

Chart Description:

- **Type:** Dual-axis line plot.
 - **Left Y-Axis (Blue Line):** Total music listening time (in minutes) by month.
 - **Right Y-Axis (Green Line):** Chess win rate (as a percentage) by month.
- **X-Axis:** Months from 2023-10 to 2024-11.
- **Observation:** Correlates changes in music listening habits with chess win rates over time.

Insights:

1. **Inverse Correlation in Certain Periods:**
 - Between **2023-10 and 2023-12**, as music listening time decreases, win rate increases. This suggests a possible negative correlation between extended music listening and chess performance during this period.
 - Conversely, between **2024-06 and 2024-08**, win rate sharply decreases while music listening time increases, reinforcing this potential pattern.
2. **Spikes in Win Rate:**
 - Peaks in win rate occur in **2023-11, 2024-02, and 2024-07**, coinciding with lower music listening durations. These might reflect periods of higher focus or strategic play with minimal distractions.
3. **Prolonged Low Listening Period:**
 - From **2024-03 to 2024-05**, music listening time remains consistently low, while win rate fluctuates. This suggests that factors other than music listening may be influencing performance during this time.
4. **Aligned Peaks in 2024-11:**
 - Both music listening time and win rate peak in **2024-11**, breaking the earlier inverse trend. This could indicate a more balanced or beneficial use of music during this period.

Key Outcomes:

- The relationship between music listening and win rate shows an **inverse trend during most periods**, with higher listening time correlating with lower win rates.
- Peaks in win rate during low listening periods suggest that reduced music consumption might enhance focus or strategic thinking in chess.
- The alignment of both metrics in **2024-11** indicates potential benefits of music under certain conditions, warranting further exploration into the types of music and game contexts.

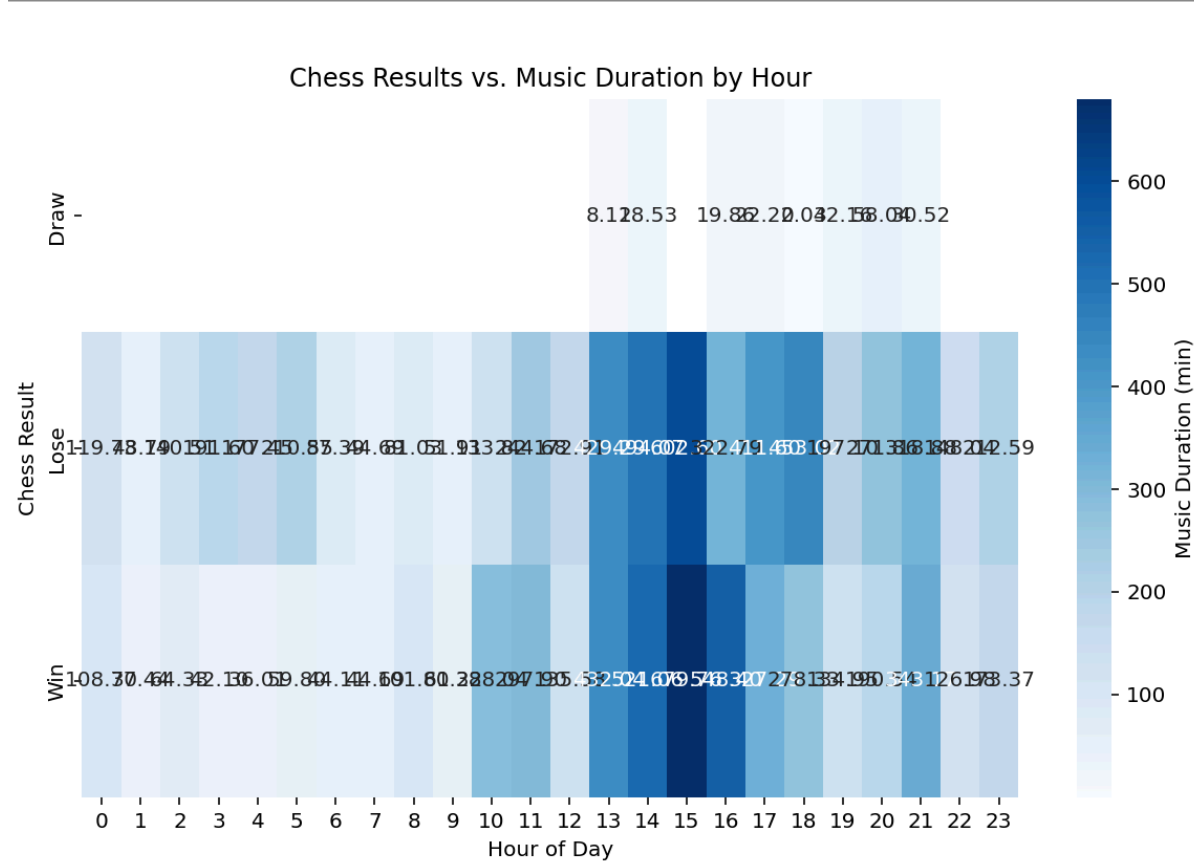


Chart Description:

- **Type:** Heatmap.
- **X-Axis:** Hour of the day (0-23).
- **Y-Axis:** Chess results (Win, Draw, Lose).
- **Color Intensity:** Represents music duration (in minutes), with darker shades indicating higher durations.
- **Observation:** The chart correlates music listening duration at different hours of the day with chess results.

