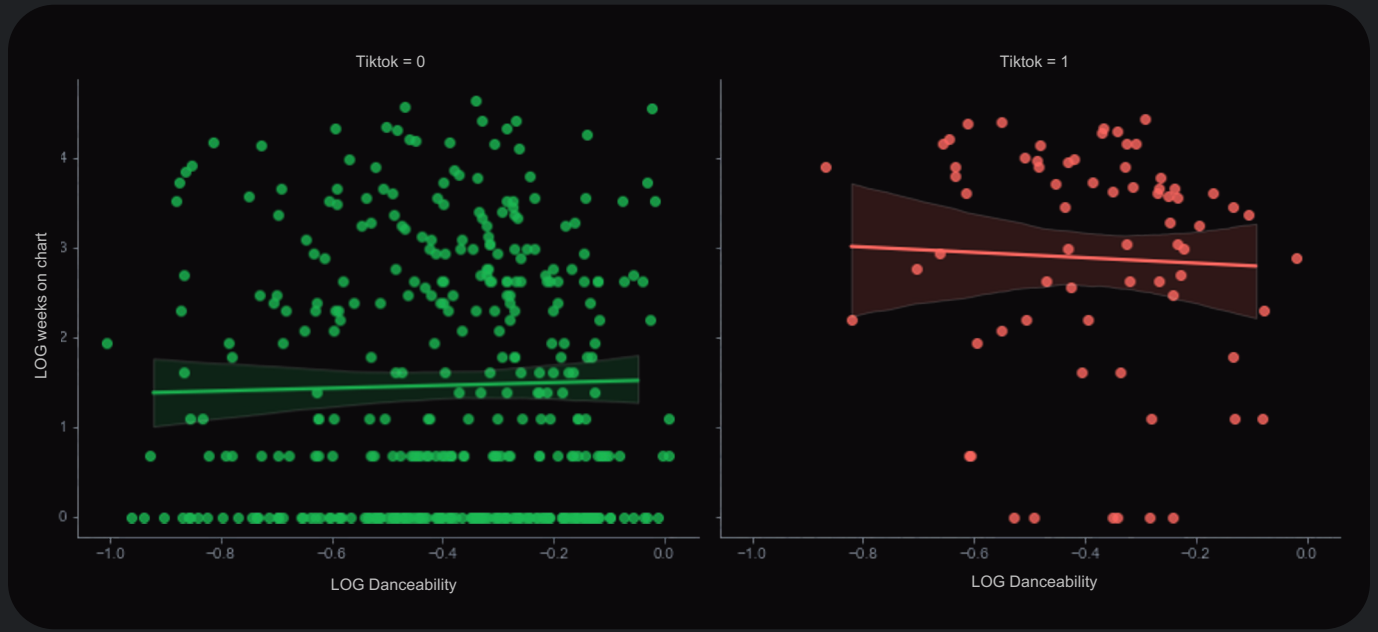
r = 0.017489

From the scatter plot, with the observational data we currently have, there is no correlation between log(week on chart) and log(danceability)



Data Visualization: Cont.

Songs that appear on TikTok seems to have a higher average number of weeks on chart than songs that does not appear on TikTok



Model Explanation

log(weeks_on_chart) = b0 + b1 log(danceability) + b2 tiktok + b3 streams + b4 loudness + b5 log(energy)

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Residuals:
    Min      1Q  Median      3Q     Max
-3.0424 -1.2265 -0.1304  1.0780  3.3988

Coefficients:
                Estimate Std. Error t value             Pr(>|t|)
(Intercept)     1.888080   0.221429   8.527 0.000000000000000242 ***
LOG.danceability -0.183713   0.327036  -0.562              0.57457
tiktok          1.373919   0.180577   7.609 0.000000000000169347 ***
streams         0.014845   0.004811   3.085              0.00216 **
loudness        0.128950   0.041101   3.137              0.00182 **
LOG.energy      -0.158326   0.333610  -0.475              0.63532
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.378 on 441 degrees of freedom
Multiple R-squared:  0.1607,    Adjusted R-squared:  0.1512
F-statistic: 16.89 on 5 and 441 DF,  p-value: 0.000000000000002748
```

The analysis showed that:

- β1 ≈ -0.183
- The expected weeks on chart decreases by 0.18% when danceability increases by 1%
- P-value of β1 ≈ 0.57
- log(danceability) is not significant

	LOG.weeks_on_chart	LOG.danceability	tiktok	streams	loudness	LOG.energy
LOG.weeks_on_chart	1.00000000	0.01748872	0.34507451	0.08374450	0.1887917	0.12770133
LOG.danceability	0.01748872	1.00000000	0.01174009	0.02222473	0.2010677	0.16761281
tiktok	0.34507451	0.01174009	1.00000000	-0.06338938	0.1081044	0.06573248
streams	0.08374450	0.02222473	-0.06338938	1.00000000	-0.1652033	-0.03024335
loudness	0.18879175	0.20106772	0.10810436	-0.16520331	1.0000000	0.71329885
LOG.energy	0.12770133	0.16761281	0.06573248	-0.03024335	0.7132989	1.00000000

Model Explanation: Cont.

$$\log(\text{weeks\_on\_chart}) = b_0 + b_1 \log(\text{danceability}) + b_2\,\text{tiktok} + b_3\,\text{streams} + b_4\,\text{loudness}$$

```
Residuals:
    Min      1Q  Median      3Q     Max
-3.0923 -1.2242 -0.1562  1.0722  3.4333

Coefficients:
                 Estimate Std. Error t value             Pr(>|t|)
(Intercept)       1.87931    0.22046   8.524 0.00000000000000245 ***
LOG.danceability -0.18808    0.32662  -0.576               0.5650
tiktok            1.37481    0.18041   7.620 0.00000000000155417 ***
streams           0.01456    0.00477   3.053               0.0024 **
loudness          0.11515    0.02902   3.968 0.00084573900363055 ***
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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.377 on 442 degrees of freedom
Multiple R-squared:  0.1603,    Adjusted R-squared:  0.1527
F-statistic:  21.1 on 4 and 442 DF,  p-value: 0.0000000000000006193
```

The analysis showed that:

- $\beta_1 \approx -0.188$ (controlling for tiktok, streams, and loudness, the expected weeks on chart decreases by 0.18% when danceability increases by 1%)
- $\beta 2 \approx 1.375$ (295% increase in weeks on chart if TikTok = 1)
- $\beta 3 \approx 0.0145$ (1.47% increase in weeks on chart when streams increase by 1%)
- $\beta 4 \approx 0.115$ (12.2% increase in weeks on chart when loudness increases by 1%)

Conclusion: Limitations

We fail to reject the null hypothesis: there is no relationship between danceability and number of weeks on chart

> At a significance level of 0.05 and p-value of 0.5650

> Control variables all have significant relationships:
TikTok (Trends), Streams (Artist Popularity) and Loudness

Other potential factors and limitations include:

Seasonality | Movies/TV | Radio Play | Artist News | ...etc

Danceability is not a primary factor in music popularity, which is hard to predict in general

Music is intertwined and collective. It is often enjoyed with a multitude of musical elements and is listened to in a social context.

Q&A

That’s

#SPOTIFYWRAPPED