



# SPOTIFY TRACKS DATASET – EXPLORATORY DATA ANALYSIS

## DISCOVERING WHAT MAKES MUSIC POPULAR 🎵

DIVE INTO THE WORLD OF SPOTIFY DATA TO UNCOVER TRENDS, PATTERNS, AND FEATURES THAT DEFINE HIT SONGS.

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**ROLL NO. :GCECTB-R24-3032**

**DEPT : CSE**

EXPLORE HOW ENERGY, DANCEABILITY, TEMPO, VALENCE, AND ACOUSTICNESS SHAPE MUSICAL SUCCESS ACROSS TIME AND GENRES.



## TOOLS USED: PANDAS MATPLOTLIB SEABORN

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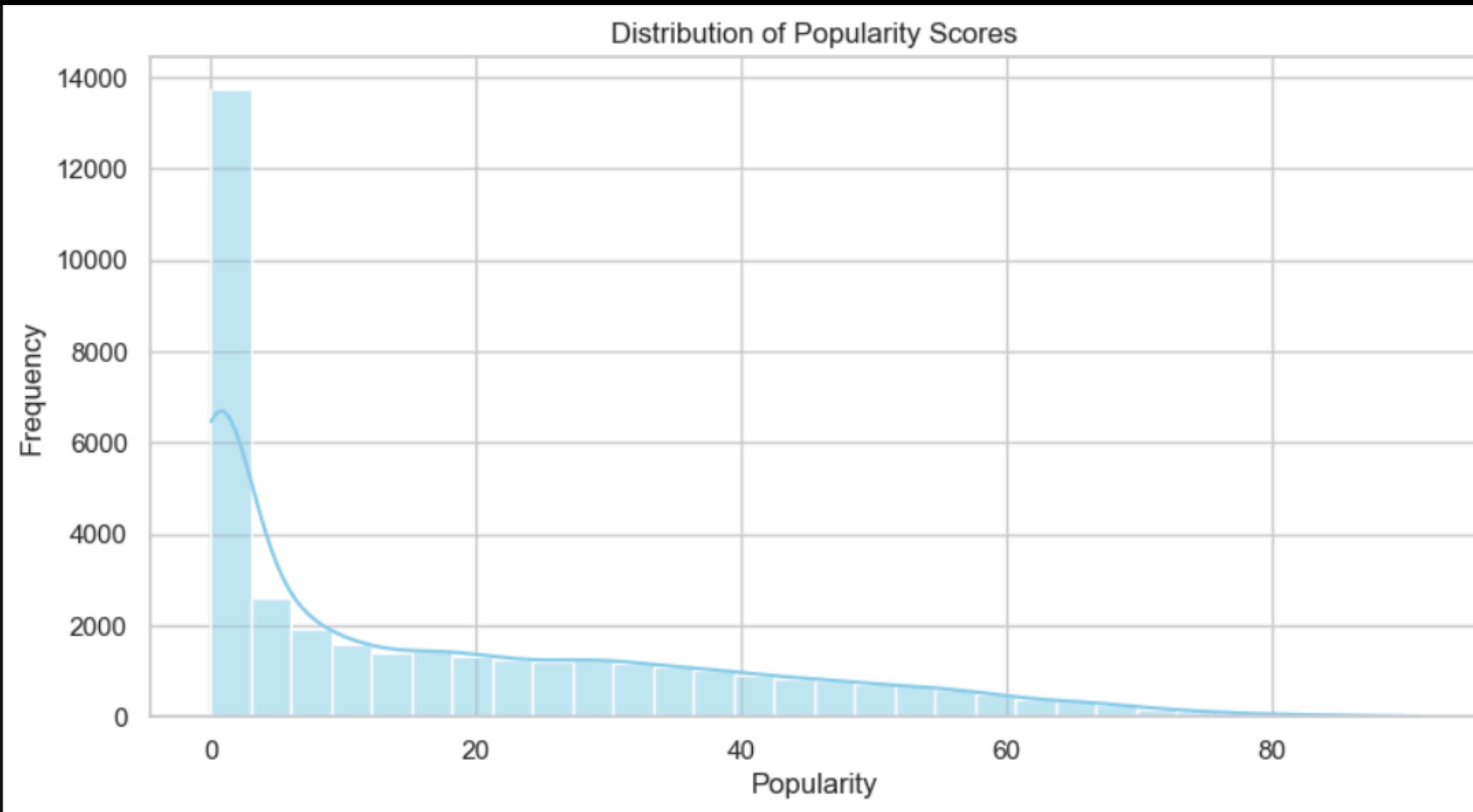
Focus: Music trends, popularity  
insights,  
and audio feature analysis



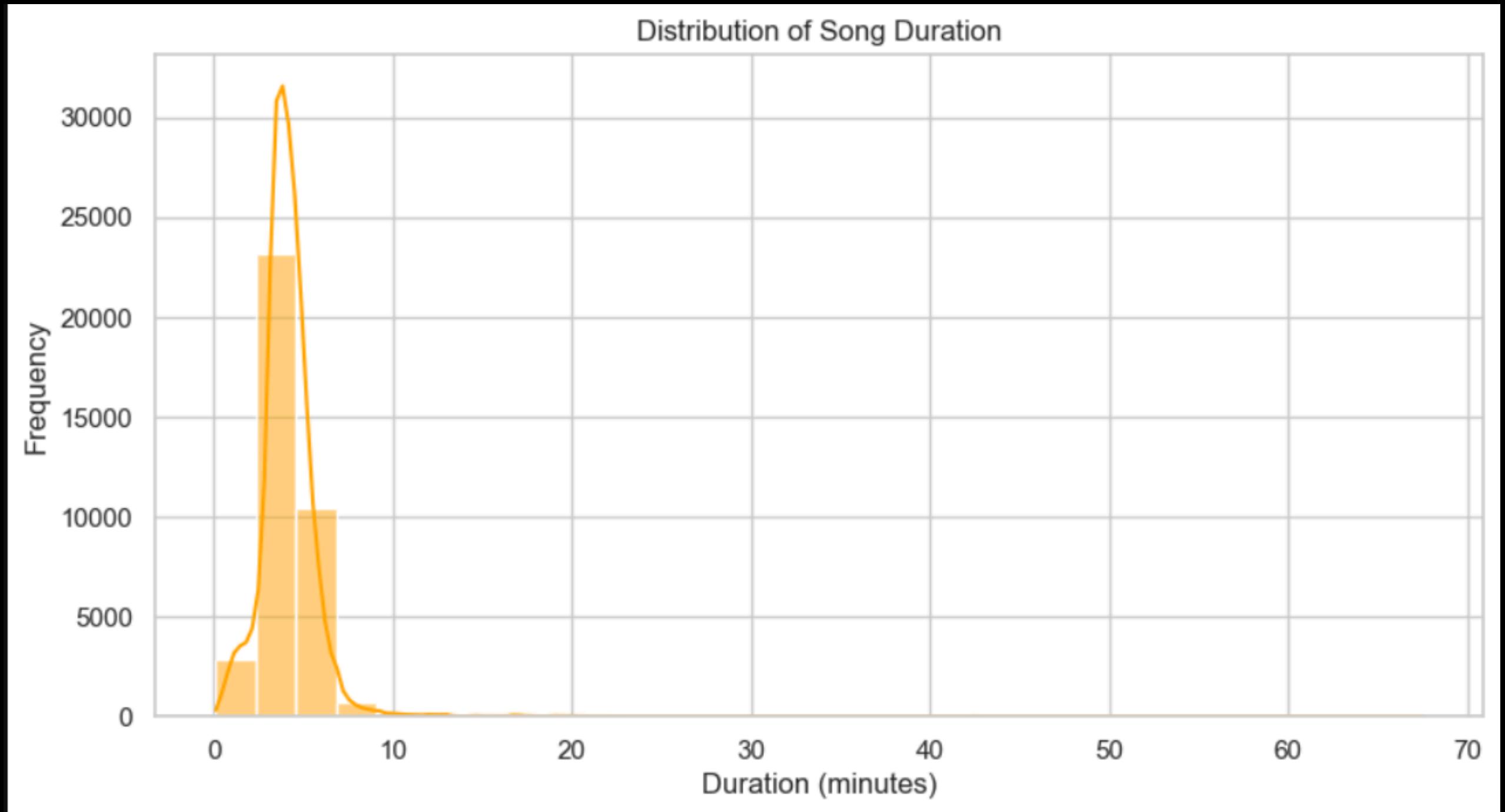
# UNIVARIATE ANALYSIS



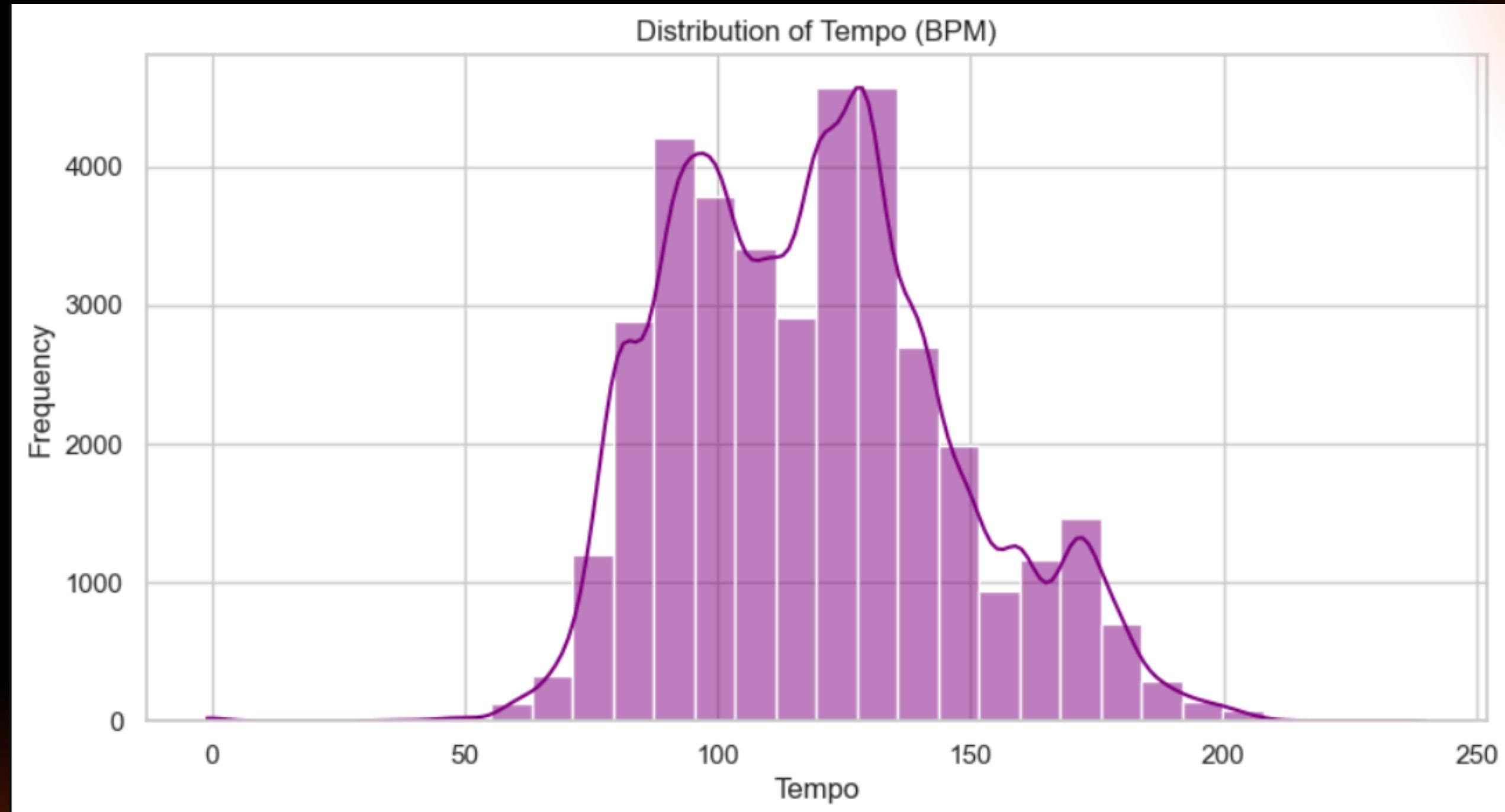
Distribution of Popularity Scores



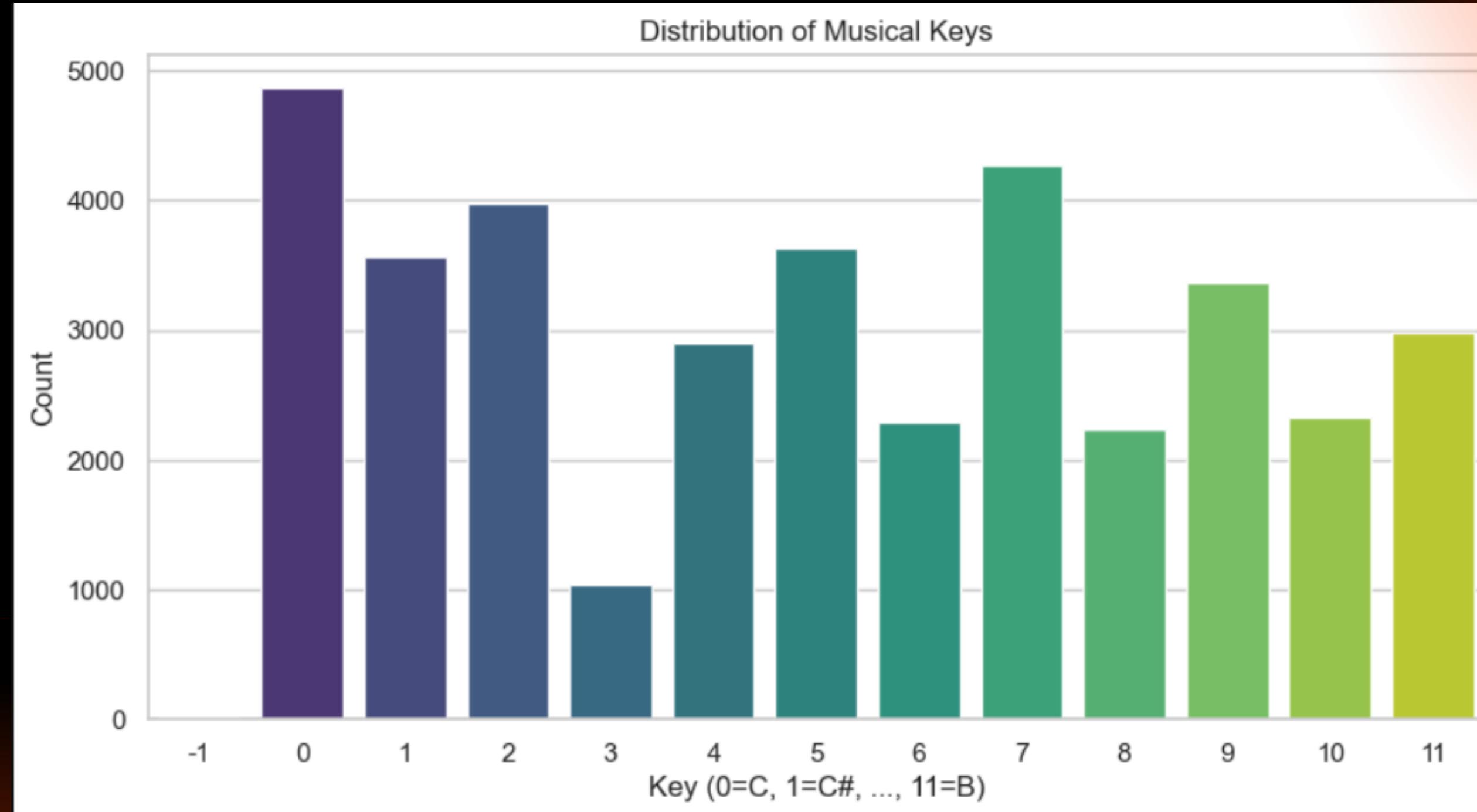
- Popularity is right-skewed – most songs have moderate scores, with few highly popular tracks.
- This shows that achieving high popularity is relatively rare across the dataset.



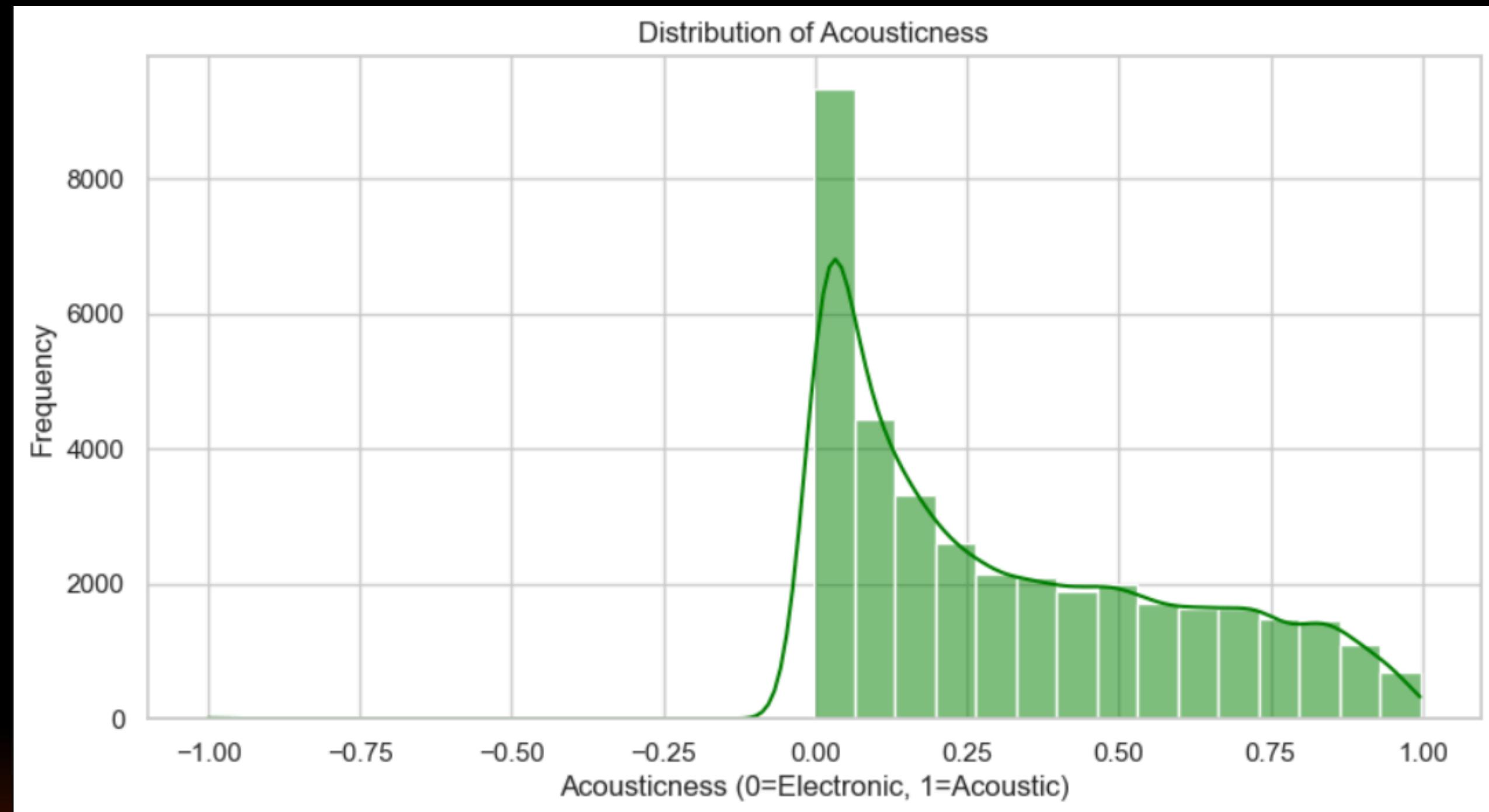
- Most songs last between 3 to 4 minutes, typical of mainstream music standards.
- There are few very short or very long tracks, indicating consistent commercial structure.



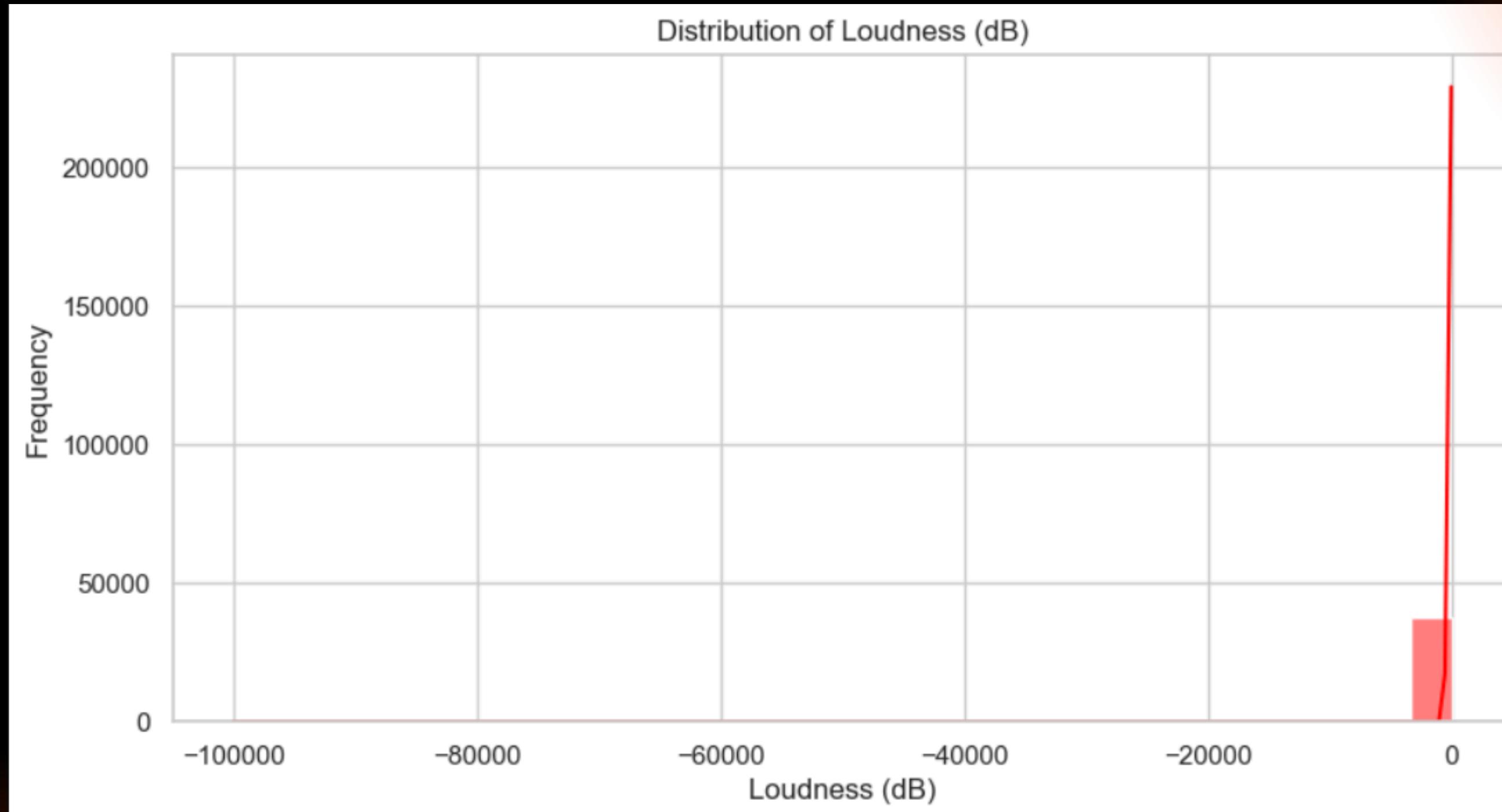
- Tempo values cluster around 100–130 BPM, common for pop and dance music.
- It indicates that moderate tempos dominate the Spotify catalog.



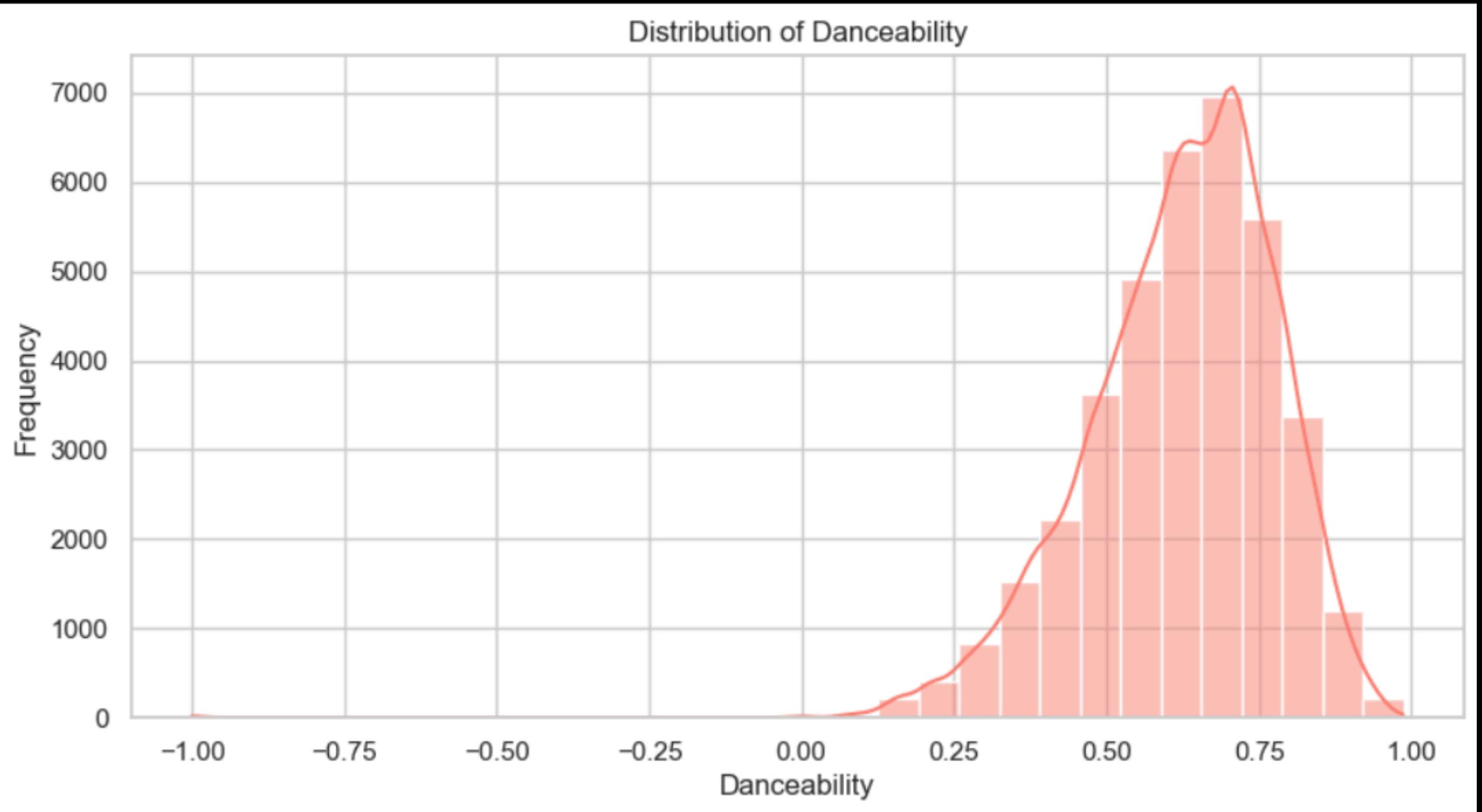
- Musical keys are fairly evenly distributed, though some keys appear slightly more often.
- This suggests artists use a broad tonal range without strong key preference.



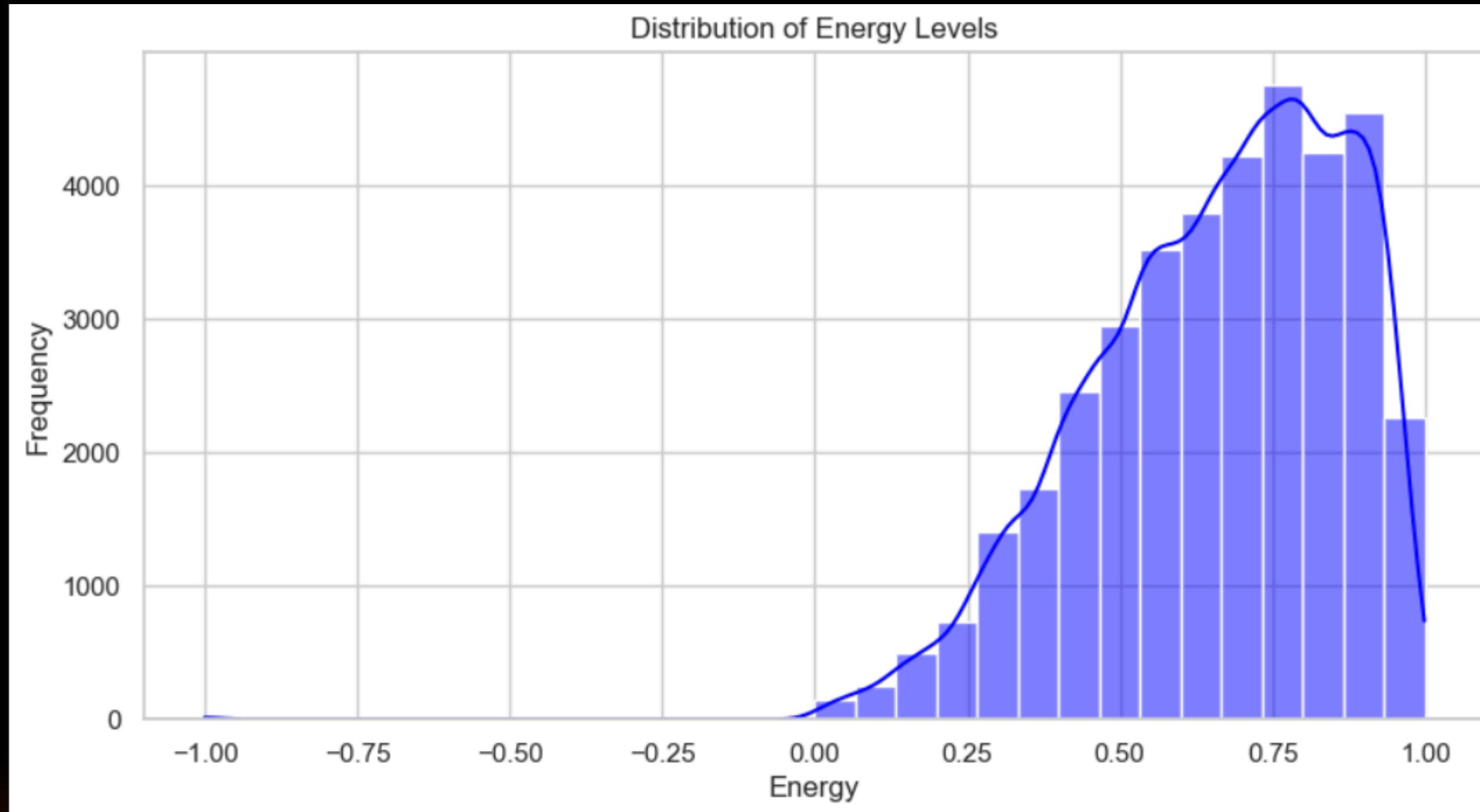
- Most tracks are low on acousticness, showing a dominance of electronic or studio-produced music.
- Highly acoustic songs form a smaller portion of the dataset.



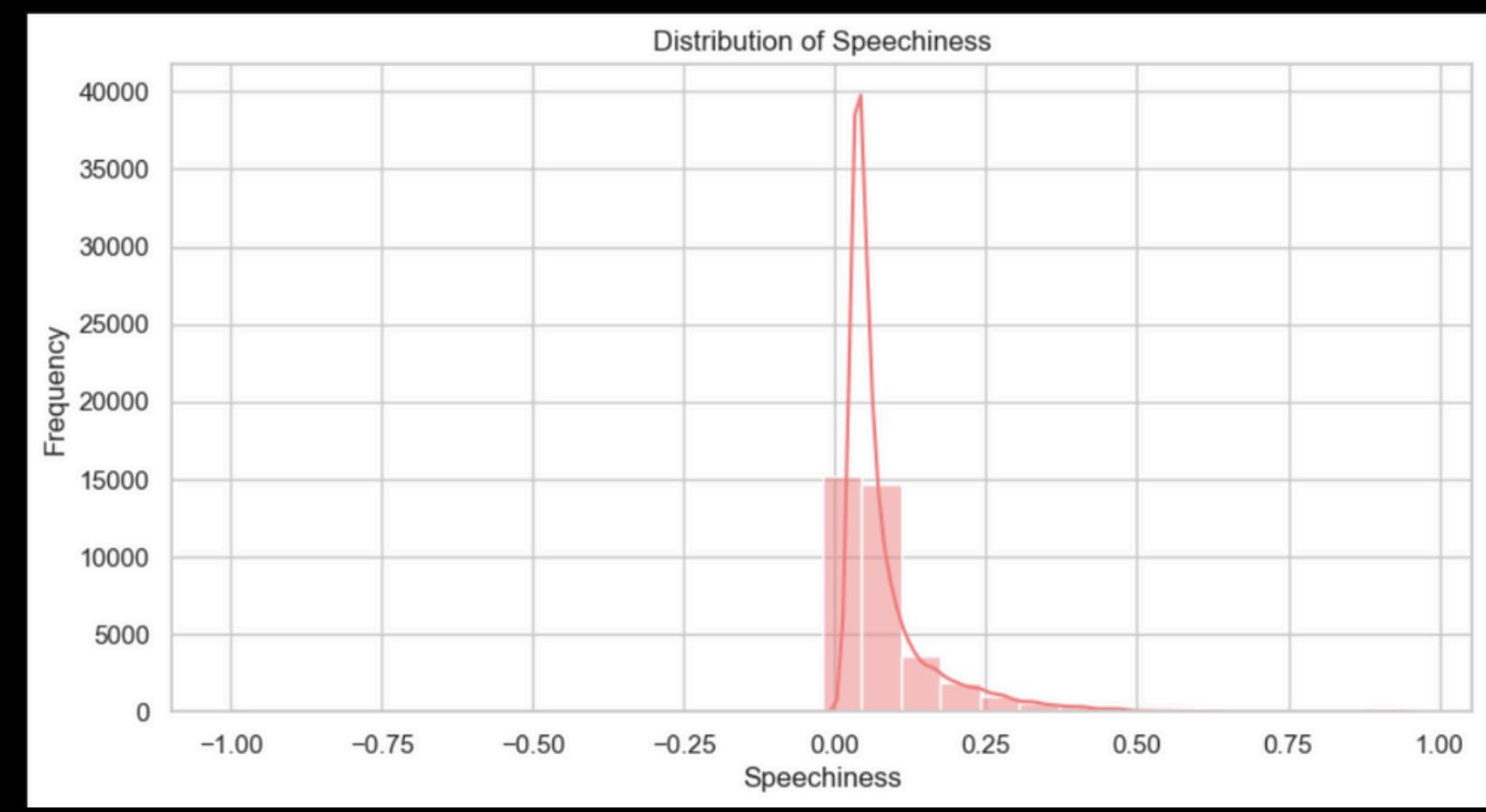
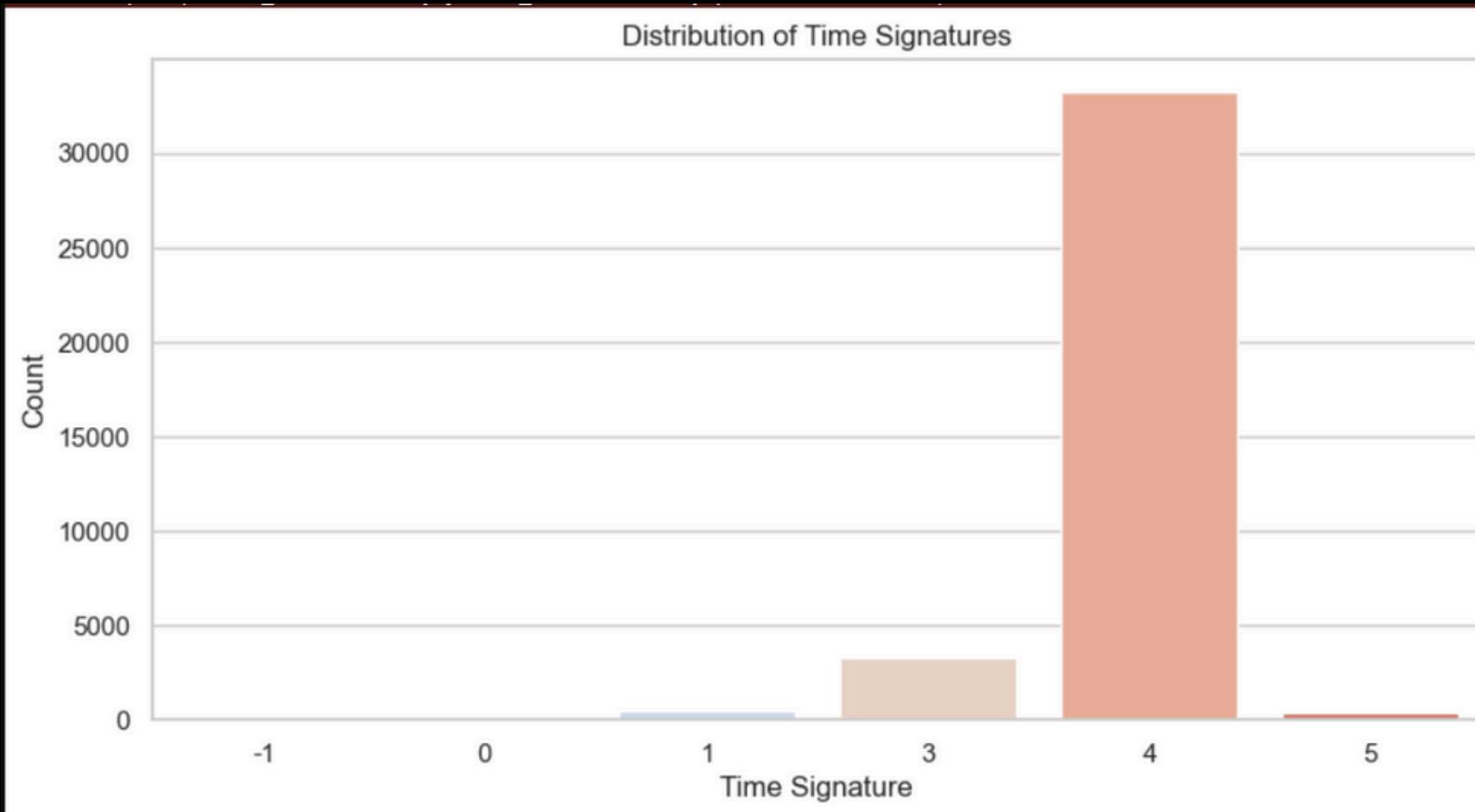
- Loudness is centered around -6 to -8 dB, consistent with the loudness war trend in production.
- Very quiet or extremely loud tracks are rare.



- 🎵 Danceability values are generally high, showing that upbeat, rhythm-driven tracks are common.
- 🎵 Spotify's catalog leans toward music that's easy to move to.

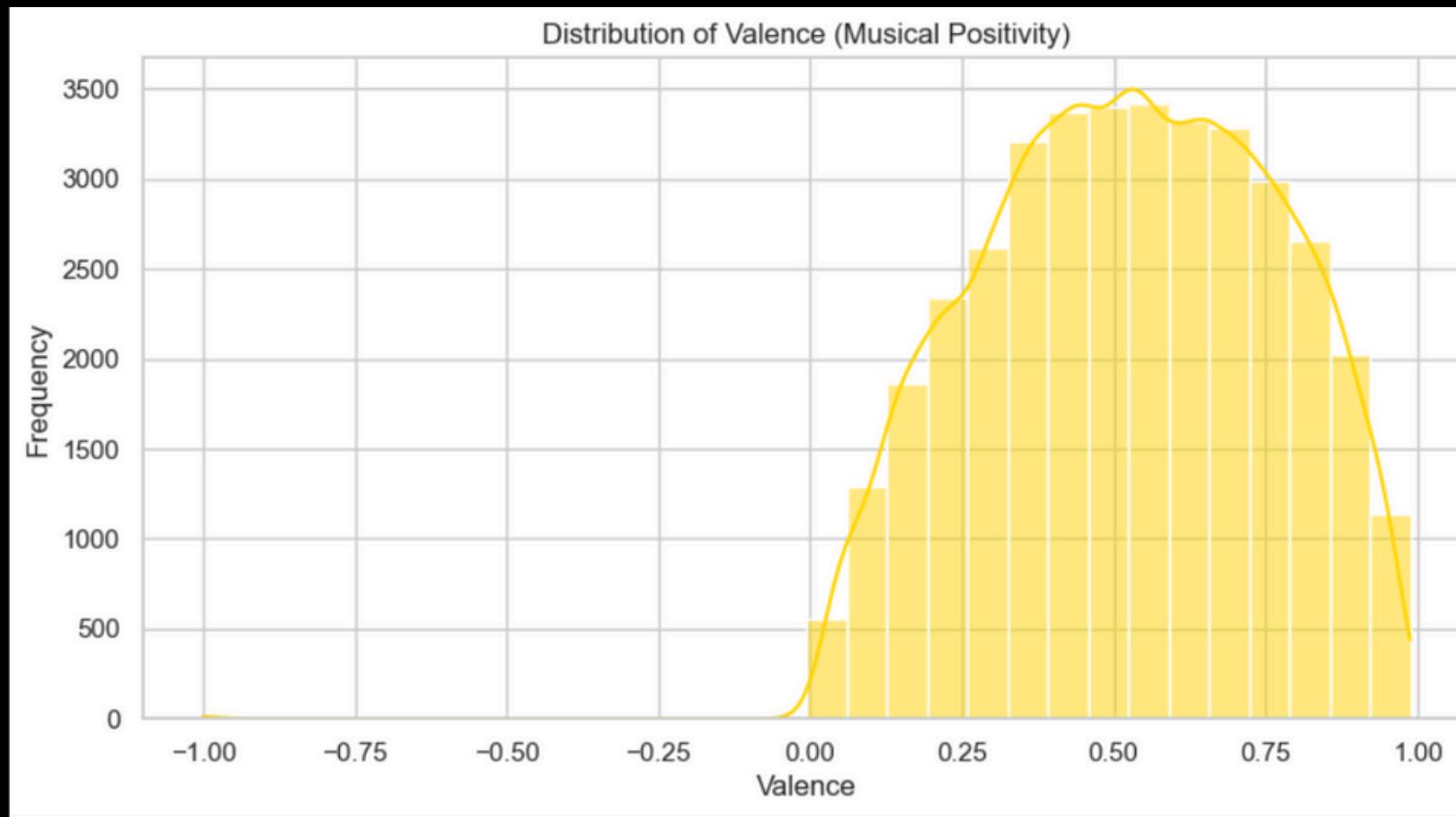


- Energy scores peak at medium-to-high values, indicating energetic music dominates.
- Low-energy or mellow tracks are less frequent overall.

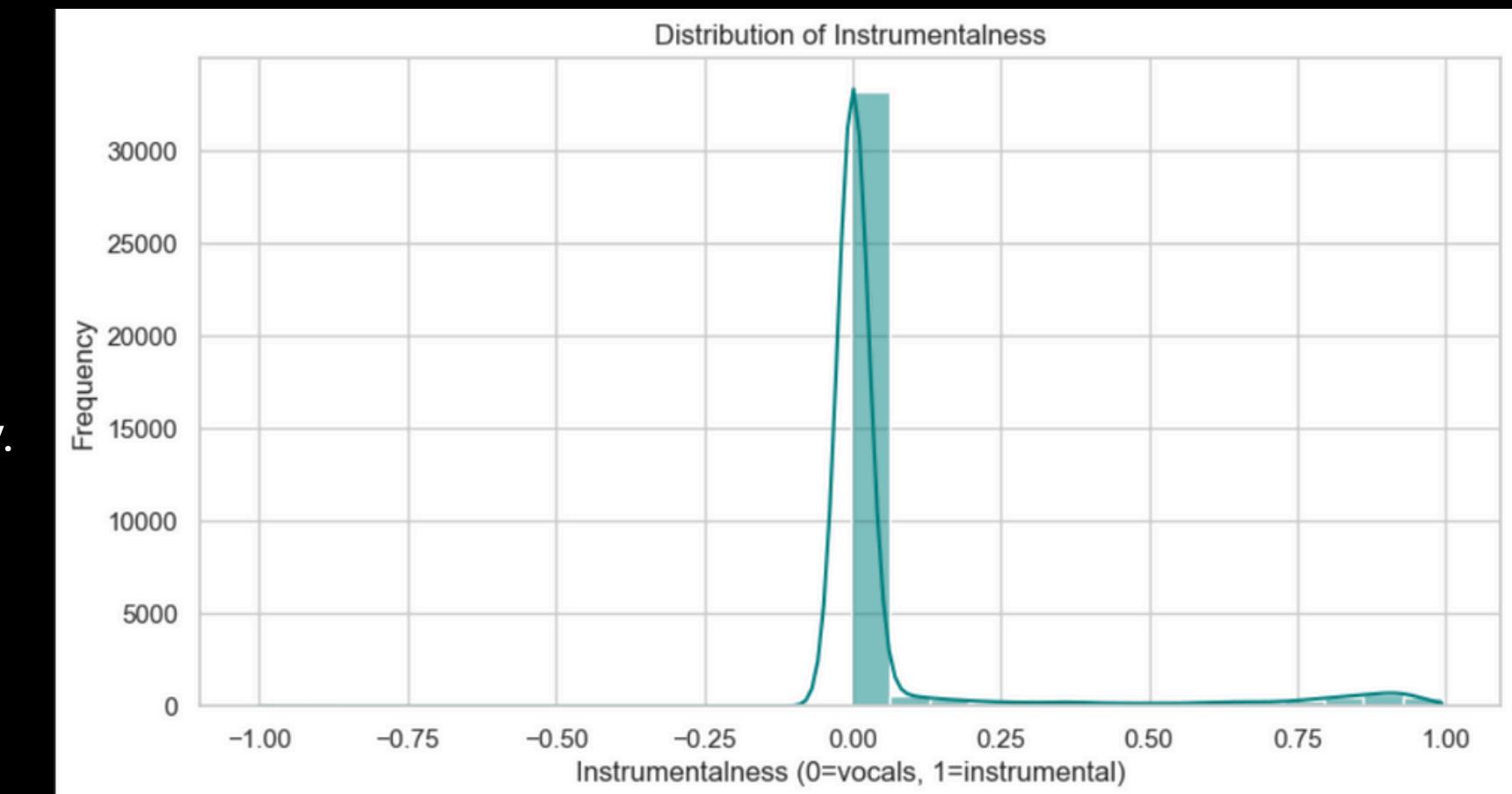


- Most tracks are in 4/4 time, the standard in popular music.
- Uncommon signatures like 3/4 or 5/4 appear rarely.

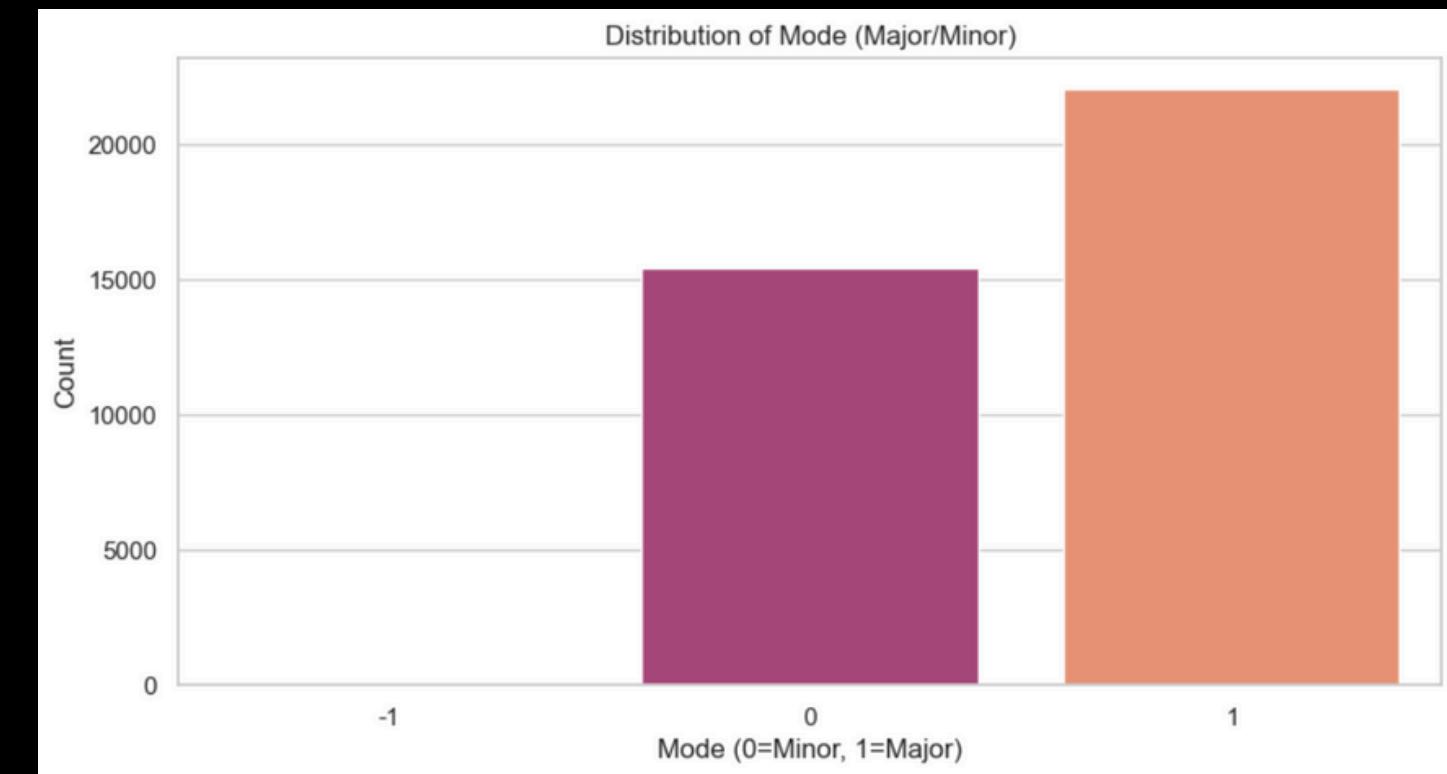
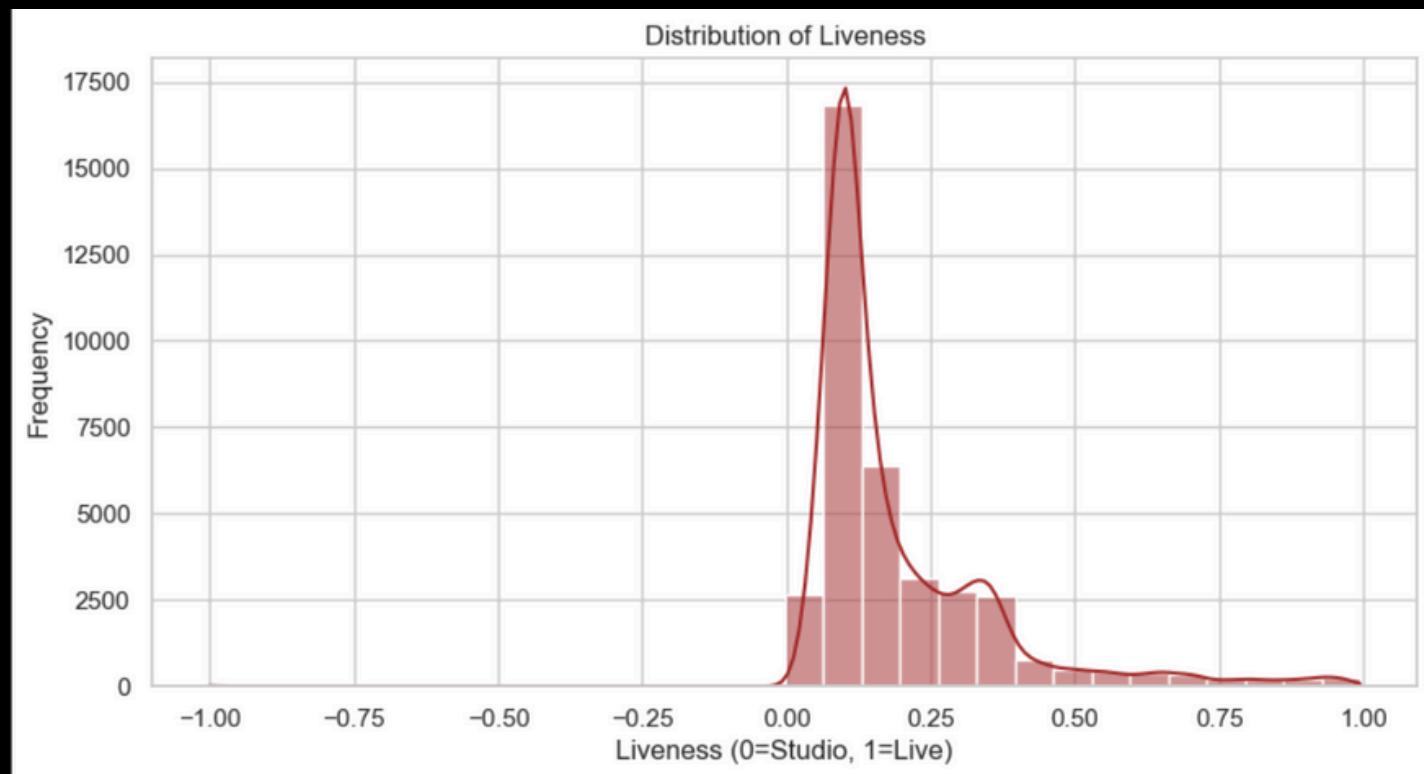
- Speechiness is low for most songs, reflecting a focus on singing rather than spoken vocals.
- Only a small fraction of tracks approach rap- or podcast-like characteristics.



- Valence centers around mid-values, suggesting a balance between happy and sad songs.
- Extreme emotional tones (very happy or very sad) are less common.

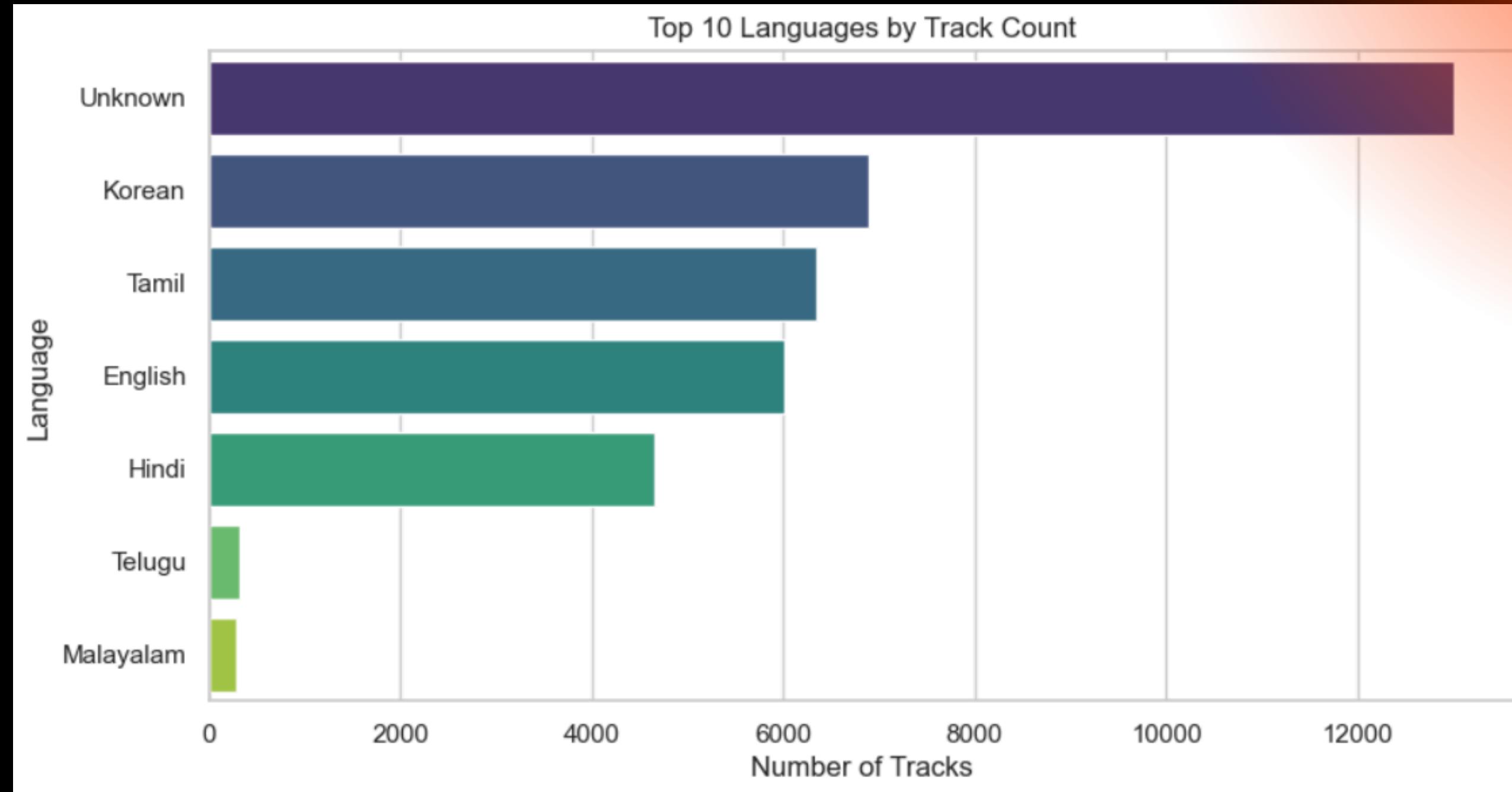


- Most tracks are vocal, with instrumental pieces being a minority.
- Instrumentalness near zero dominates across the dataset.

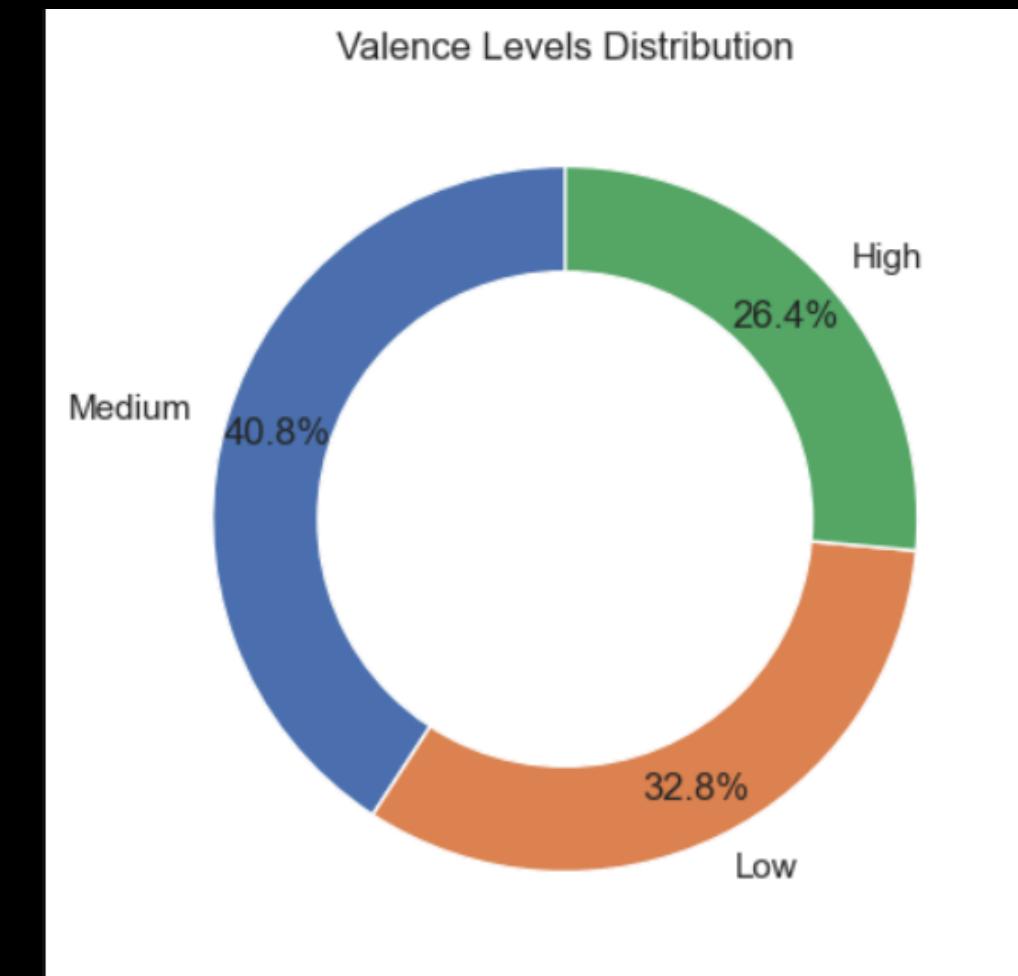
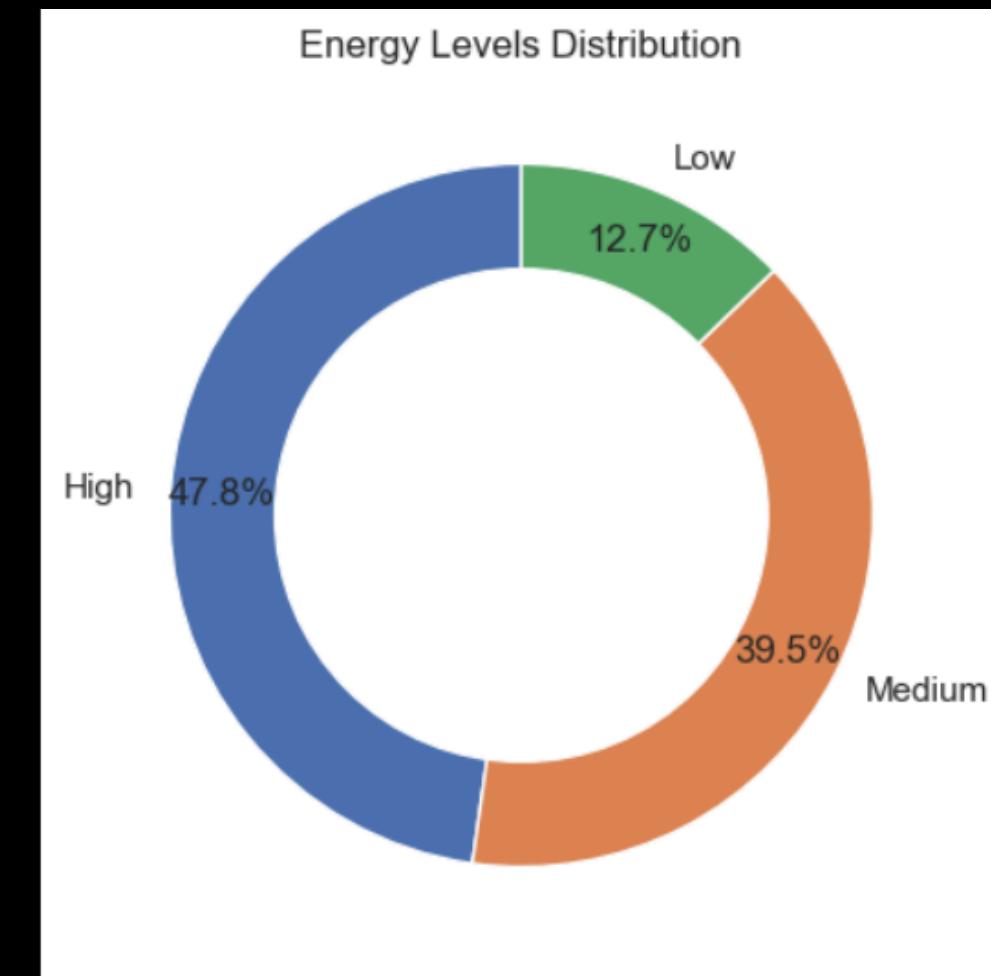
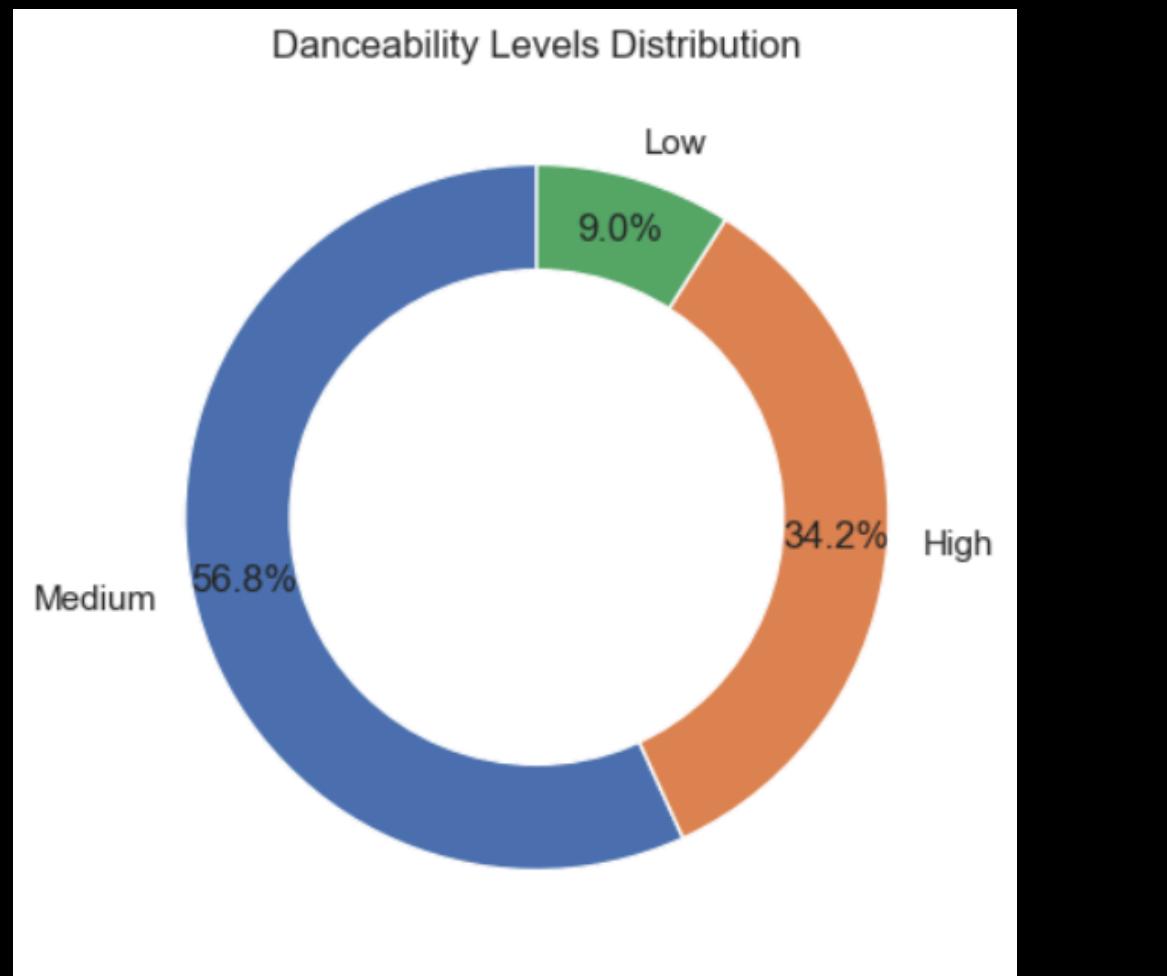


- Most tracks are studio-recorded with low liveness values.
- Live recordings form a smaller subset of Spotify content.

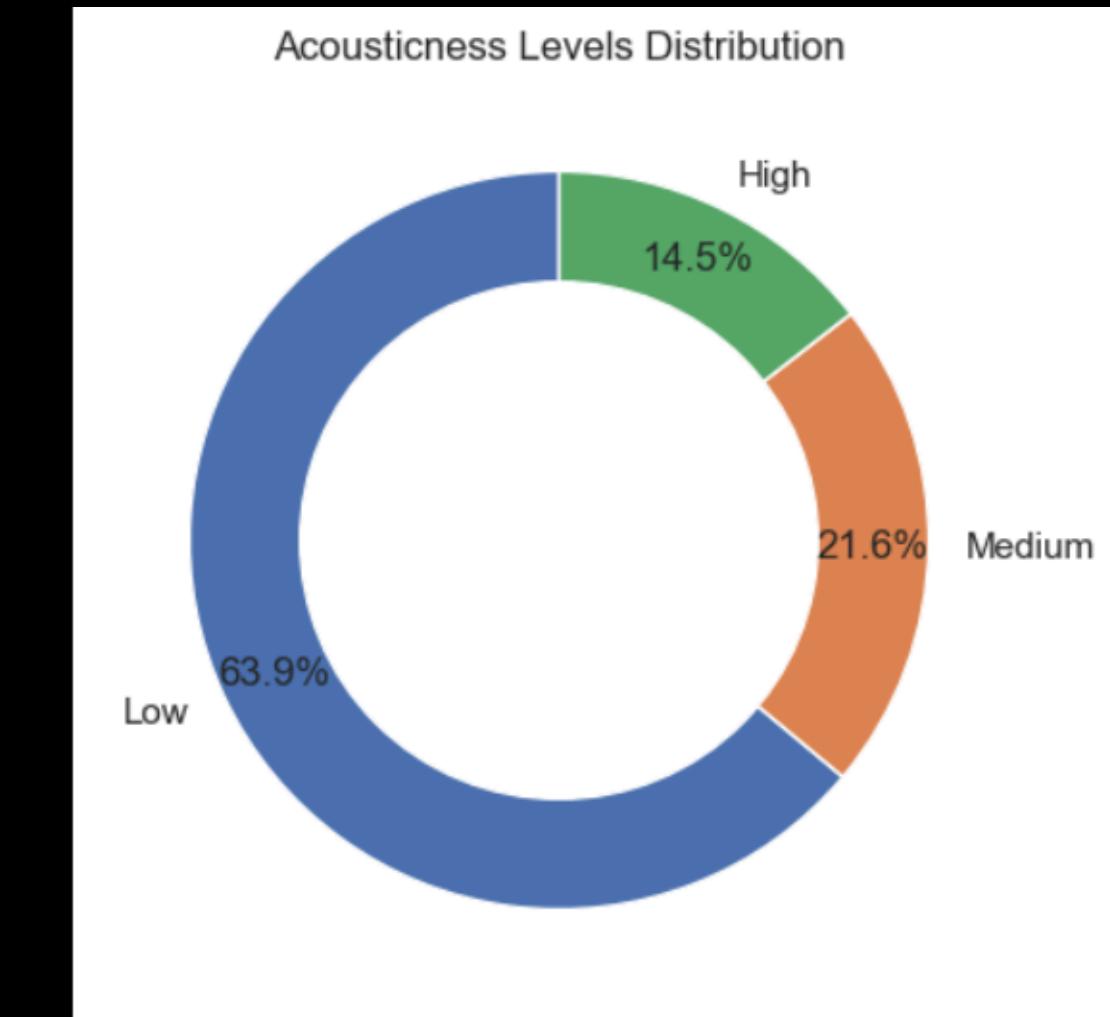
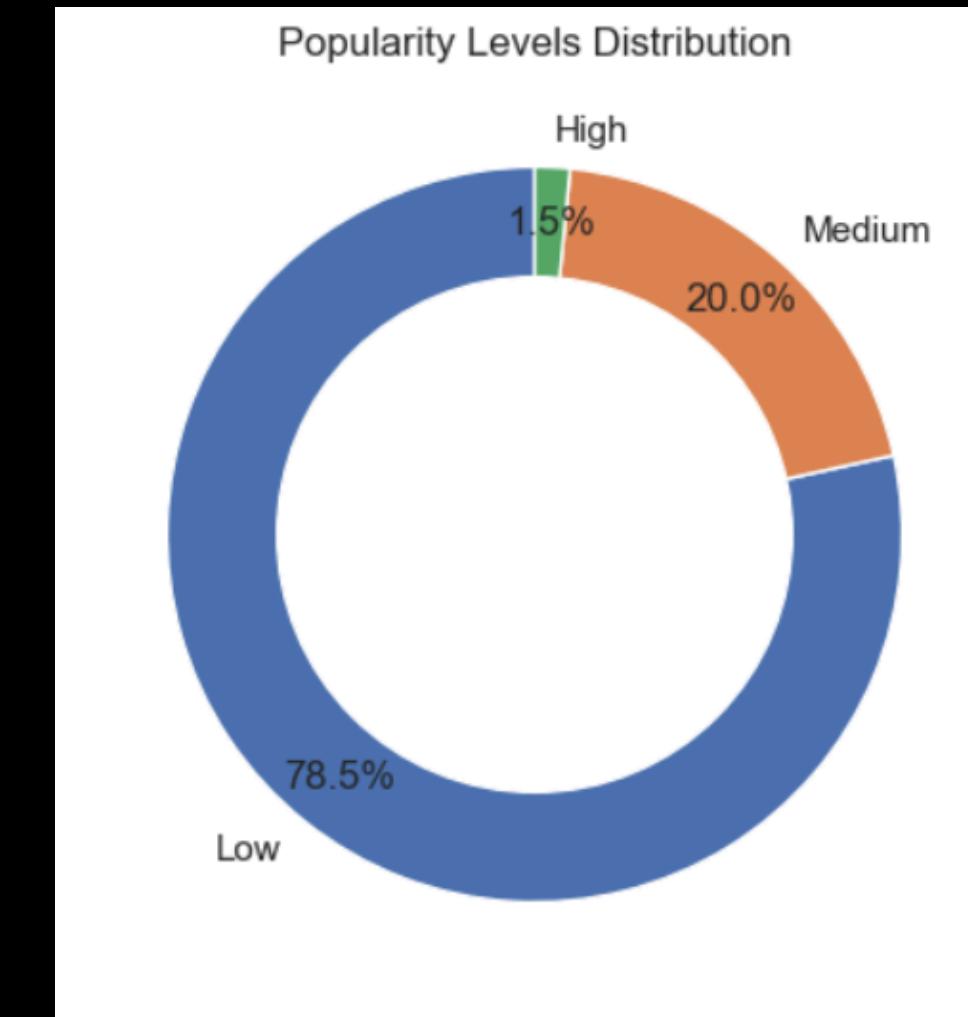
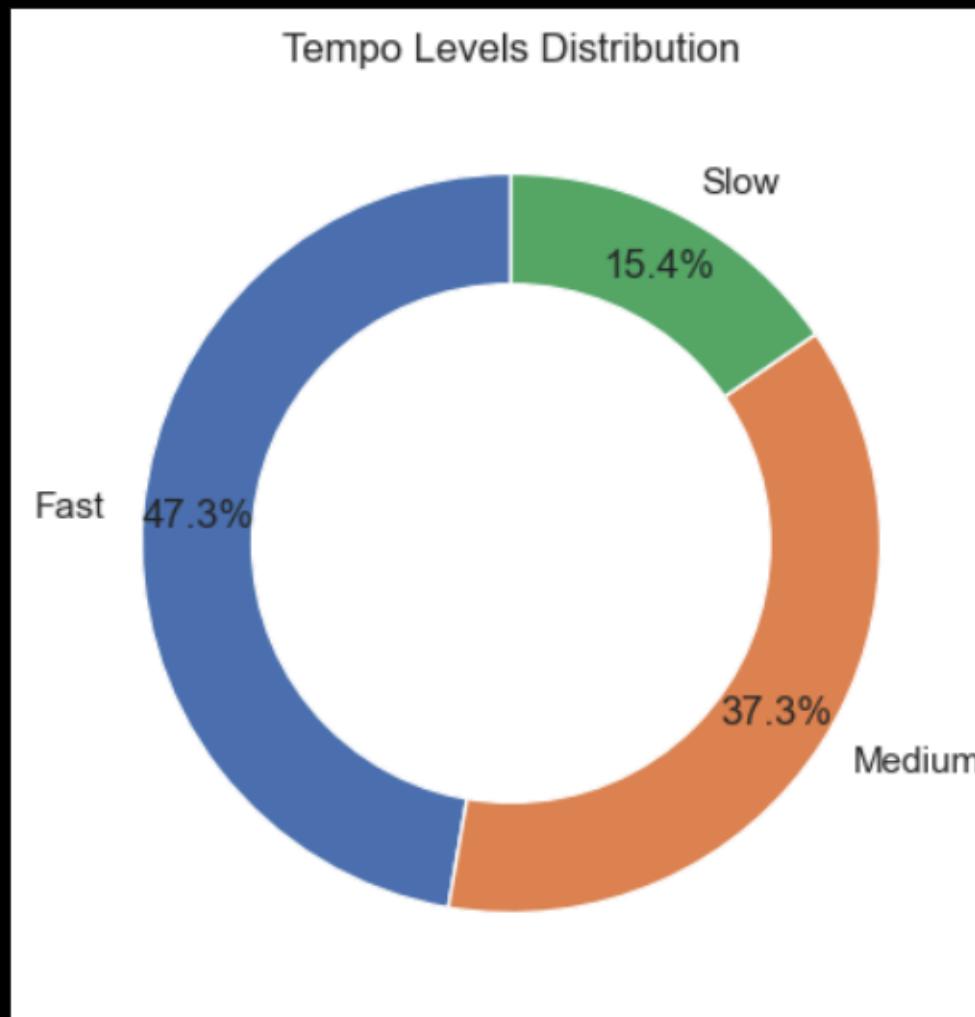
- Major mode songs outnumber minor ones, fitting the upbeat trend of popular music.
- Listeners tend to prefer tracks that sound happier or brighter.



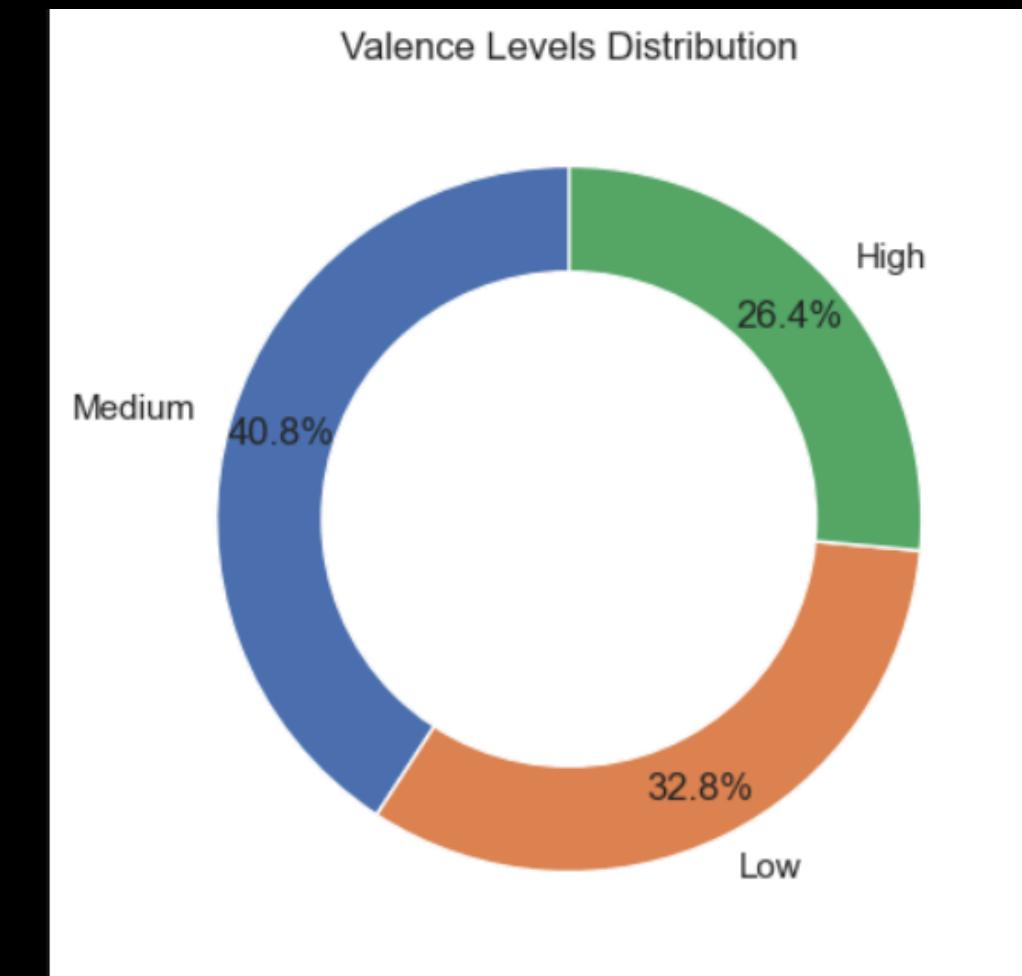
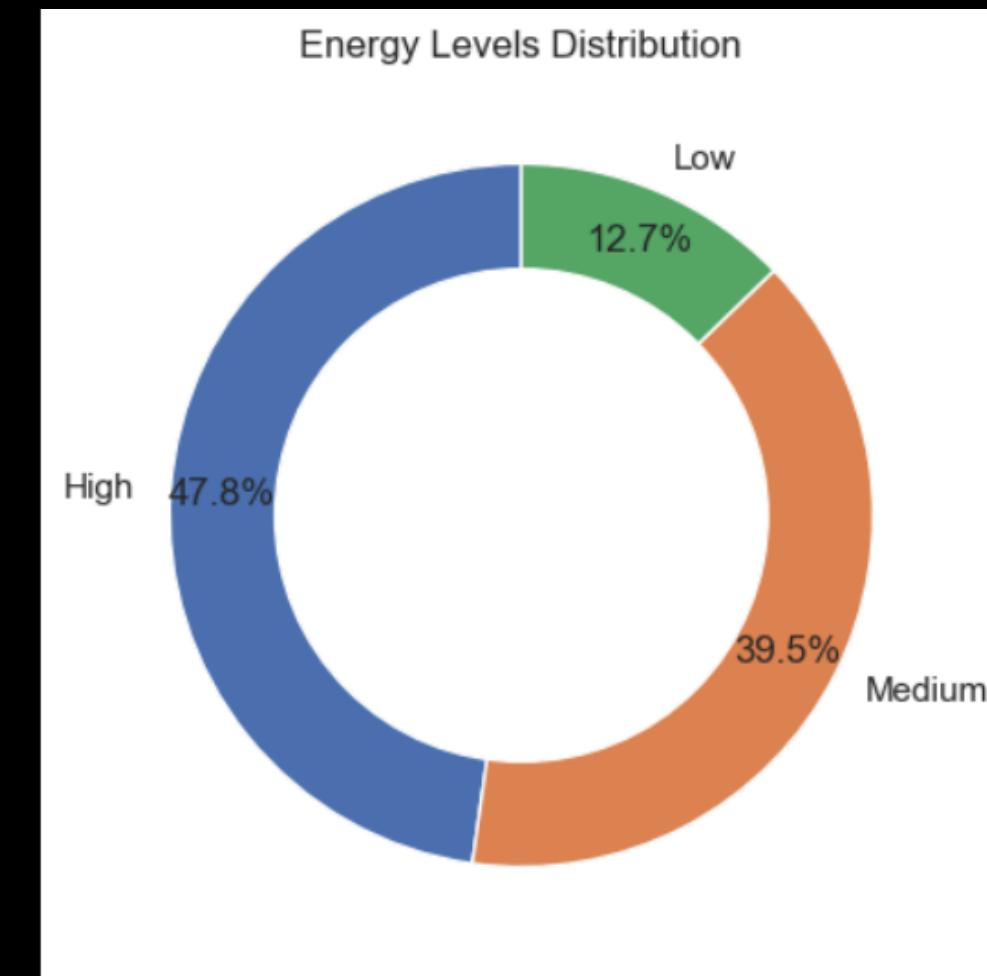
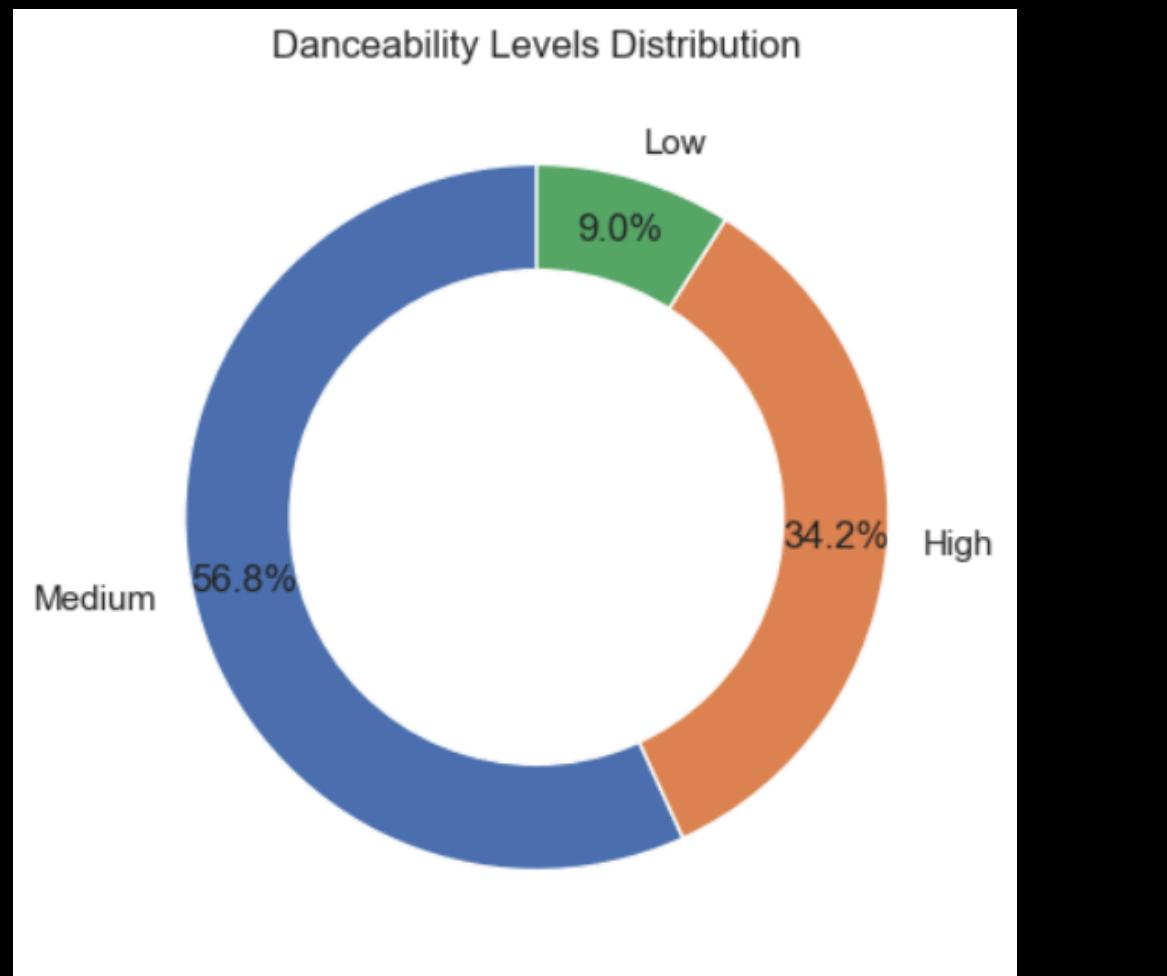
- 🎵 English overwhelmingly dominates, followed by a few global languages.
- 🎵 This reflects the international influence of English-language pop.



- Most features like danceability, energy, and valence fall in the medium-to-high range.
- Spotify's dataset favors engaging, energetic, and moderately positive songs.



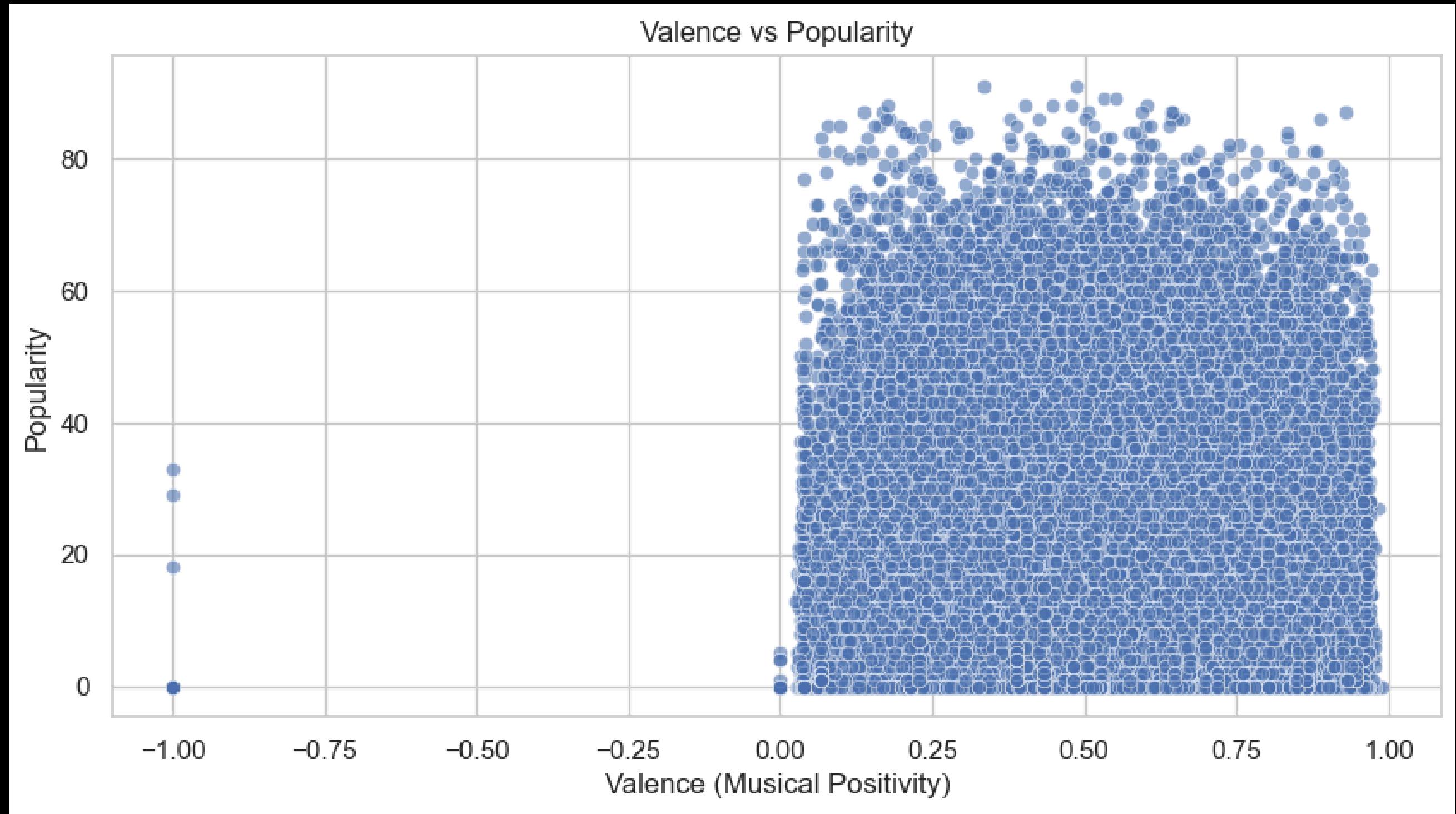
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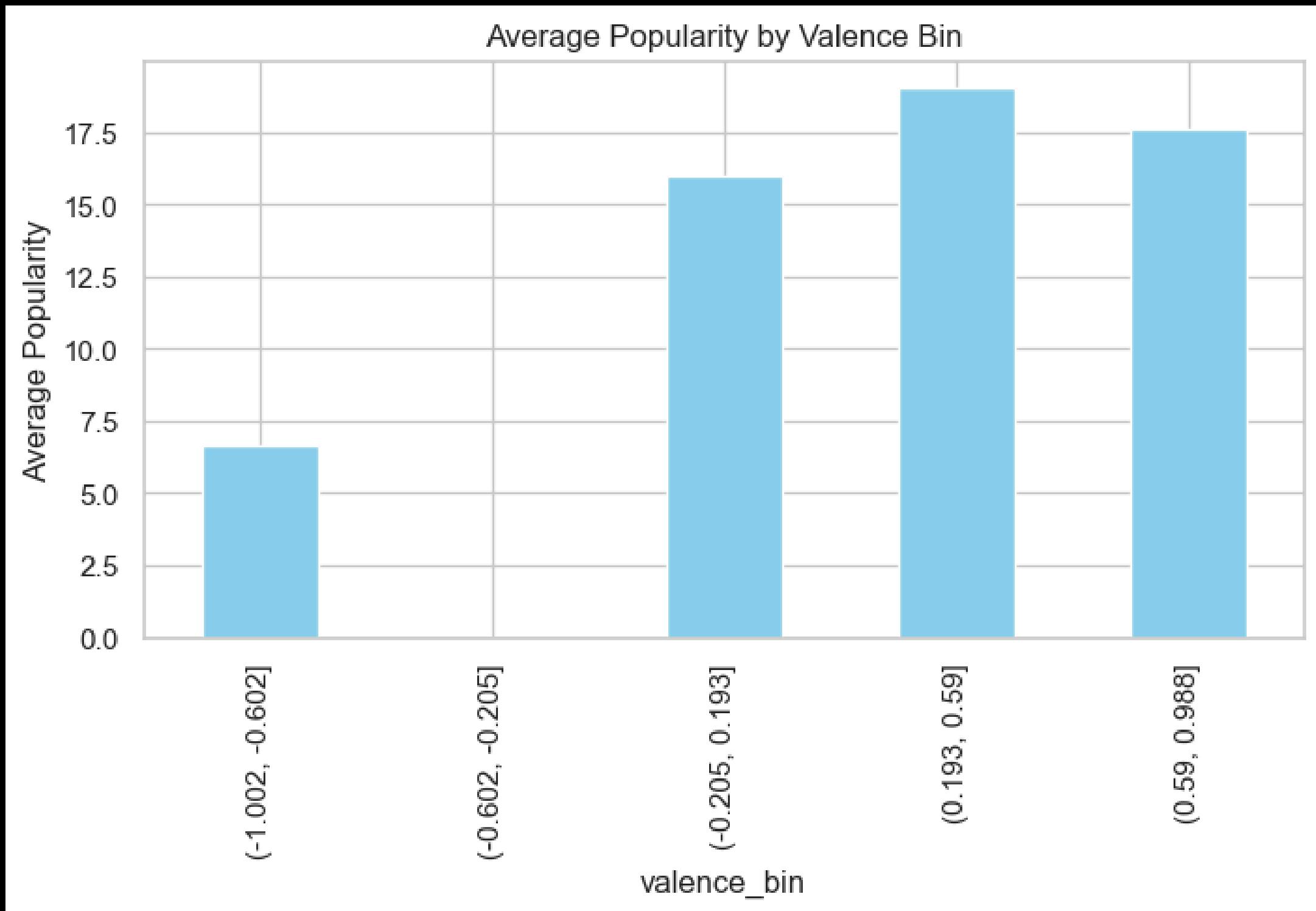
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# BIVARIATE ANALYSIS

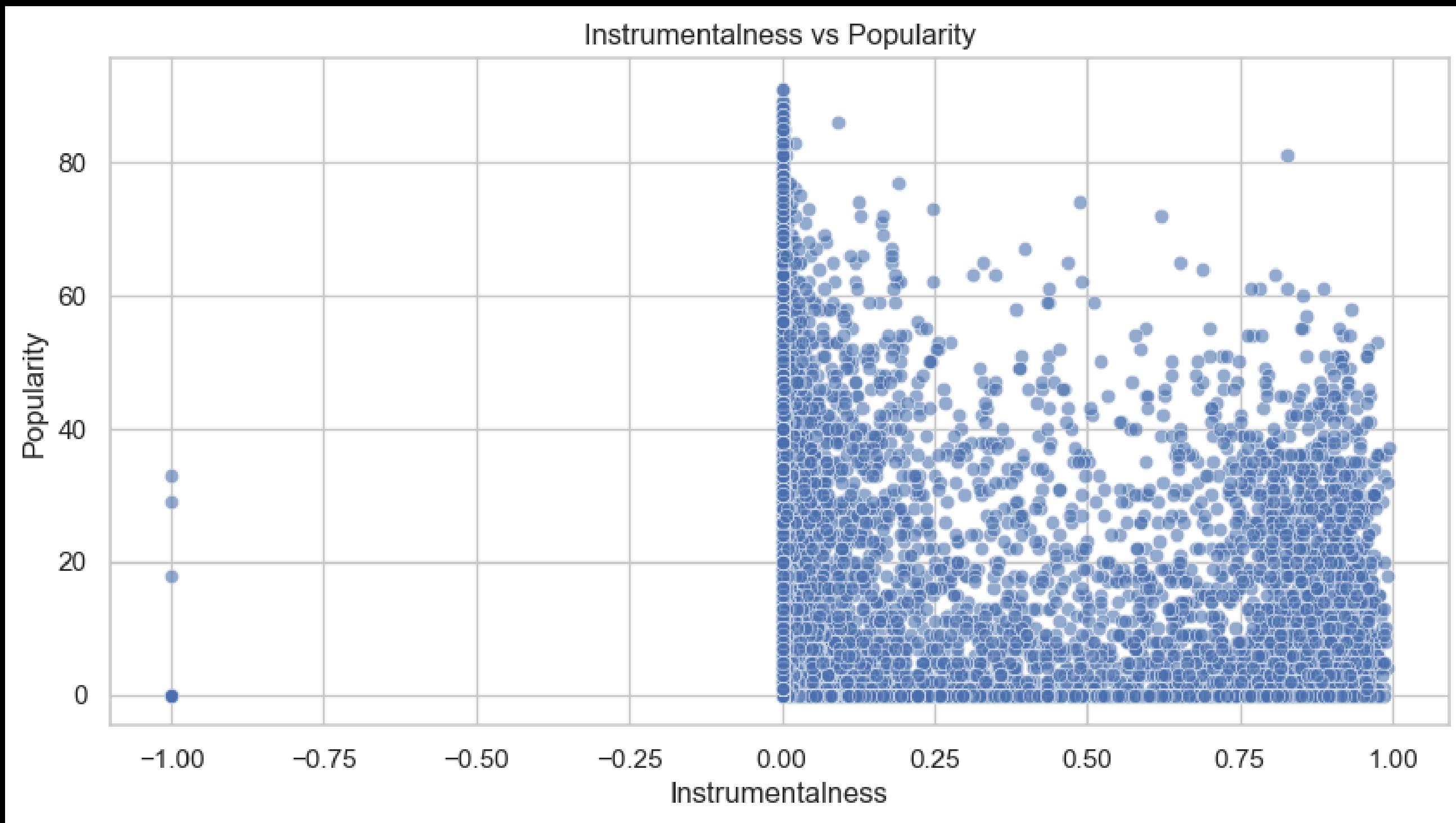




- ♪ There's a slight positive correlation – happier songs tend to be more popular.
- ♪ However, extreme valence doesn't guarantee higher popularity.

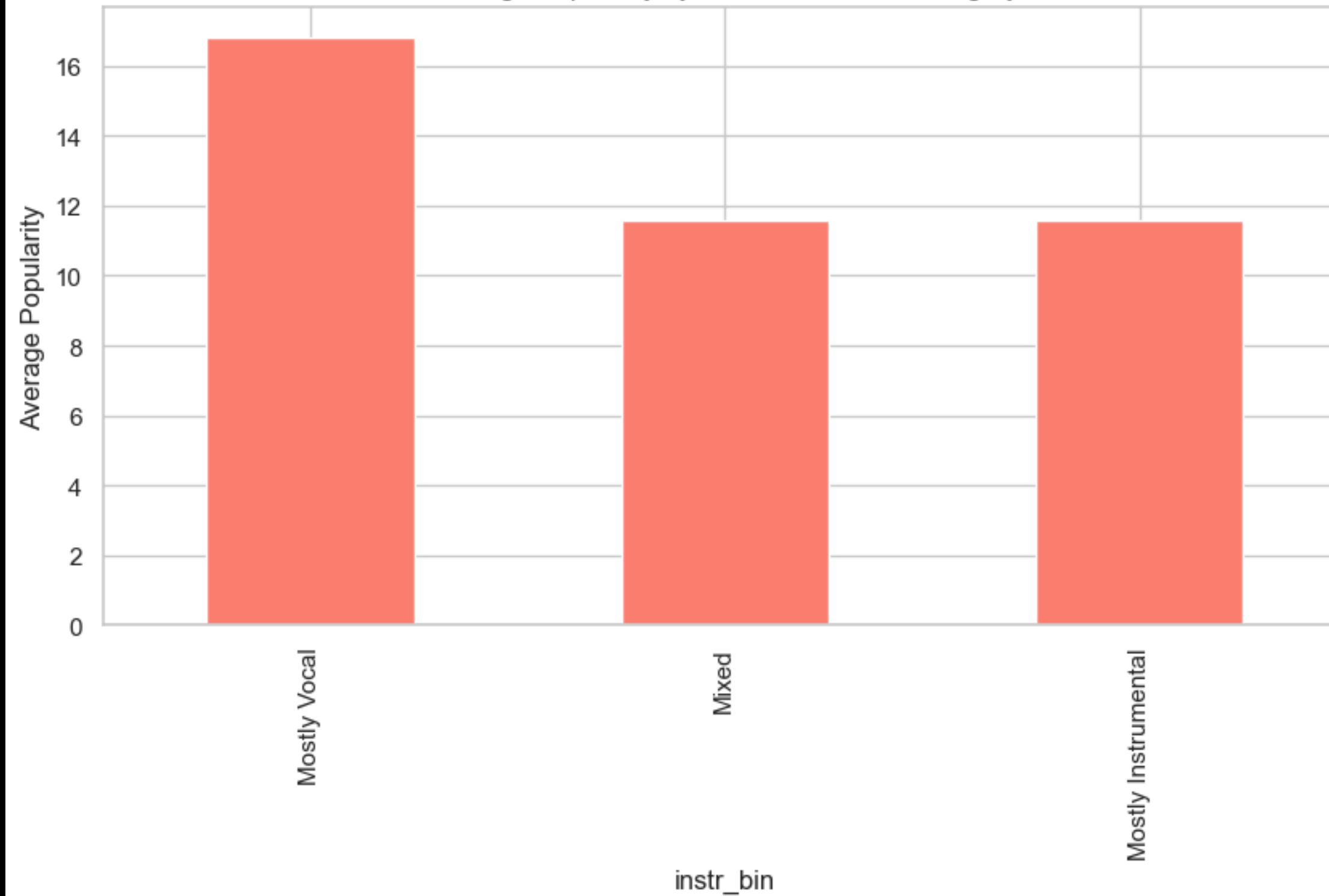


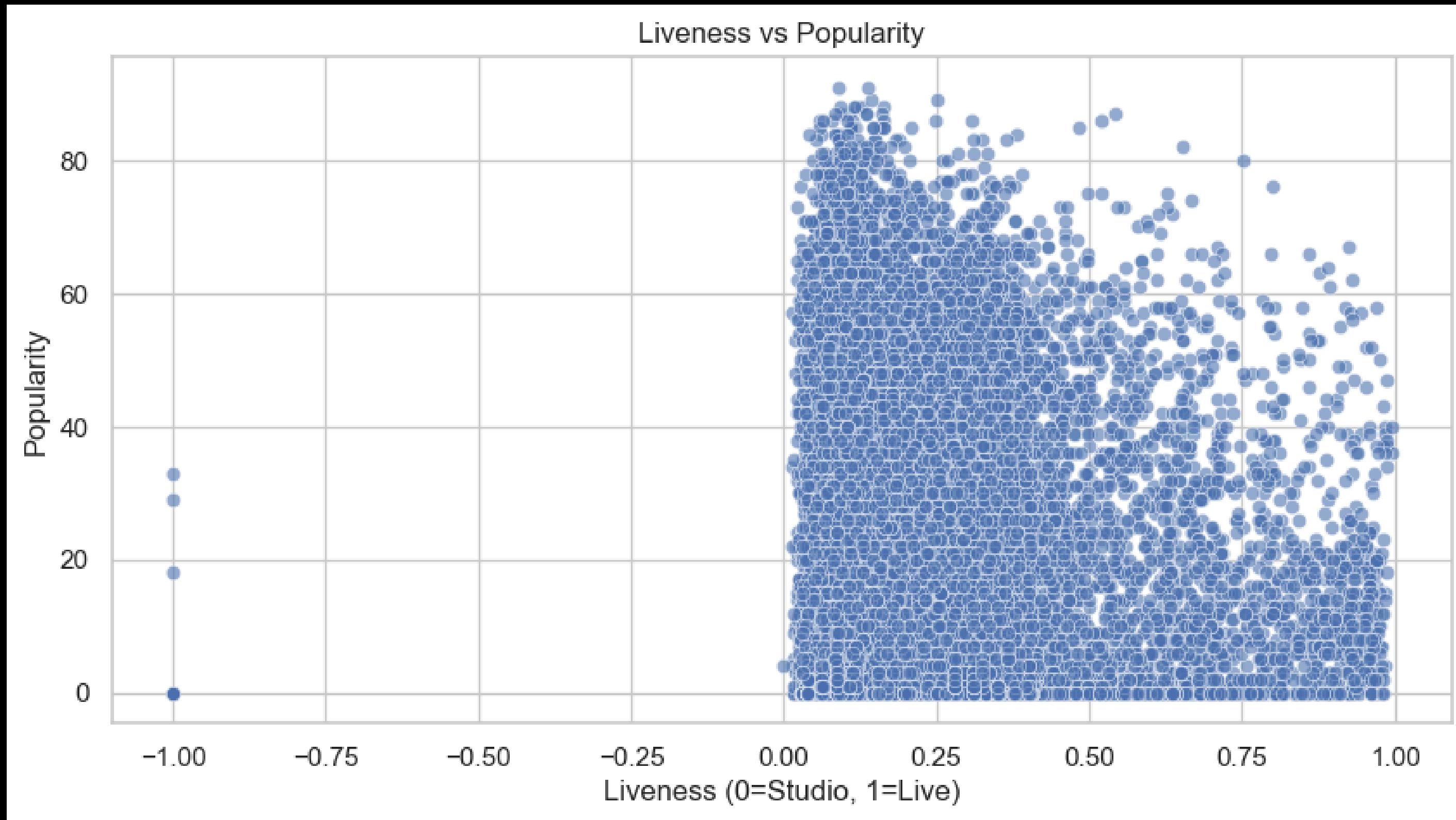
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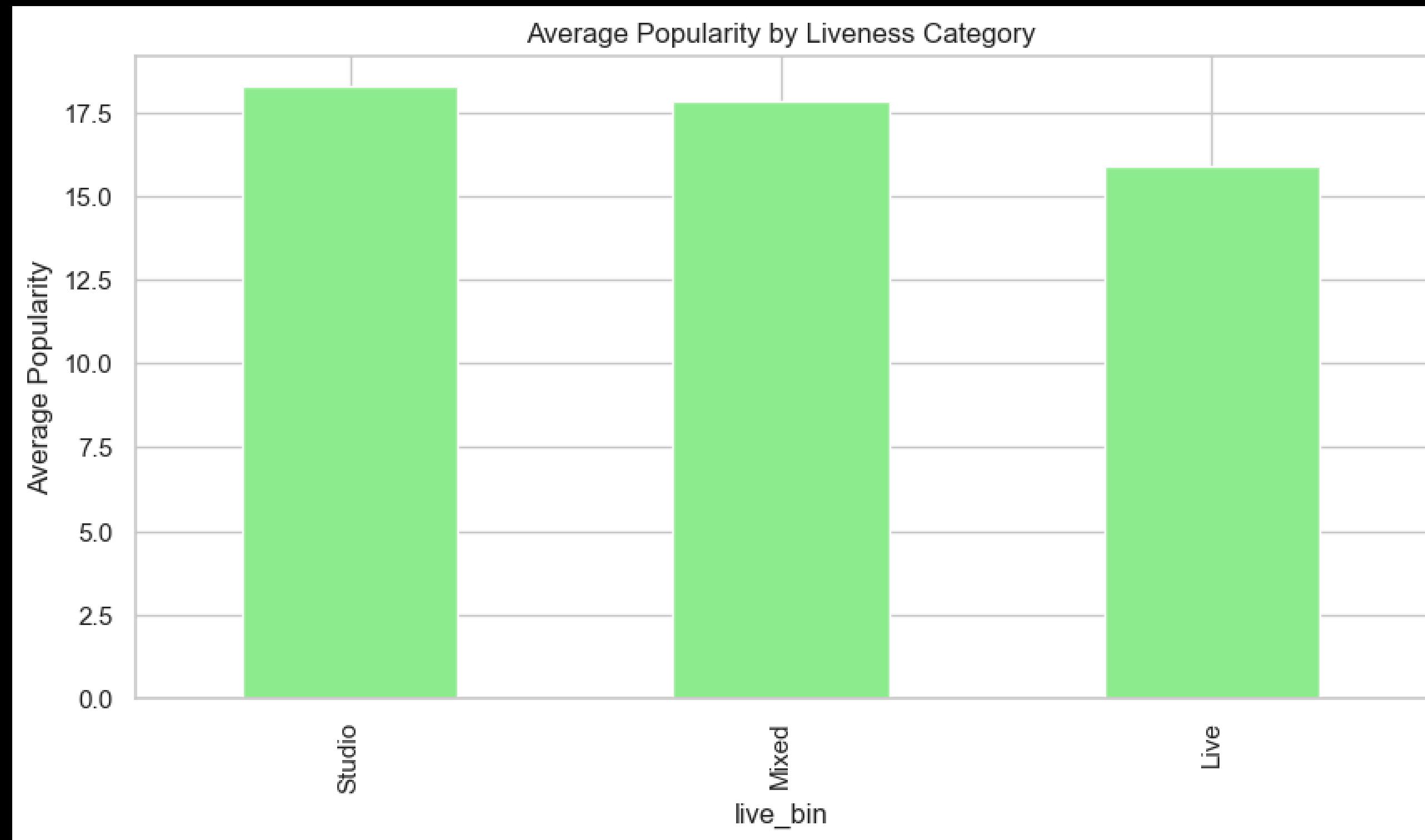


- Popularity decreases as instrumentalness increases.
- Listeners seem to prefer songs with vocals.

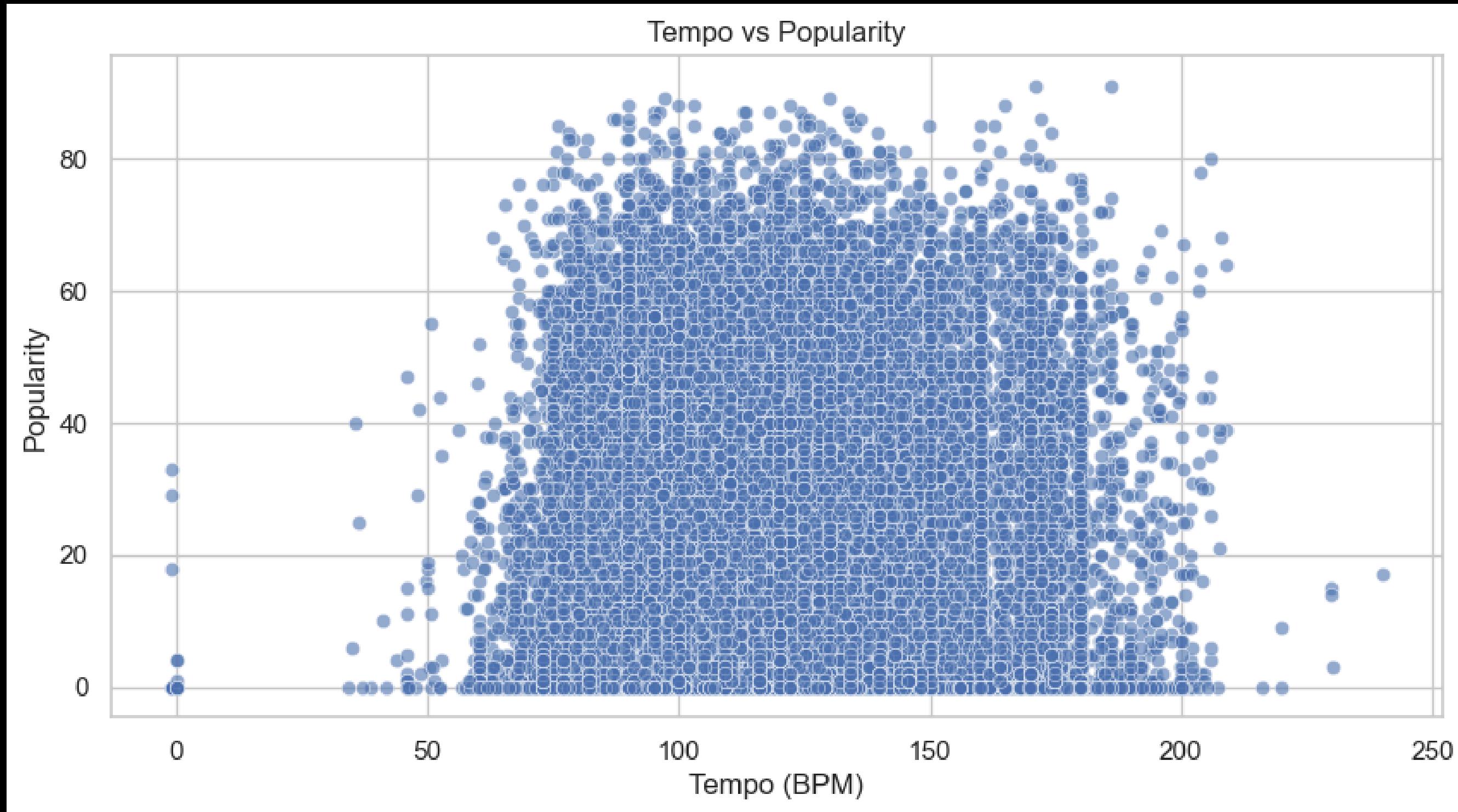
Average Popularity by Instrumentalness Category

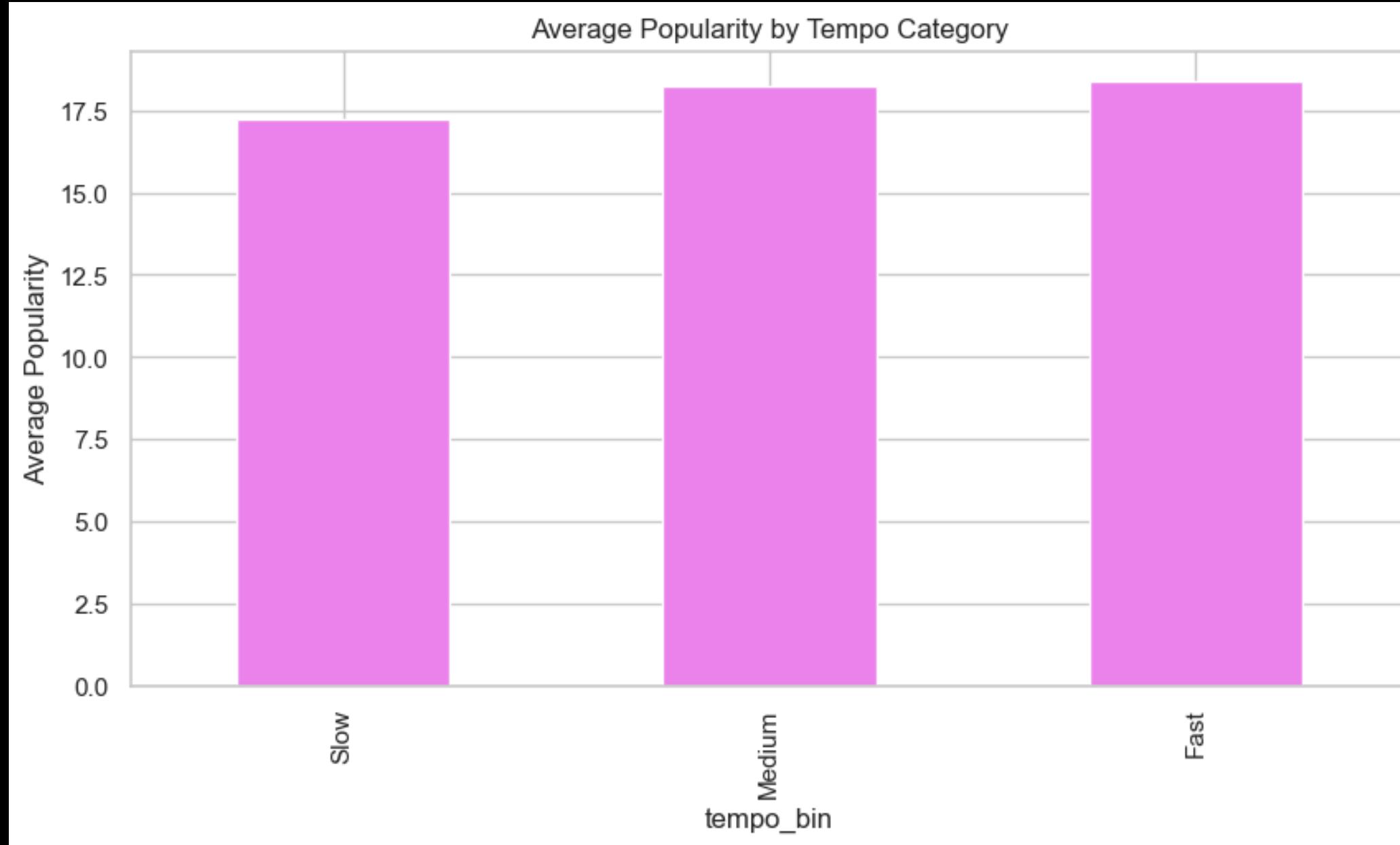




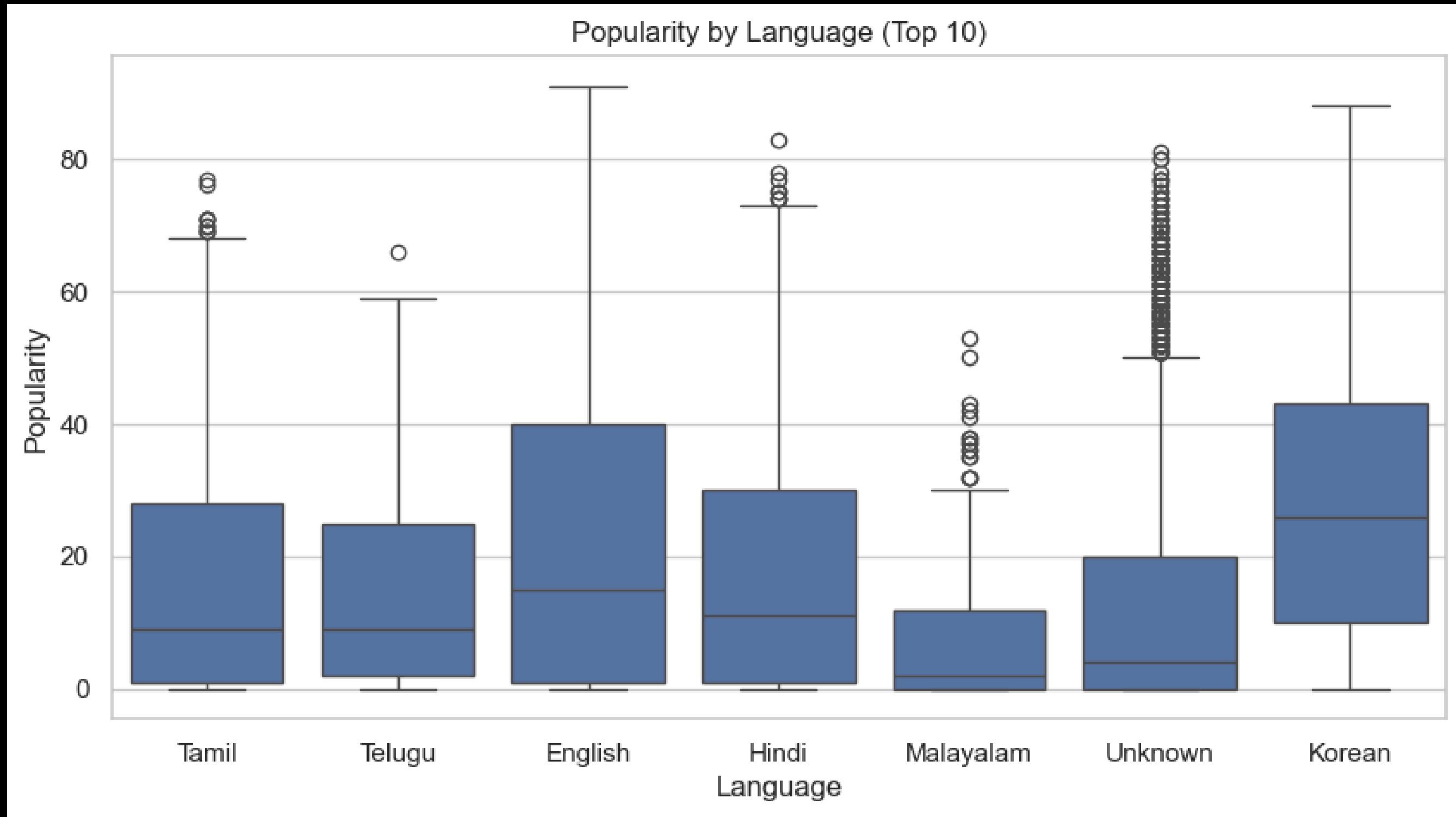


- Studio-produced songs (low liveness) are generally more popular.
- Live tracks attract niche audiences but not mainstream appeal.

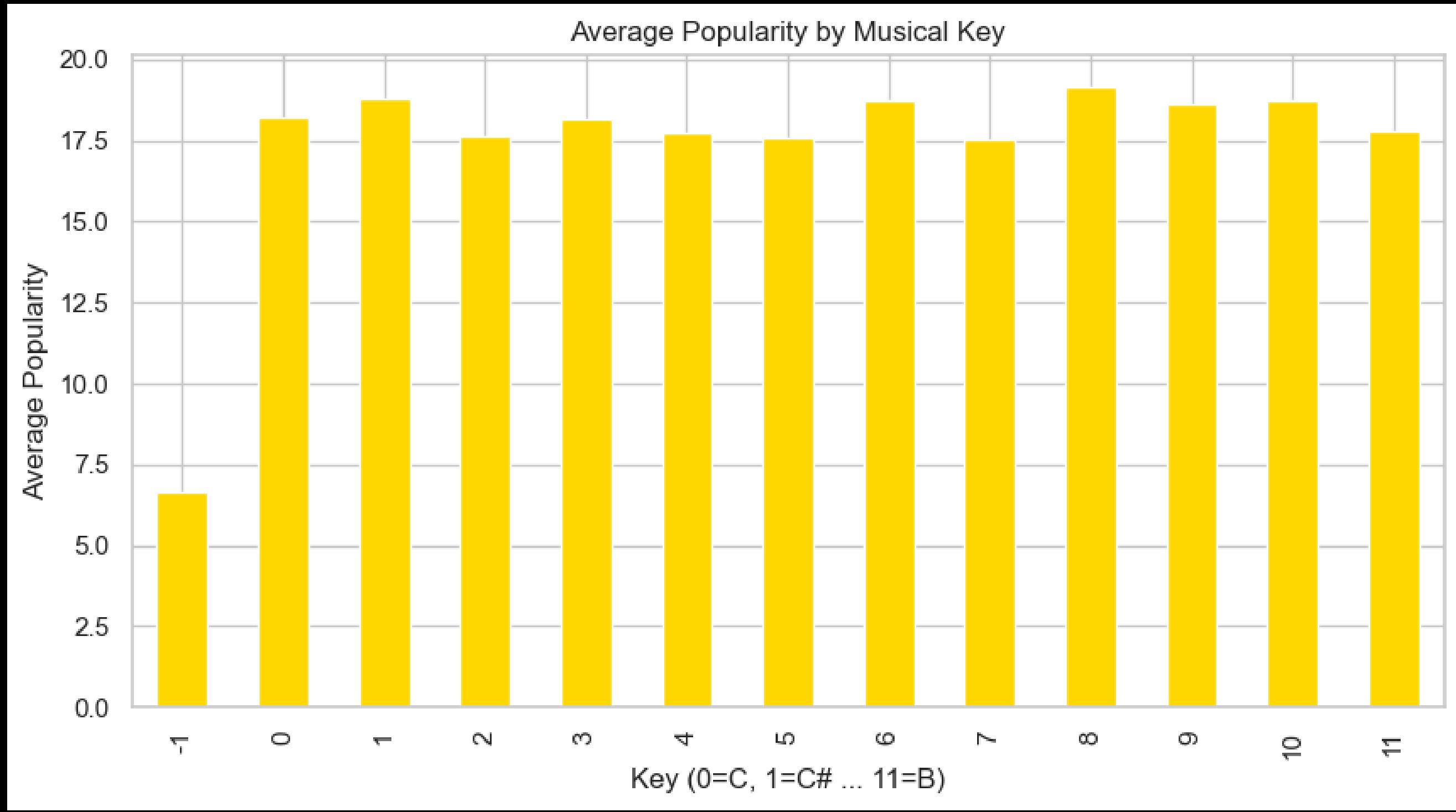




- Medium-tempo songs (90–120 BPM) achieve the highest average popularity.
- Extremely fast or slow songs tend to be less favored.

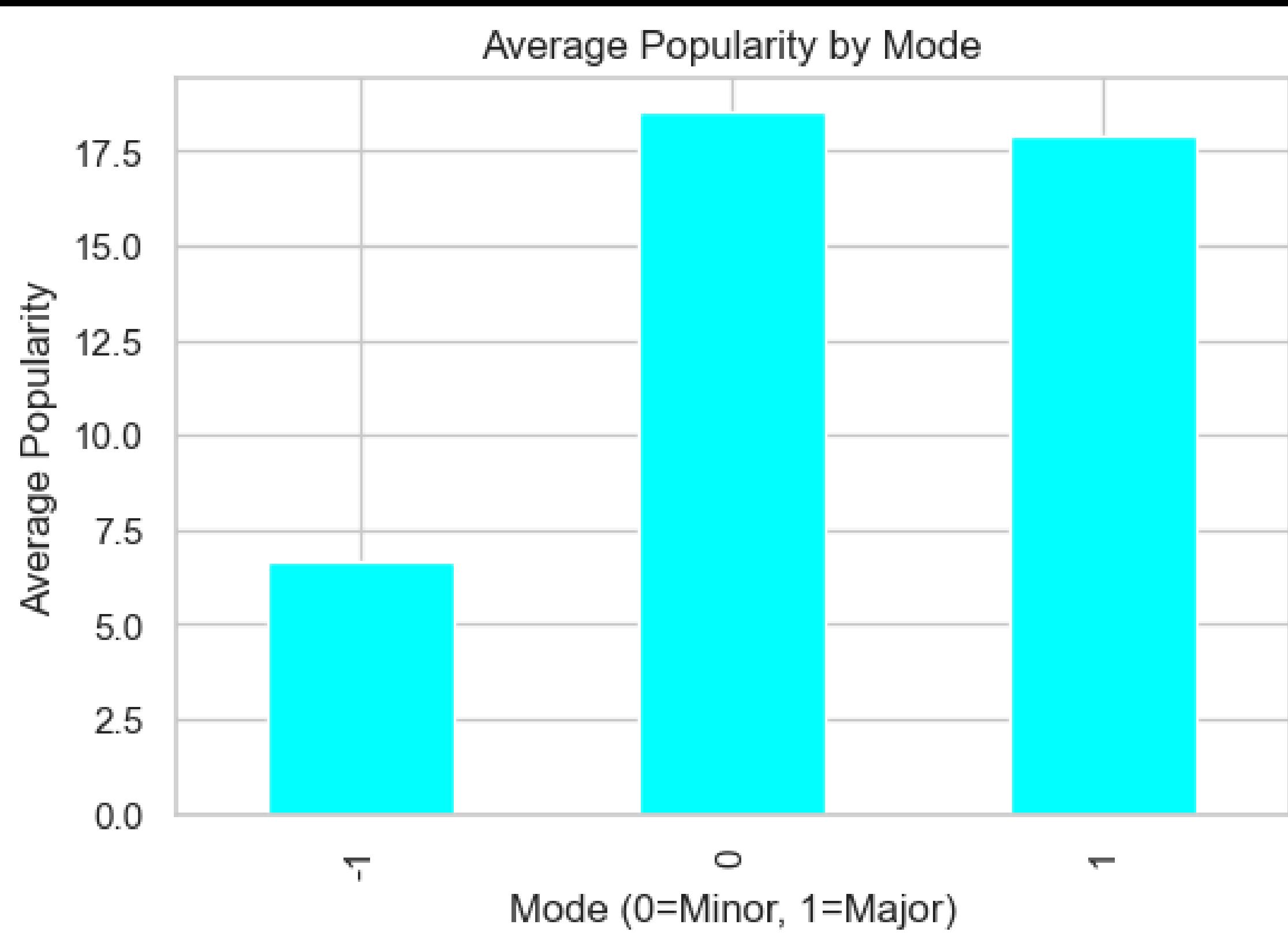


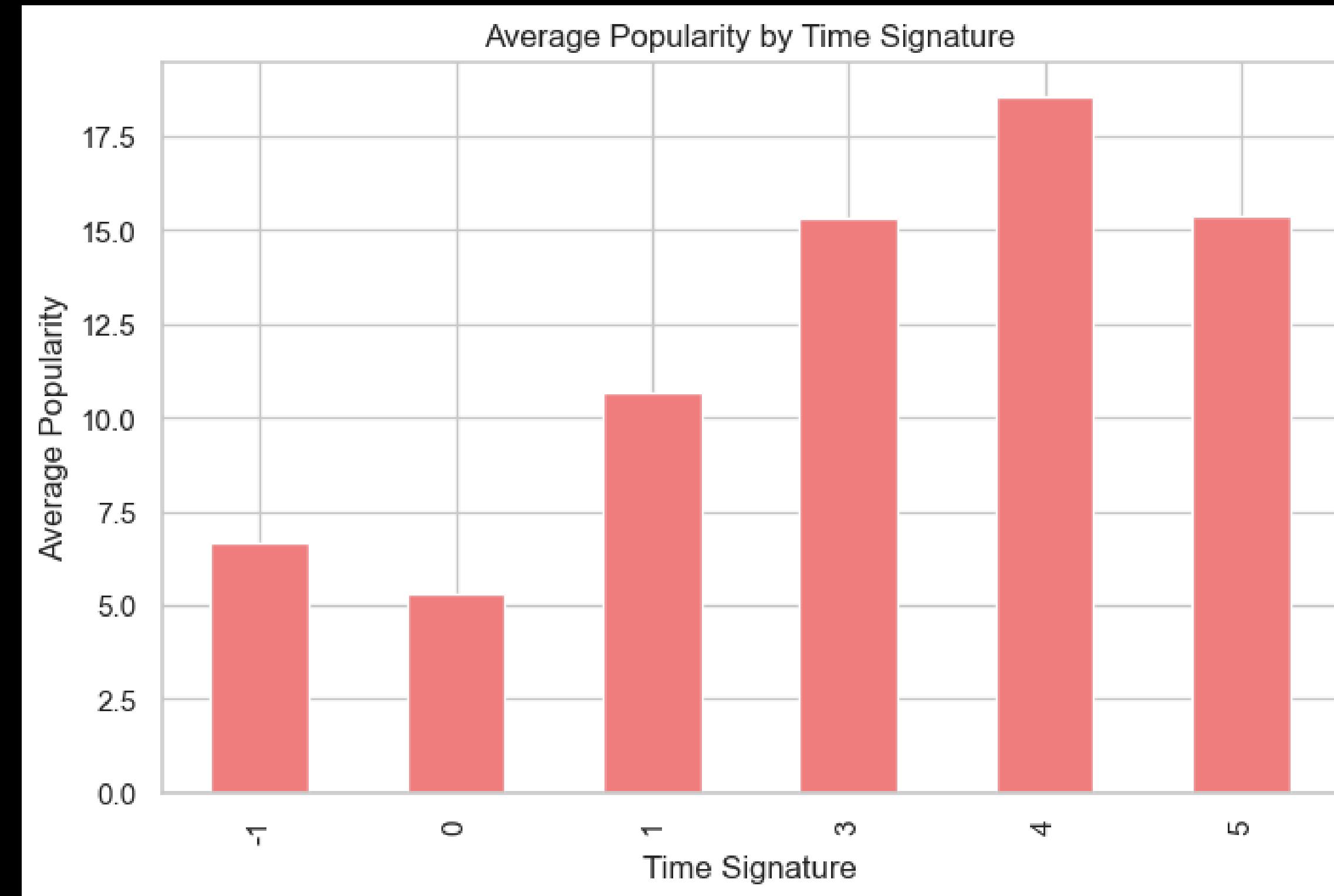
- English songs show higher median popularity than other languages.
- Non-English tracks still perform well but with wider variability.



- Major-key songs and standard 4/4 time signatures tend to be more popular.
- Certain keys (like C or G) appear slightly more often among hits.

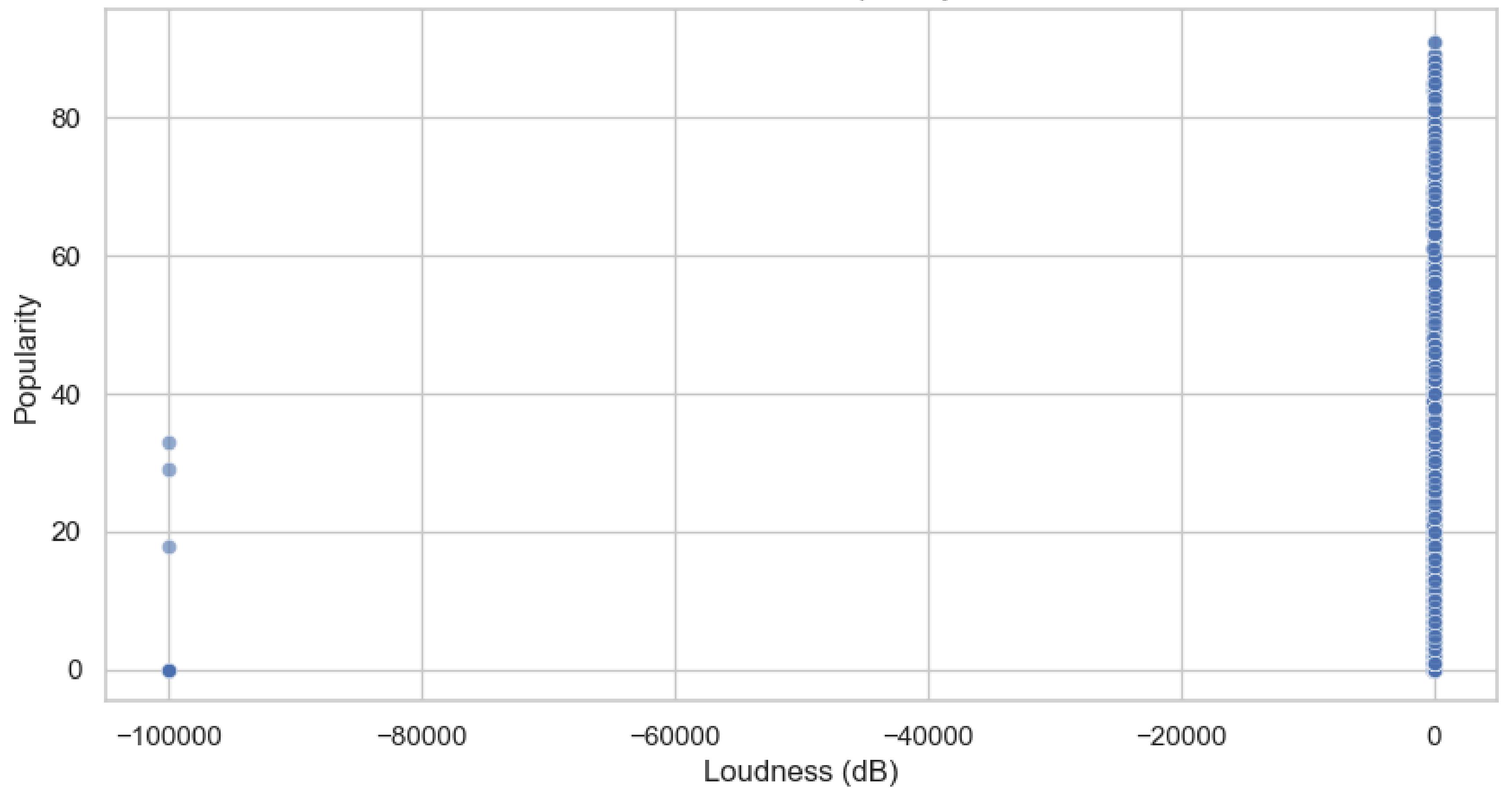
### Average Popularity by Mode

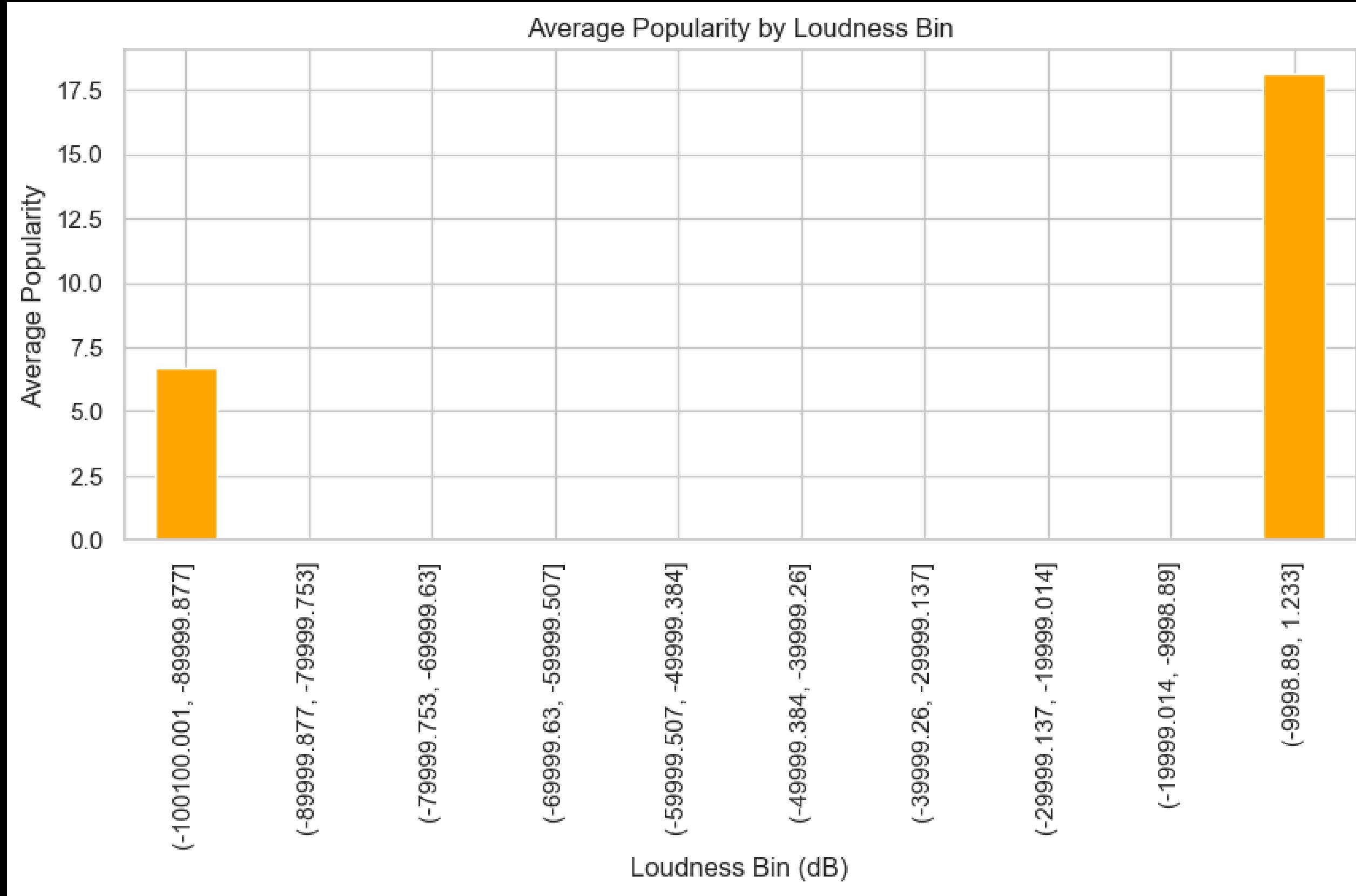




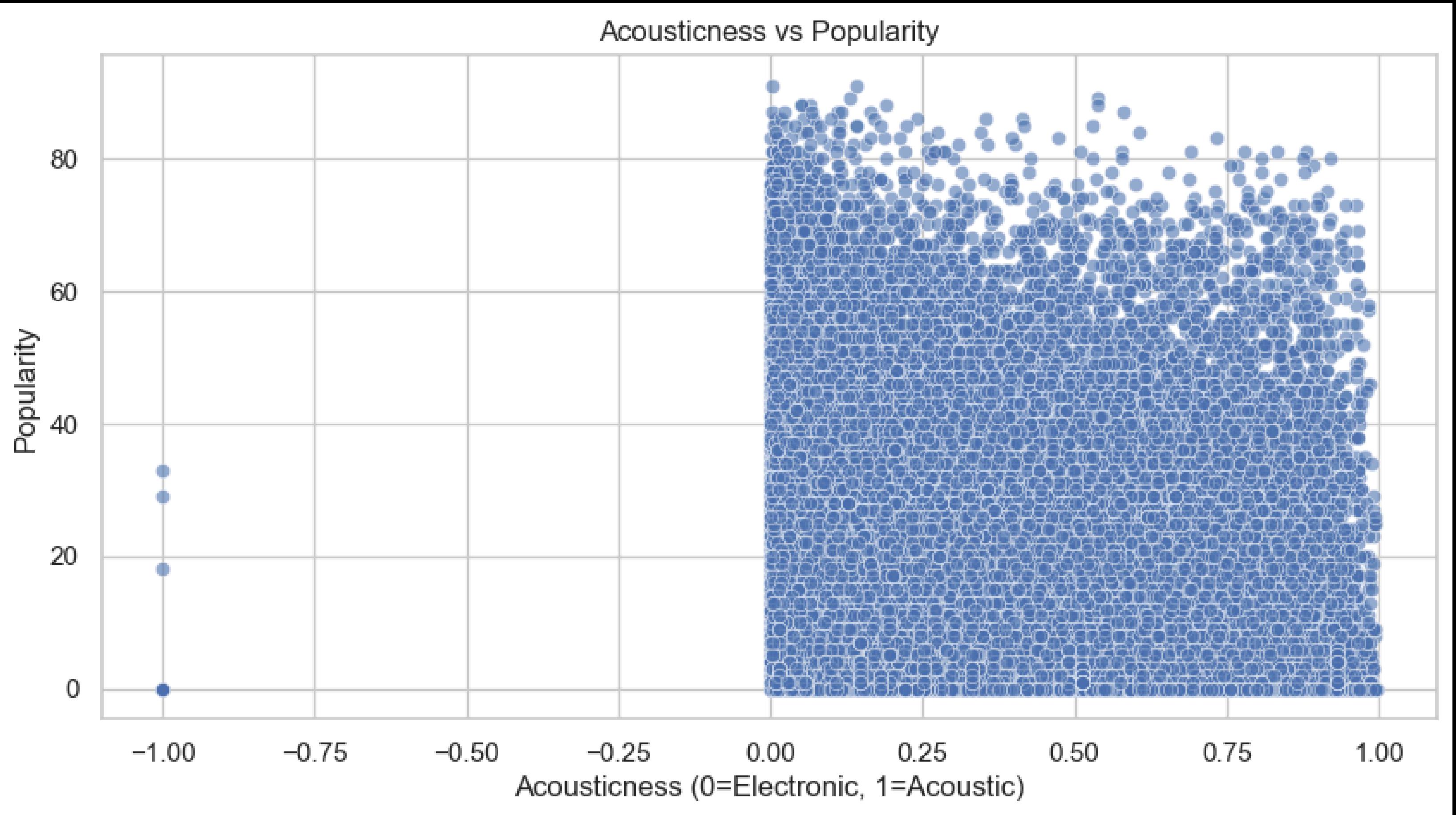
- Songs of 3–4 minutes are the sweet spot for popularity.
- Longer or very short tracks receive less attention.

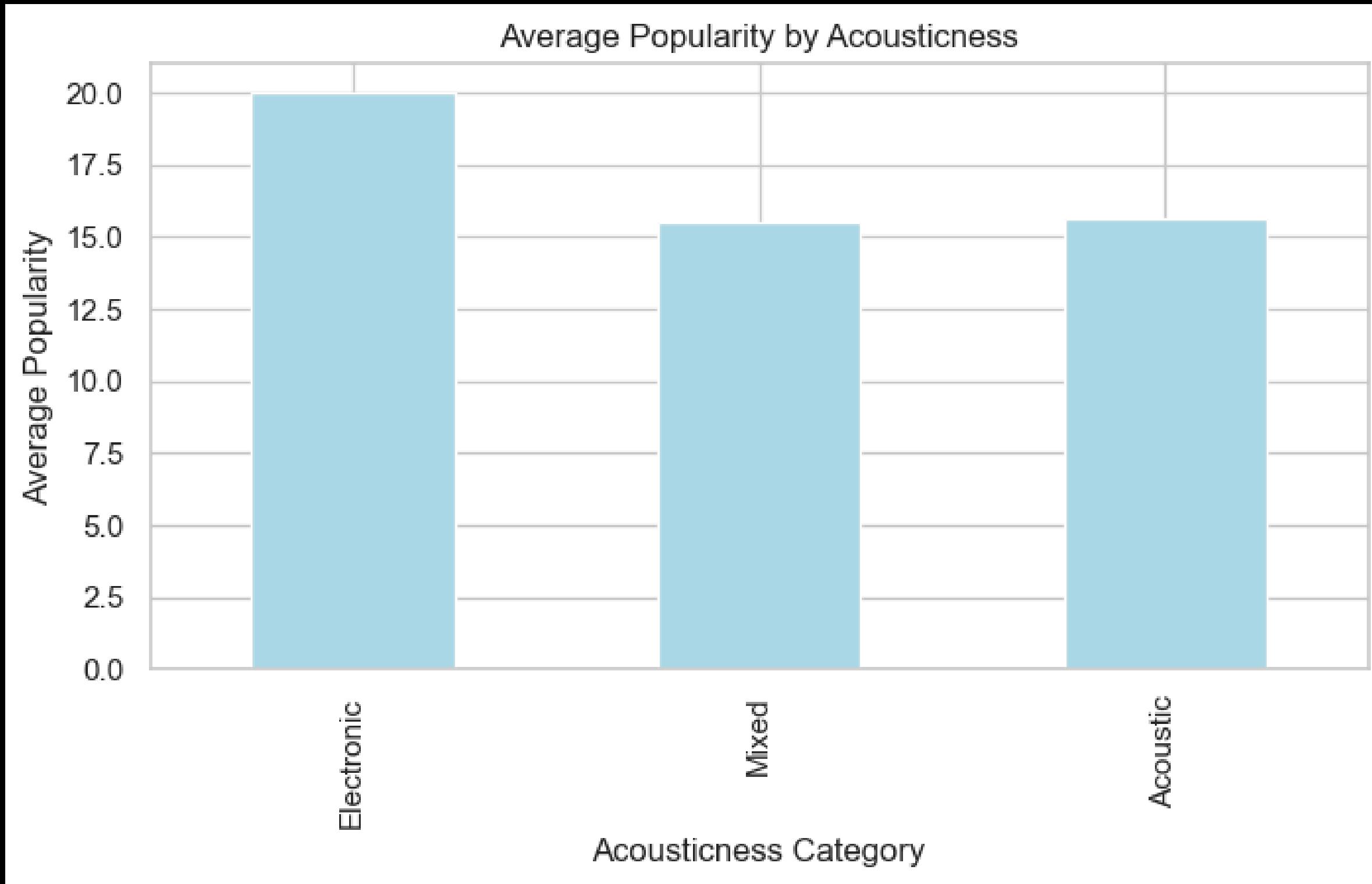
### Loudness vs Popularity



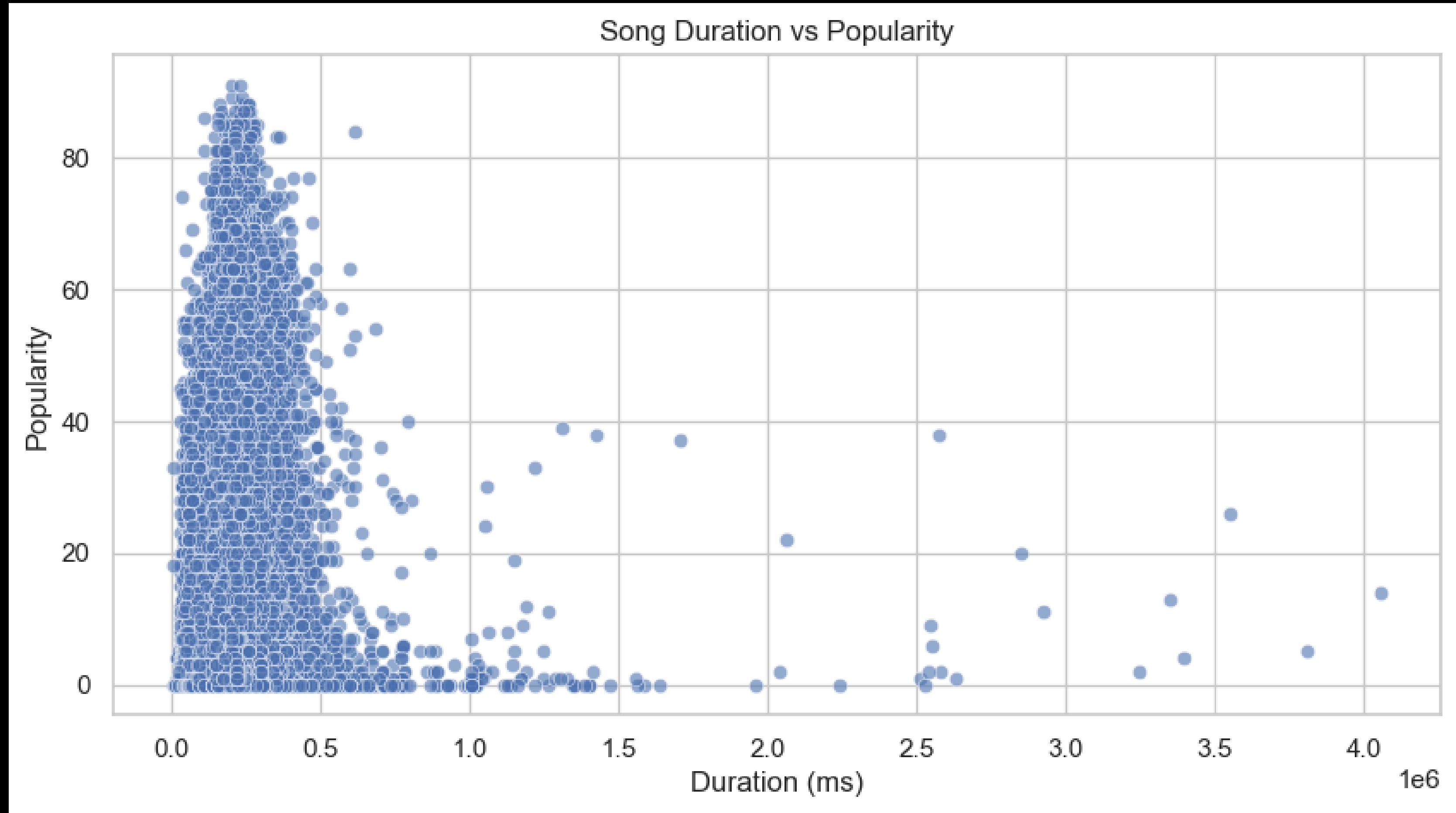


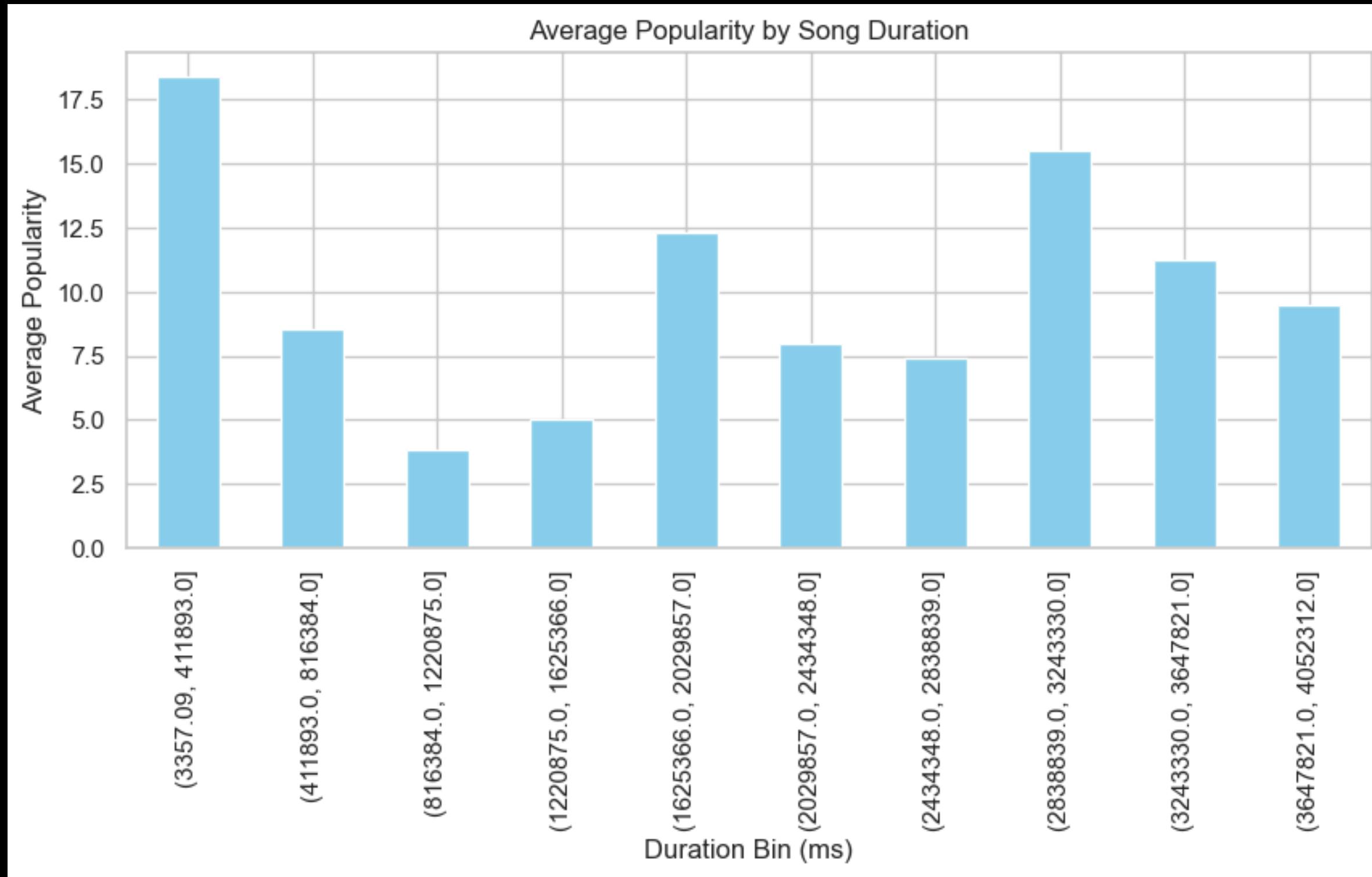
- Moderately loud songs (-6 to -4 dB) reach the highest average popularity.
- Very quiet or overly compressed tracks are less successful.



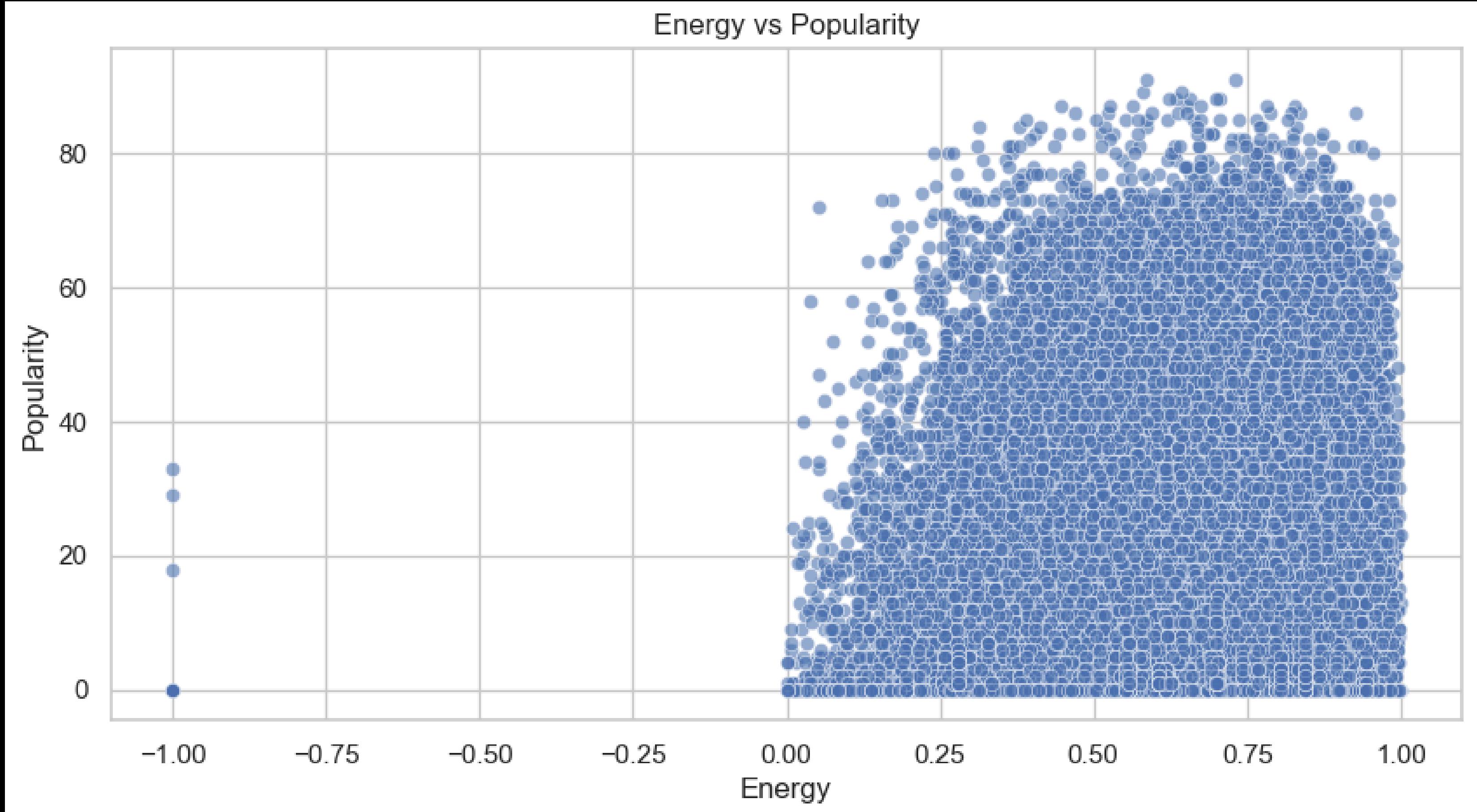


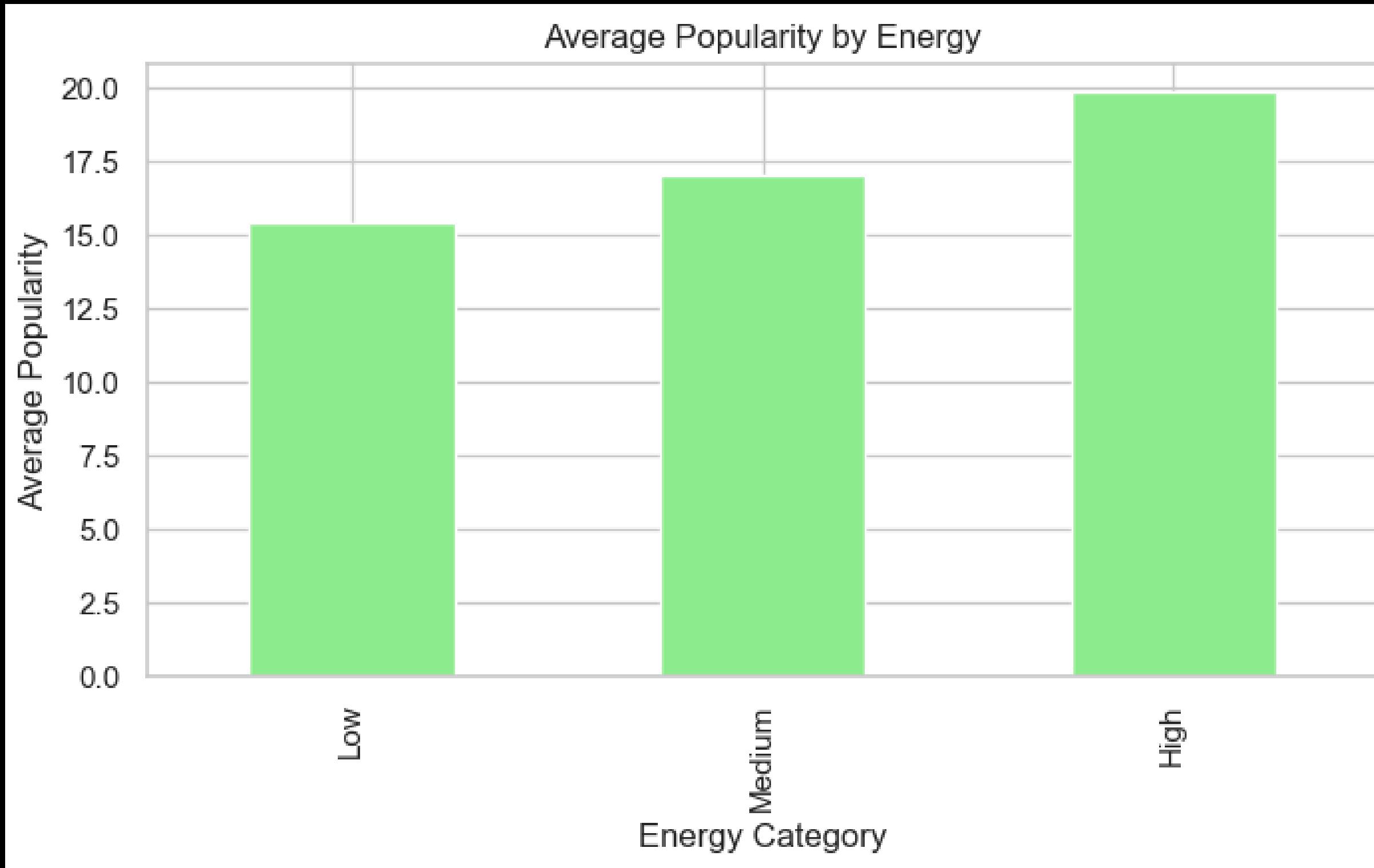
- Moderate acousticness correlates with higher popularity.
- Both highly electronic and fully acoustic extremes perform less well.



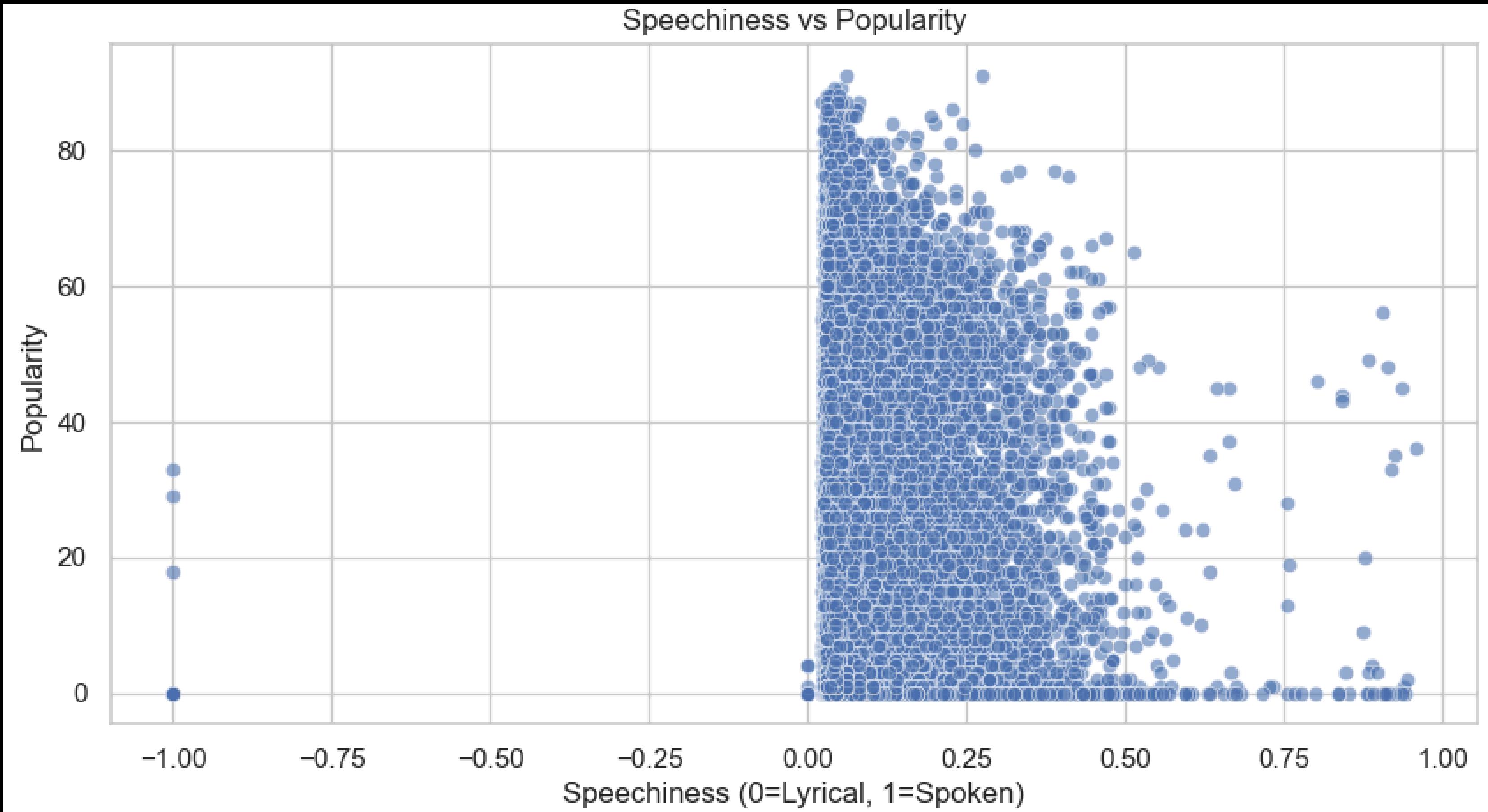


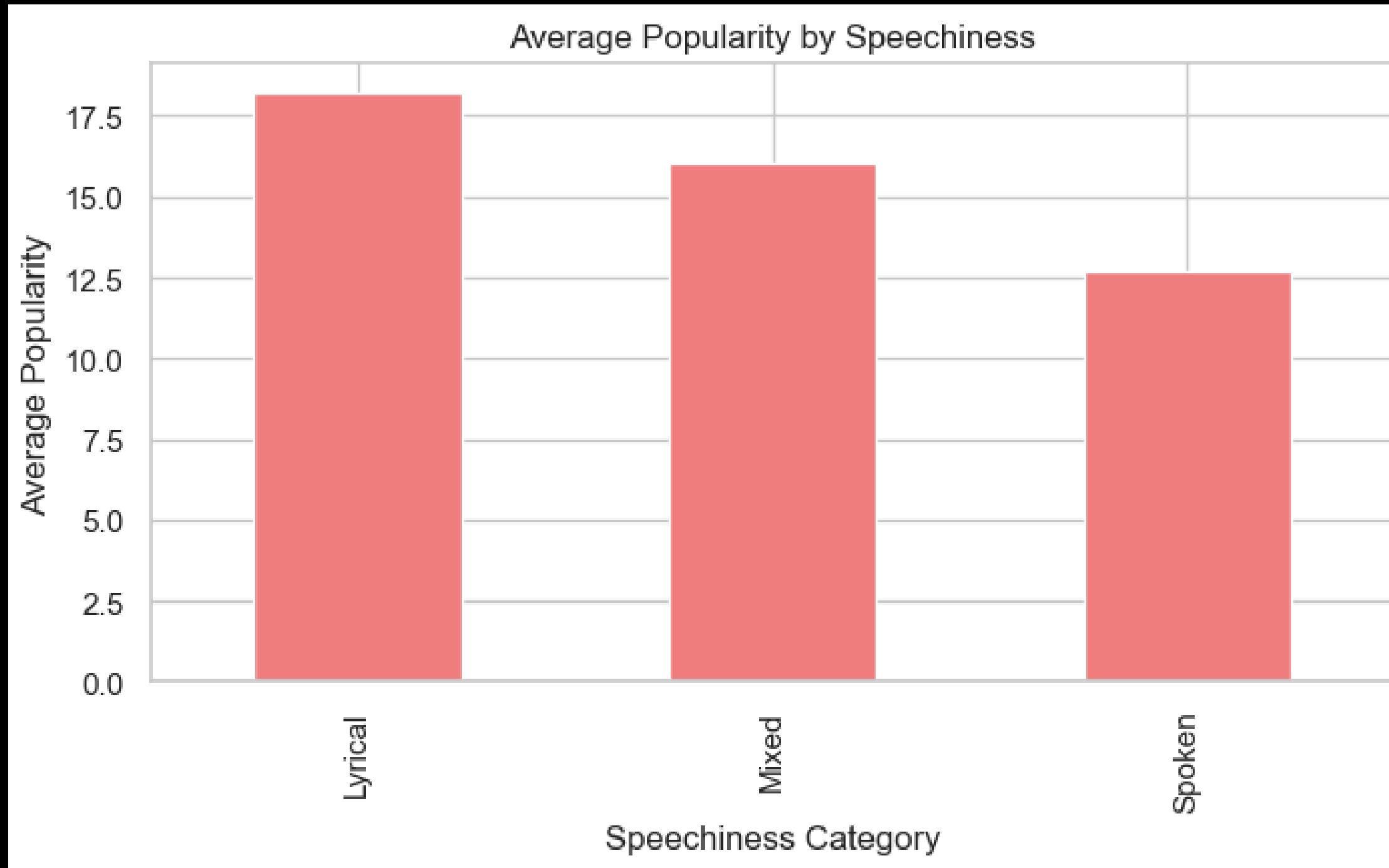
- Songs of 3–4 minutes are the sweet spot for popularity.
- Longer or very short tracks receive less attention.





- Medium-to-high energy songs are more popular than low-energy ones.
- Energetic tracks tend to engage listeners better.

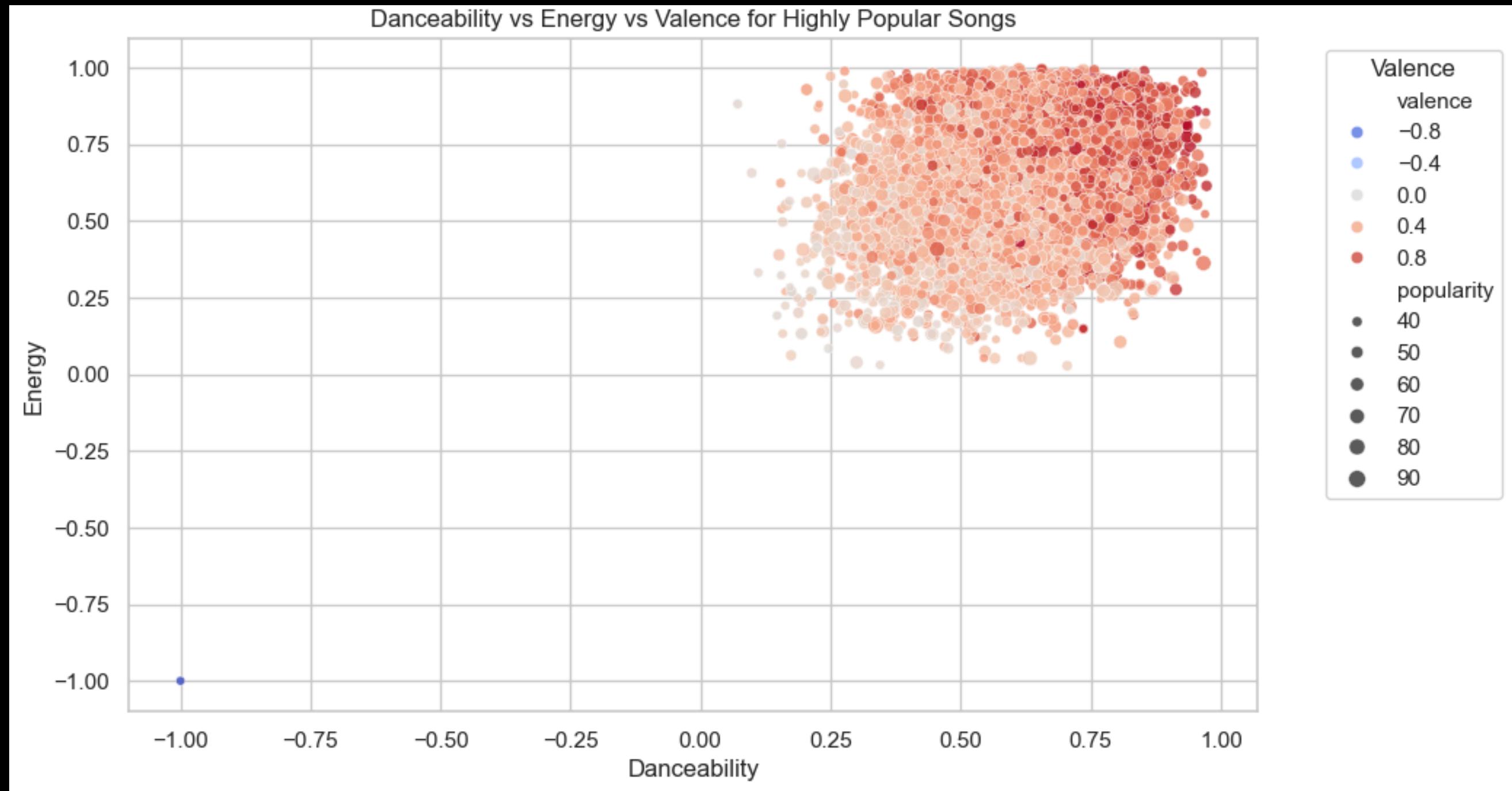




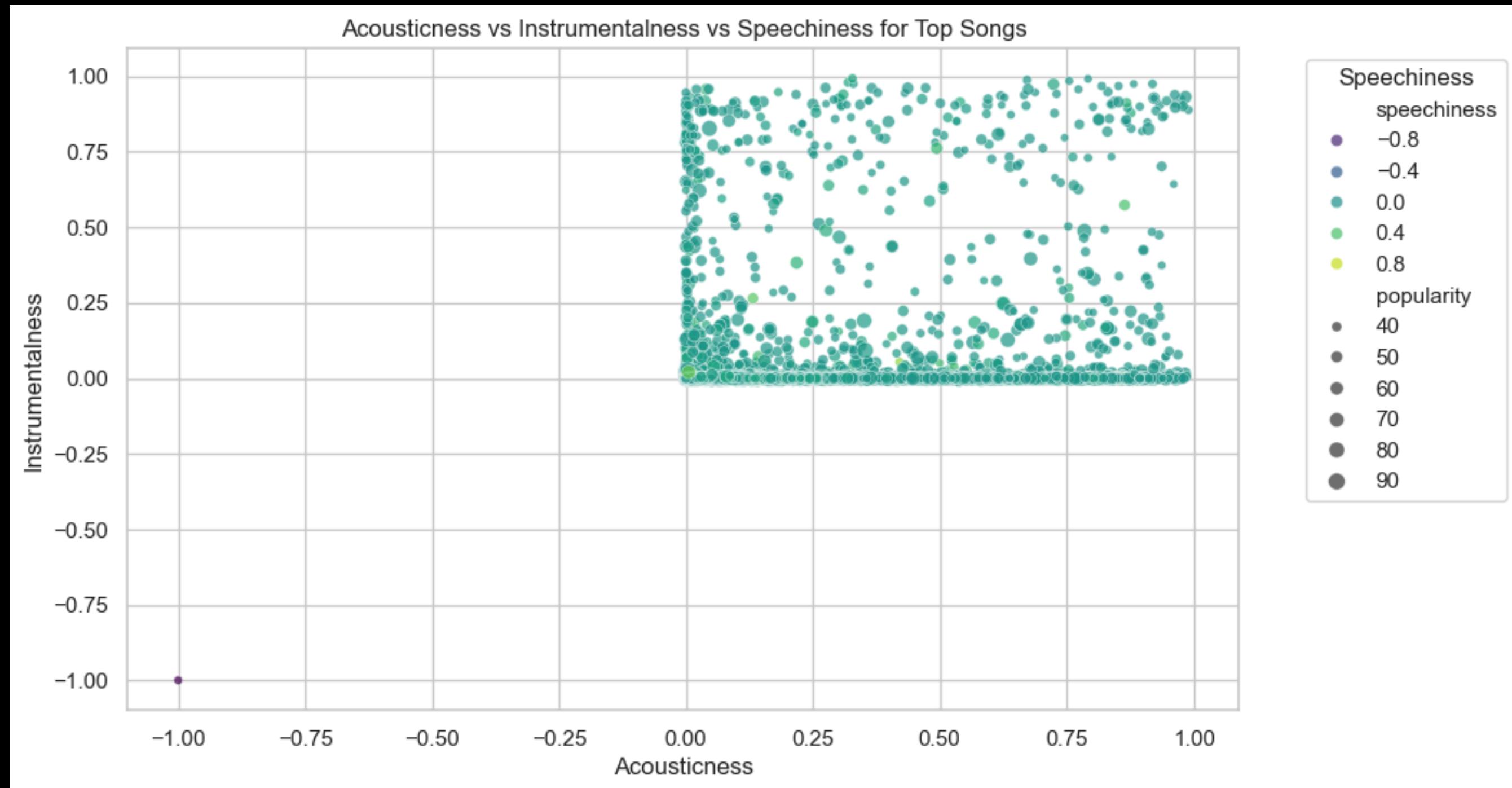
- Moderate speechiness (e.g., rap-pop blends) yields the highest popularity.
- Tracks that are entirely spoken or purely lyrical are less favored.

# MULTIVARIATE ANALYSIS

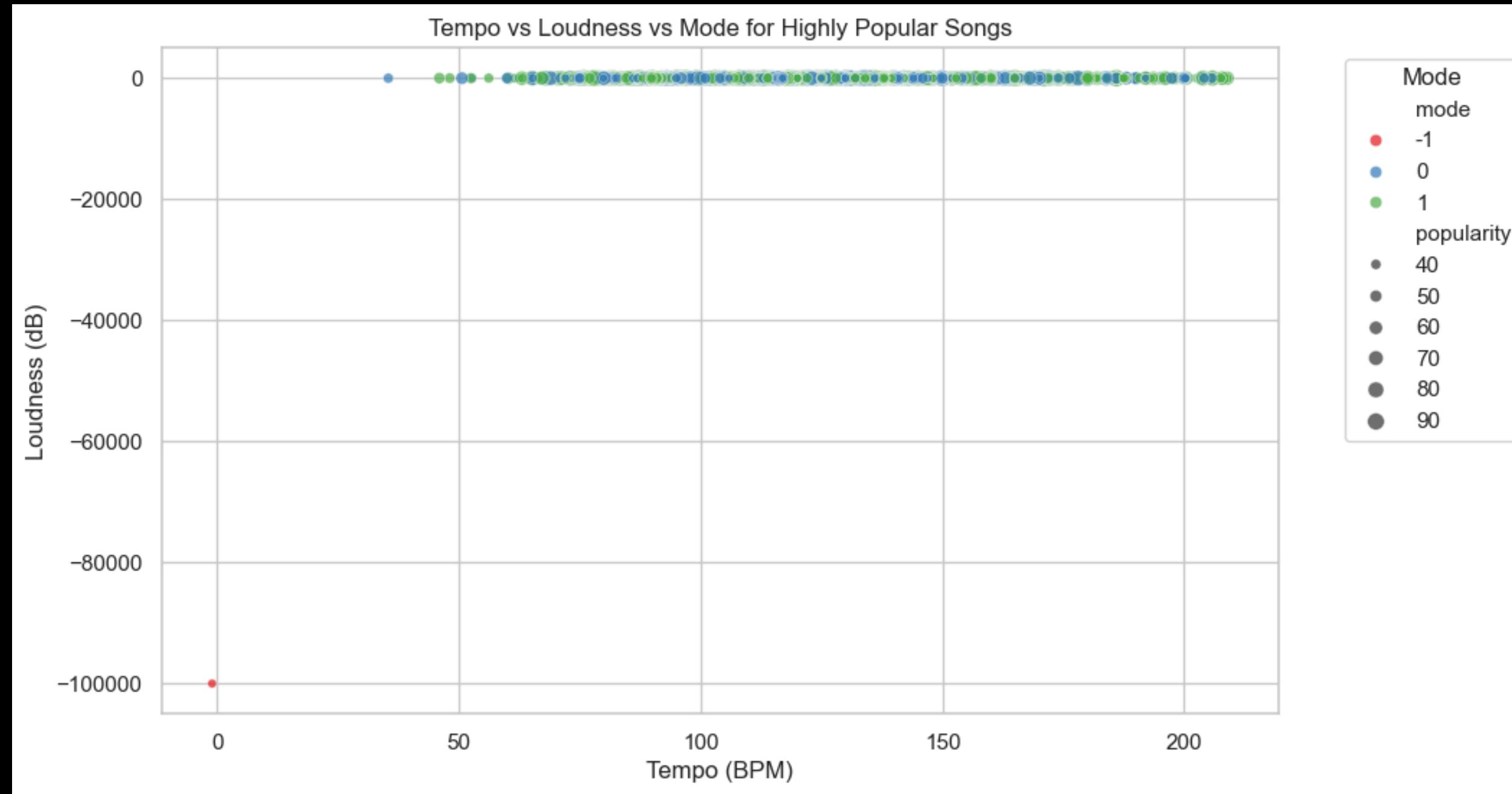




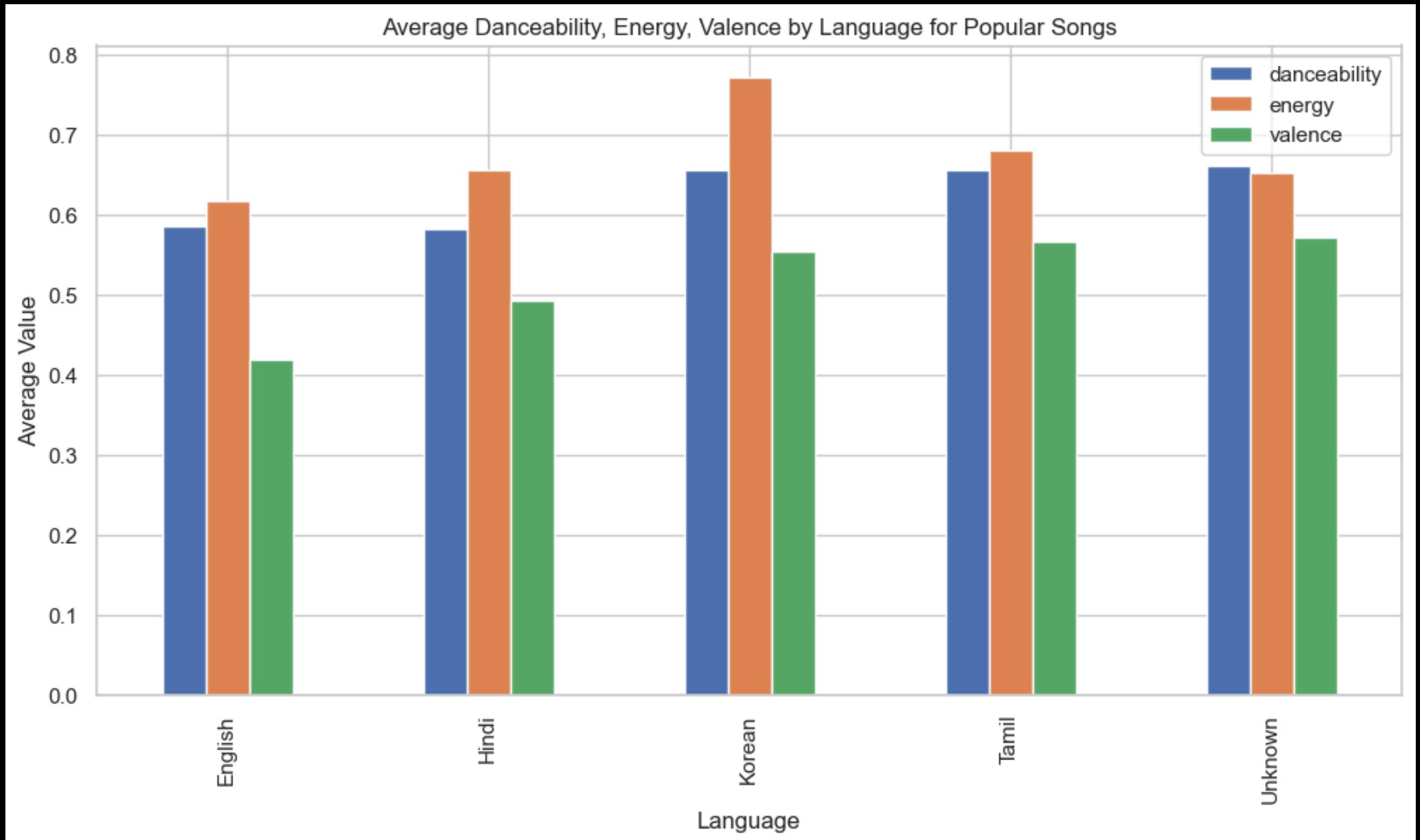
- Top songs are energetic, danceable, and moderately positive in mood.
- They cluster in the high-energy, high-valence quadrant.



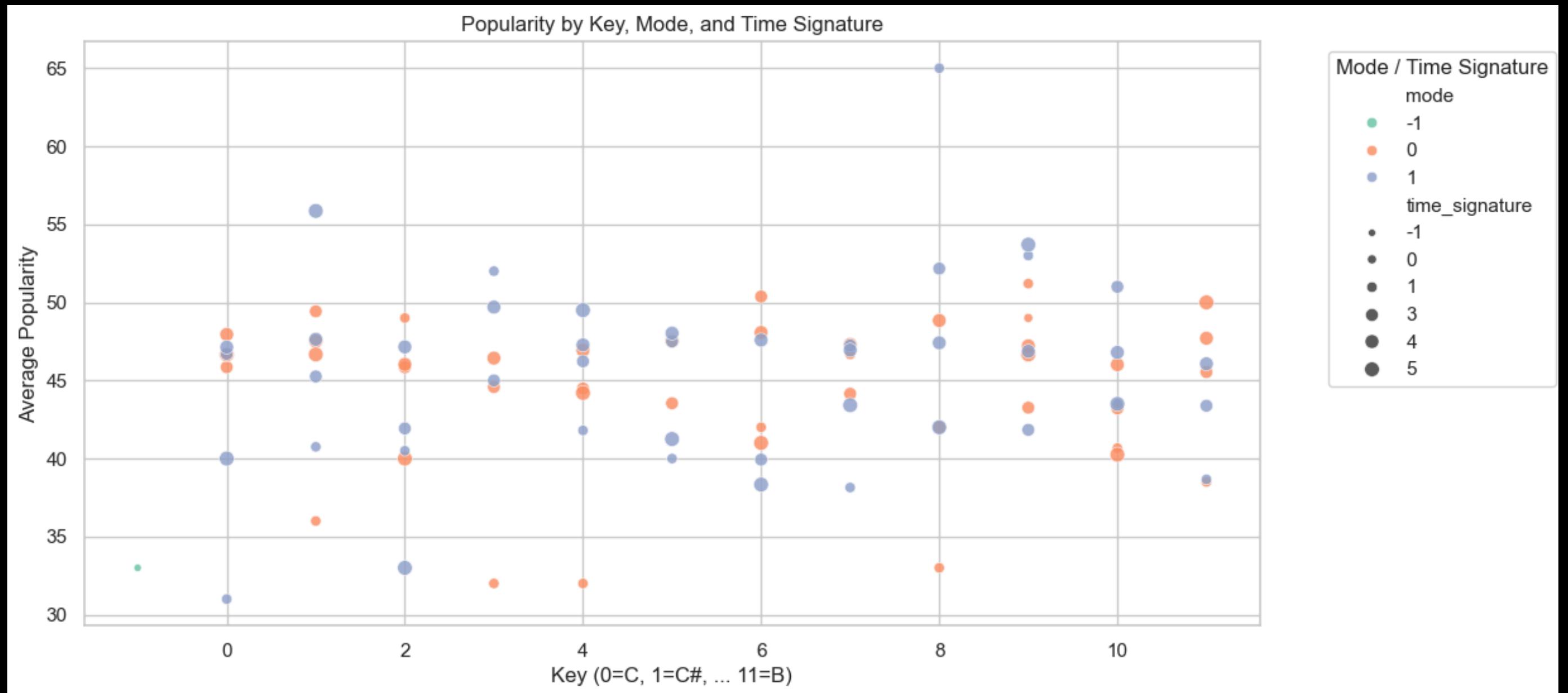
- Top songs balance acoustic and electronic elements with moderate speechiness.
- Highly instrumental or speech-heavy tracks are less frequent among hits.



- Popular tracks tend to be louder and in major mode with medium tempos.
- This combination produces bright, energetic soundscapes.



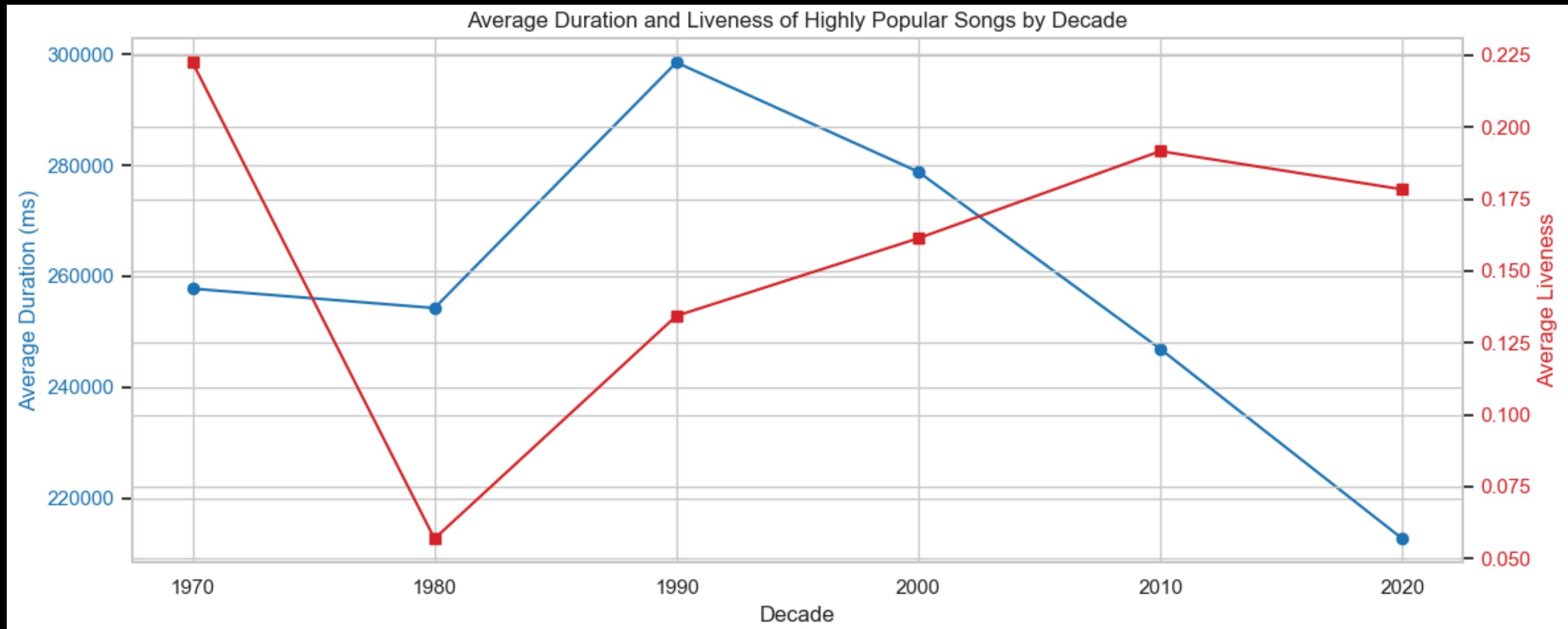
- English and korean tracks show higher danceability and energy.
- Cultural differences influence feature balance across languages.



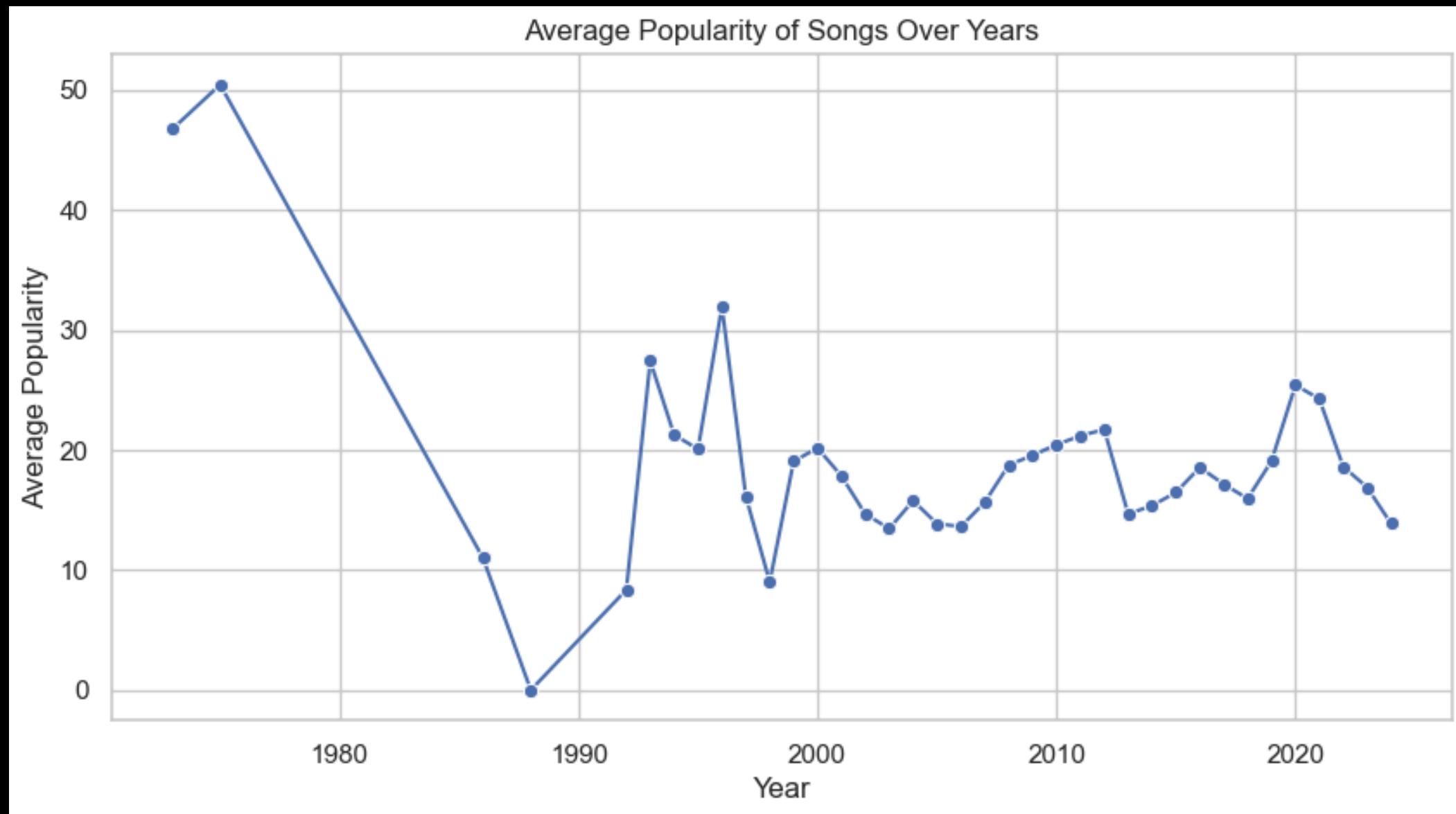
- Major-key songs with common time signatures dominate the popularity charts.
- There's minimal variation in key preference among top hits.

# TIME SERIES ANALYSIS

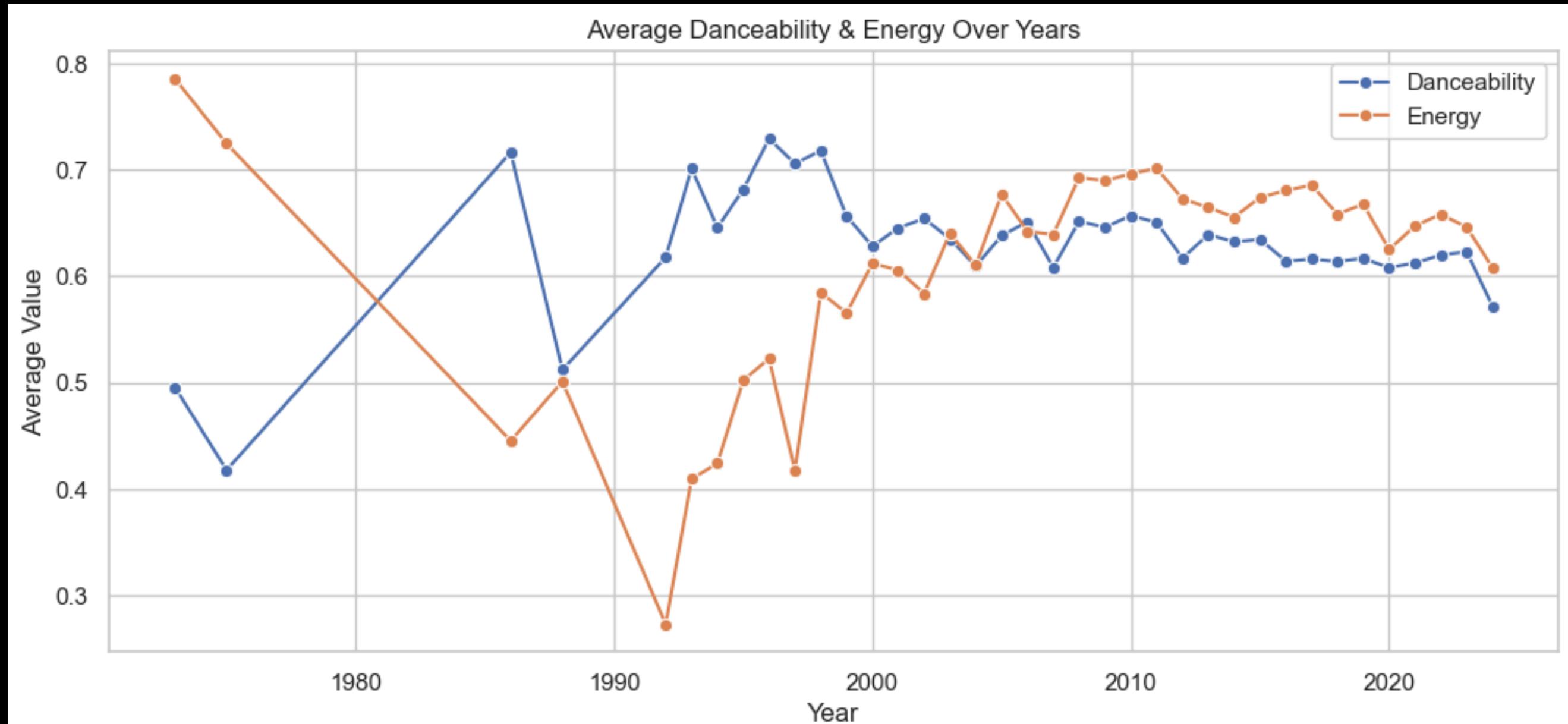




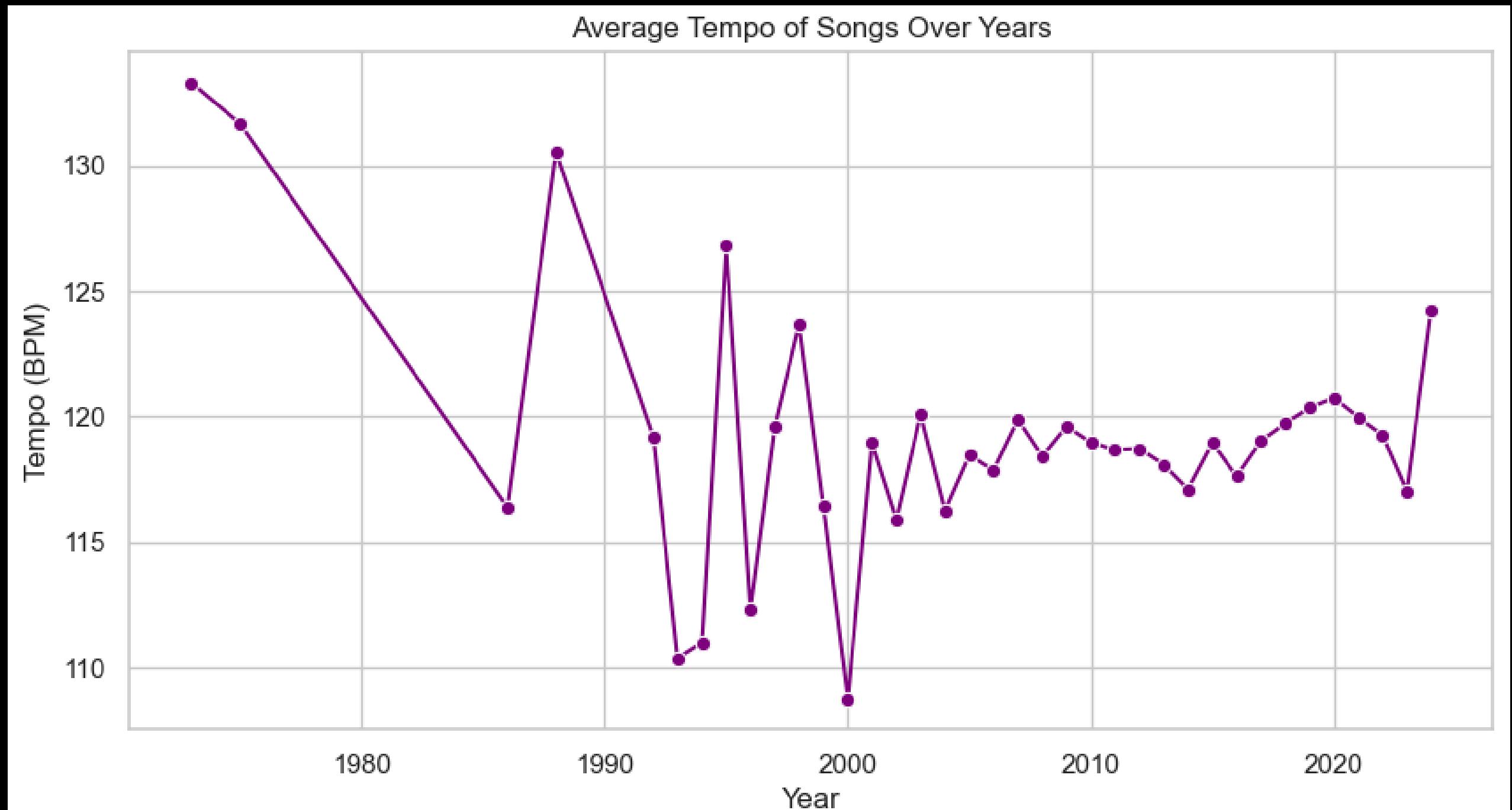
- Average song duration has slightly decreased in recent decades.
- Liveness has increased slightly, hinting at more live or natural-sounding production.



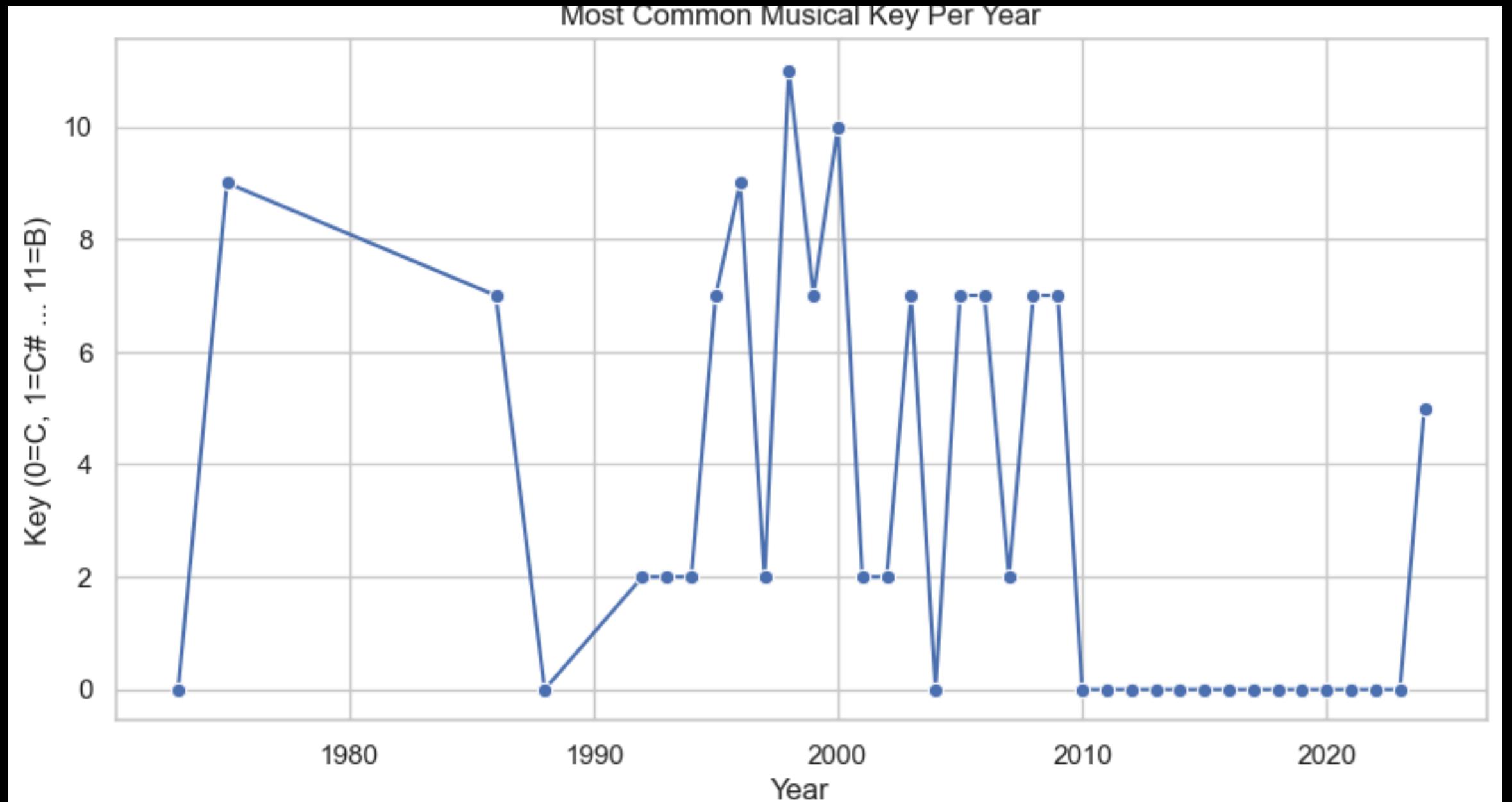
- Average song popularity fluctuates but shows an upward trend recently.
- Newer tracks gain faster traction due to streaming algorithms.



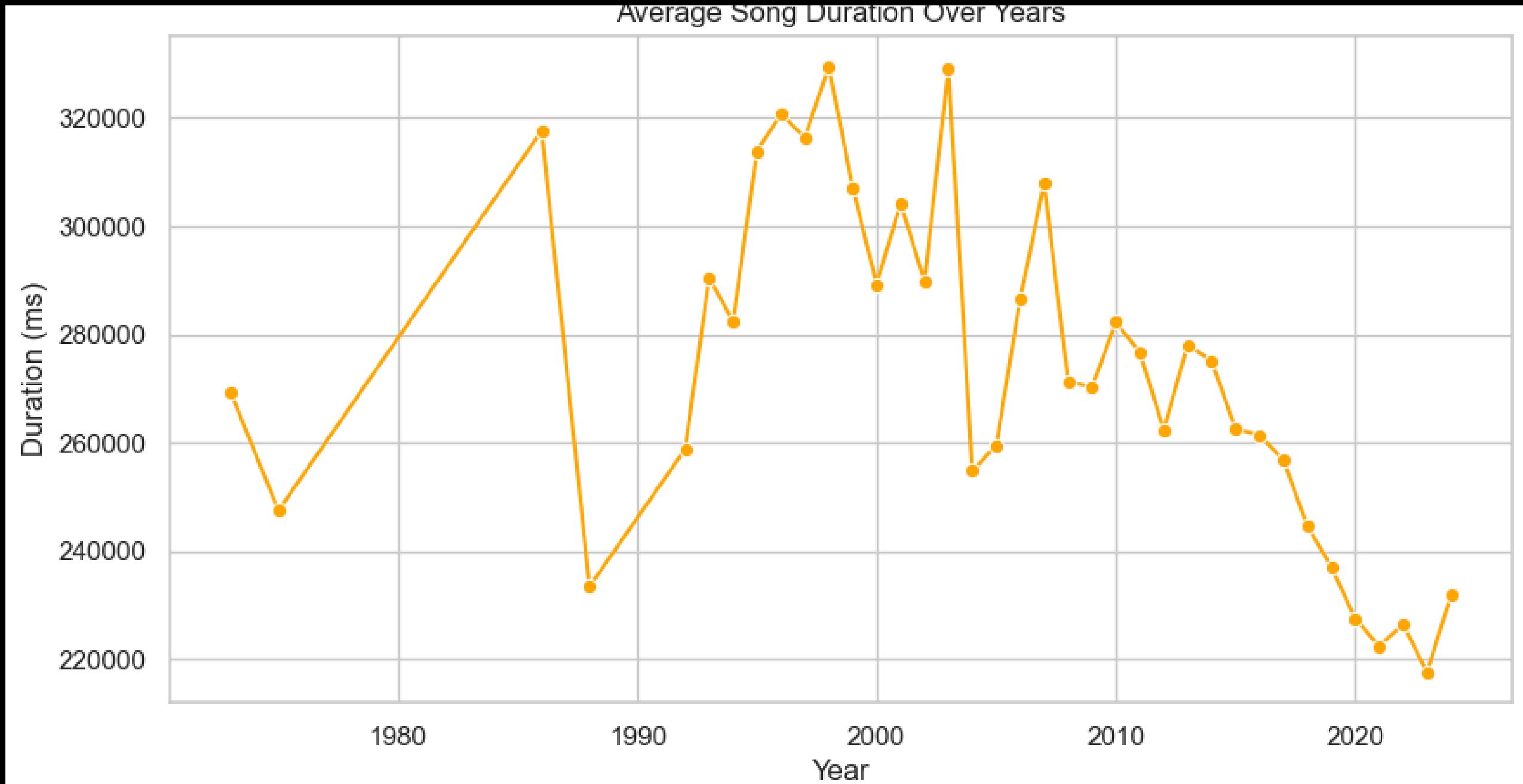
- Both danceability and energy have increased over time.
- Modern music emphasizes rhythm and production intensity.



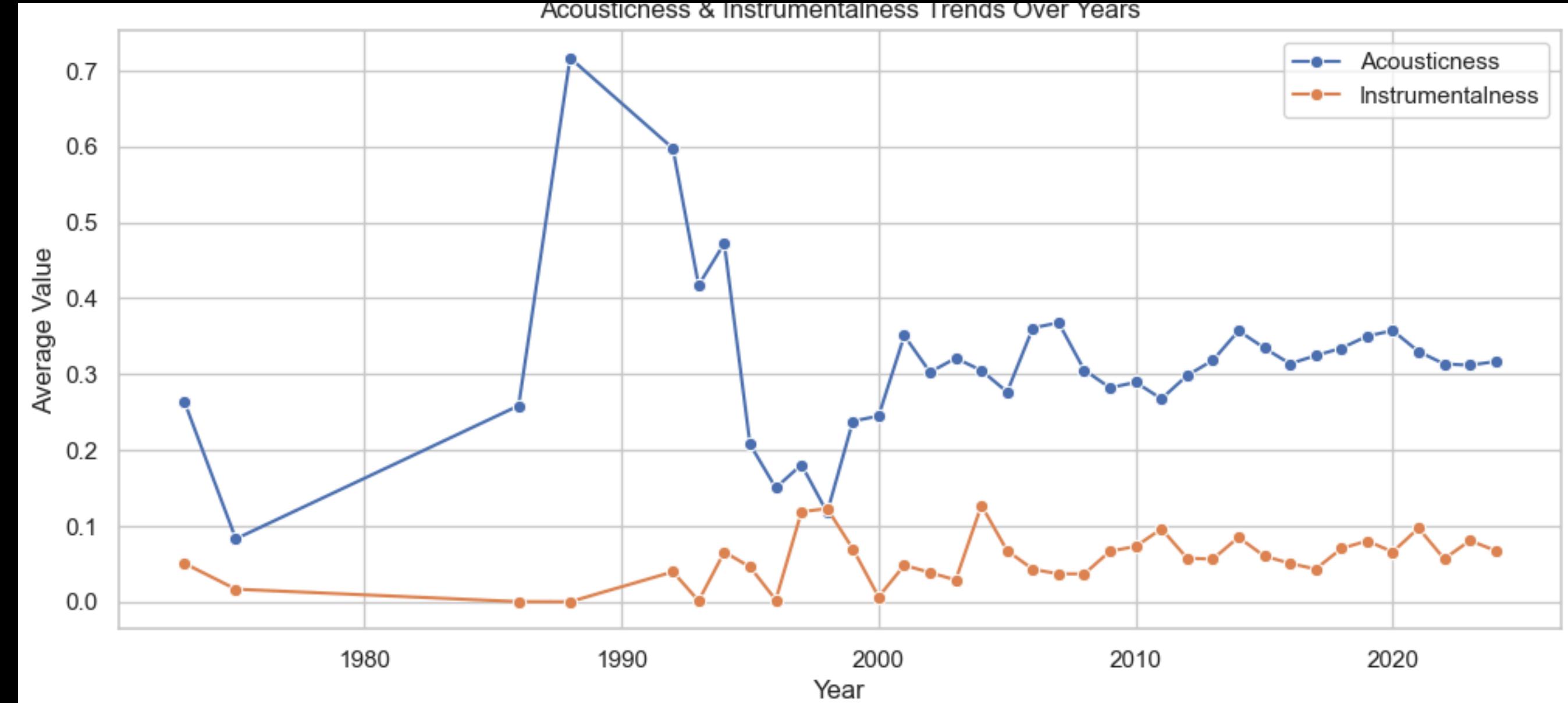
- Average tempo has remained relatively stable.
- Minor variations reflect changing genre trends but no clear long-term shift.



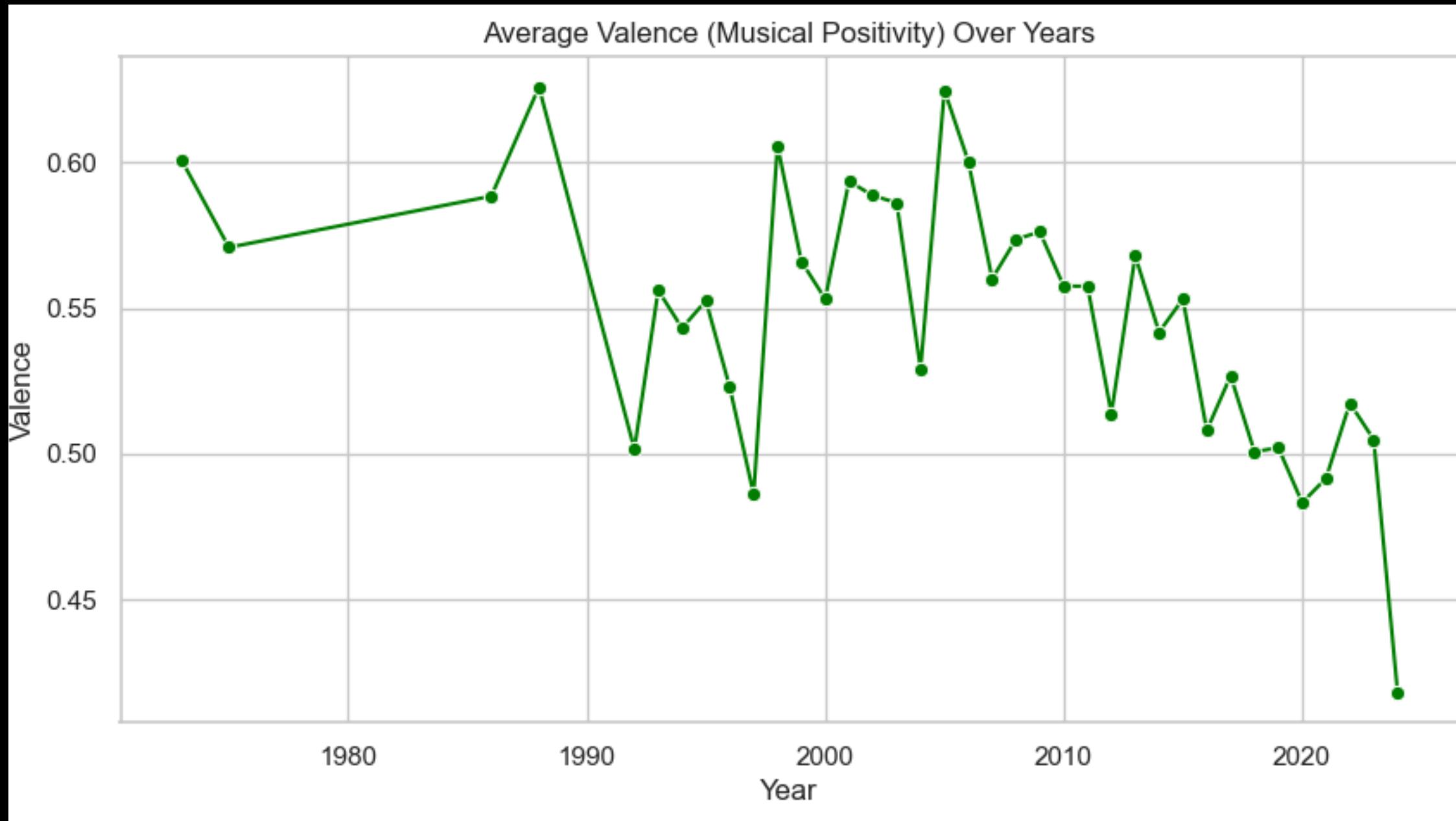
- Popular keys change periodically, with no single dominant key long-term.
- Trends may reflect genre shifts and evolving musical preferences.



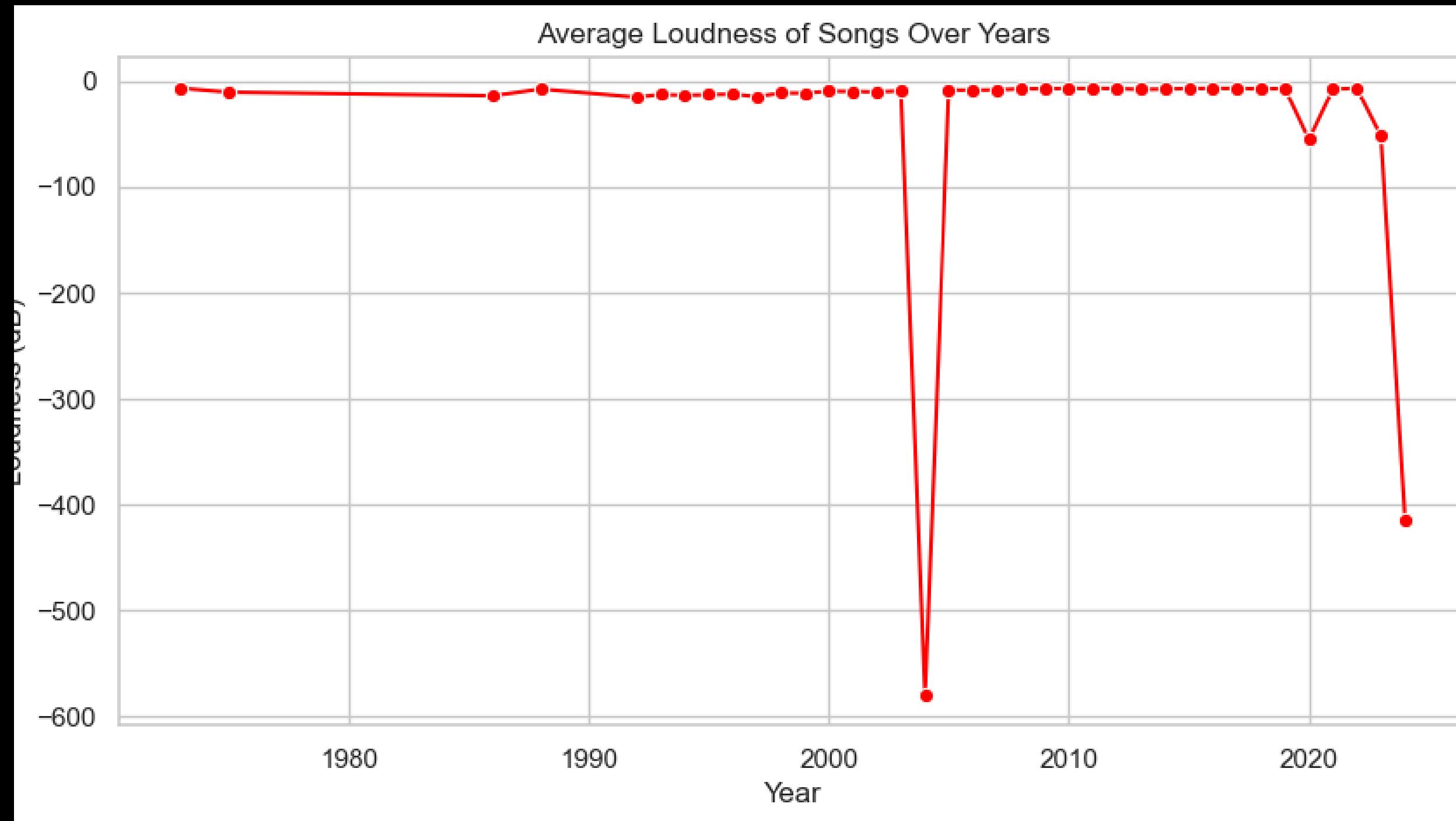
- Songs have become slightly shorter on average.
- Streaming culture may favor concise, replayable tracks.



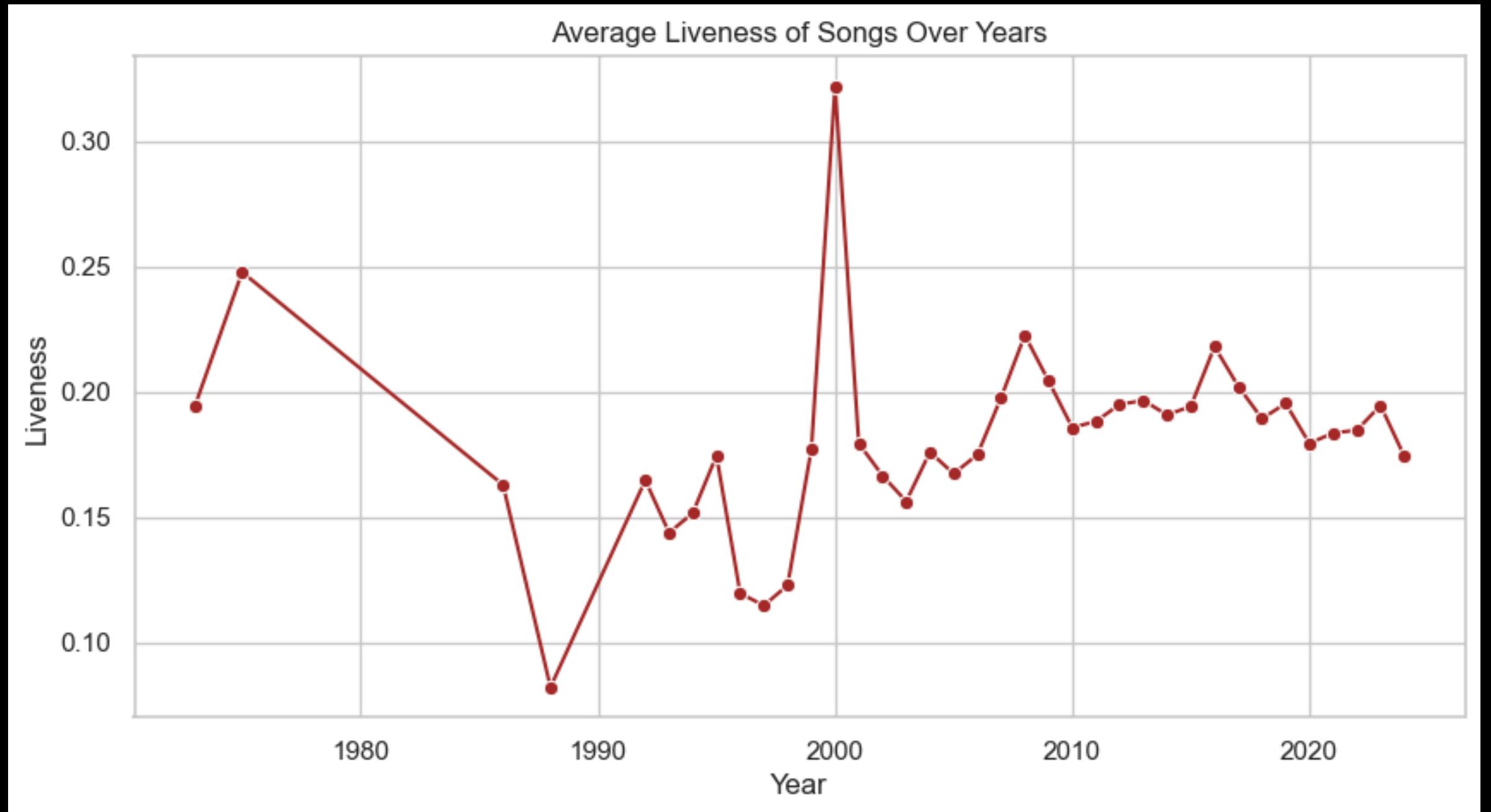
- Acousticness has declined while instrumentalness remains low.
- Production trends favor electronically enhanced sounds.



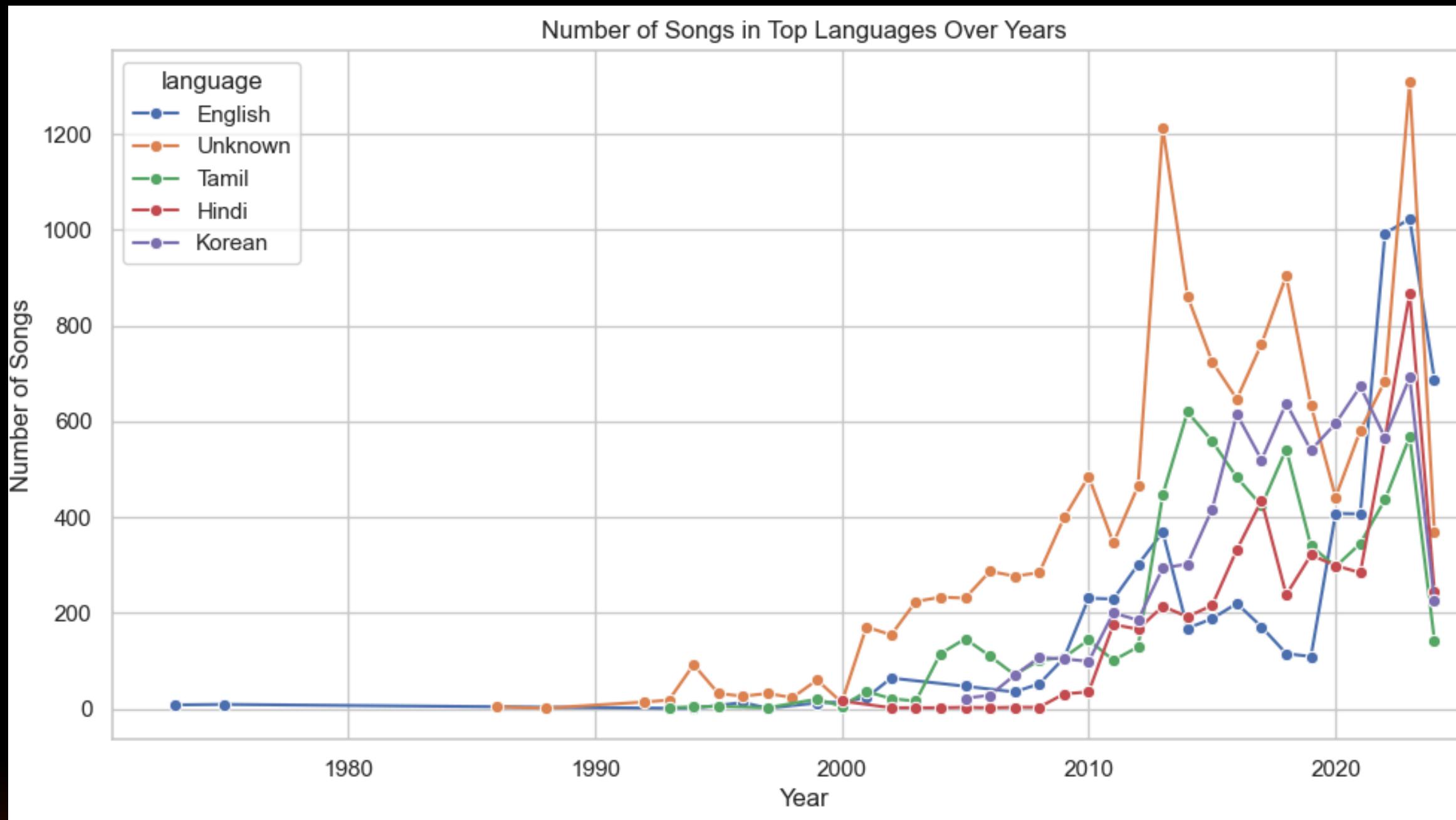
- Valence fluctuates but has trended slightly downward.
- Modern pop may lean more toward introspective or moody tones.



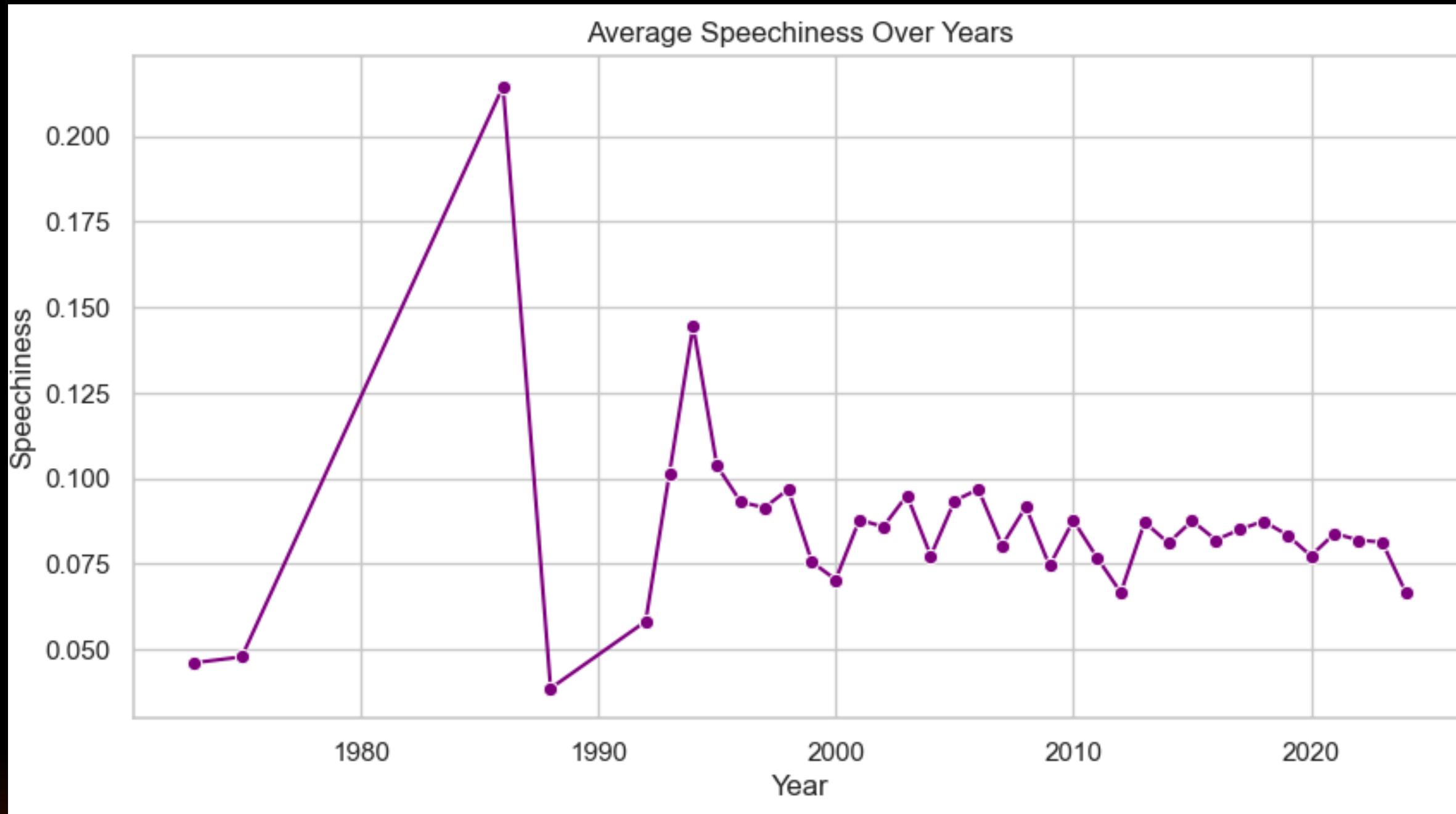
- Average loudness has increased, reflecting the loudness-war era.
- Producers push tracks to sound fuller and more aggressive.



- Liveness slightly rises, suggesting more “live-feel” mixes or performances.
- Producers might simulate live acoustics for authenticity.



- English dominates consistently, but other languages show growing presence.
- Globalization and streaming enable multilingual music success.



- Speechiness has increased, indicating more rap or spoken-word influences.
- The rise of hip-hop and trap contributes to this trend.

# THANK YOU

A presentation is a formal talk, often delivered in front of an audience, aimed at conveying information, persuading others, or sharing insights on a particular topic. Presentations can take various forms, such as verbal speeches, slideshows, demonstrations, or multimedia displays. They are commonly used in academic, professional, and social settings to communicate ideas, proposals, reports, or findings.