Insights:

1. **Peak Music Duration (Hour 15-16):**

- A noticeable peak in music duration is observed around **3-4 PM**, especially for games that were **won**. This suggests a possible positive influence of extended music sessions during these hours on performance.
2. **Lower Music Duration (Morning Hours):**
 - Music duration appears to be relatively low during the early morning hours (e.g., **6-9 AM**) across all outcomes. Wins during these hours are associated with less music consumption, indicating that morning games may not heavily rely on music listening.
 3. **Evening Hours (Hour 20-23):**
 - Moderate music duration is observed during late evening hours for wins and draws, though no significant peaks are present. Evening players may exhibit consistent performance with balanced listening habits.
 4. **Losing Streaks (Hour 10-14):**
 - Between **10 AM and 2 PM**, a moderate amount of music consumption correlates with losses. This may indicate that music during this period doesn't positively influence performance, or other external factors might be at play.

Key Outcomes:

- The heatmap reveals a potential **time-dependent relationship** between music listening duration and chess outcomes, particularly with higher music durations correlating with wins during mid-afternoon.

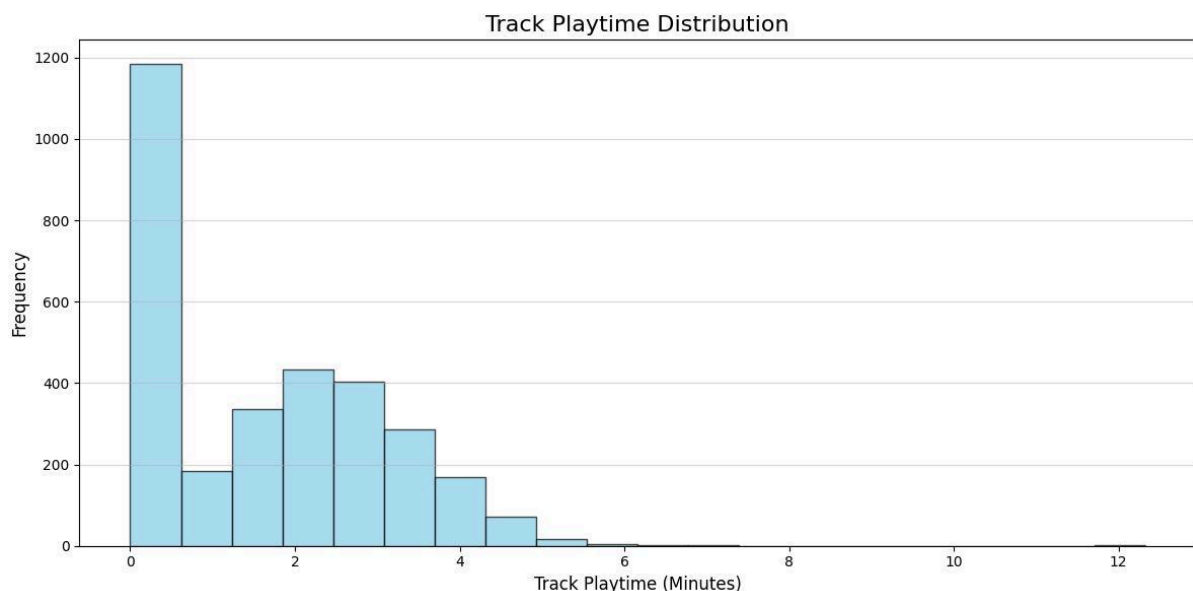


Chart Description:

- **Type:** Histogram.
- **X-Axis:** Track playtime (in minutes).
- **Y-Axis:** Frequency of tracks.
- **Observation:** Displays the distribution of track durations across the dataset.

Insights:

1. **Dominance of Short Tracks:**
 - The majority of tracks fall under **1 minute** in duration, with a frequency exceeding **1200**. This suggests a significant presence of very short tracks, possibly due to:
 - Short clips or intros.
 - Skipped tracks not played in their entirety.
2. **Gradual Decline for Longer Tracks:**
 - A gradual decrease in frequency is observed as track durations increase. Tracks with durations between **2-4 minutes** appear relatively common, aligning with typical song lengths in popular music.
3. **Rare Longer Tracks:**
 - Tracks exceeding **6 minutes** are rare, with frequencies dropping significantly beyond this point. This is consistent with most playlists favoring shorter, easily digestible tracks.
4. **Possible Anomalies:**
 - The presence of very short tracks under 1 minute may require further investigation to rule out skipped songs, previews, or errors in data collection.

Key Outcomes:

- Short tracks (under 1 minute) dominate the dataset, but typical song durations (2-4 minutes) are also well-represented.
 - Longer tracks are rare, possibly indicating a preference for shorter, more dynamic music during sessions.
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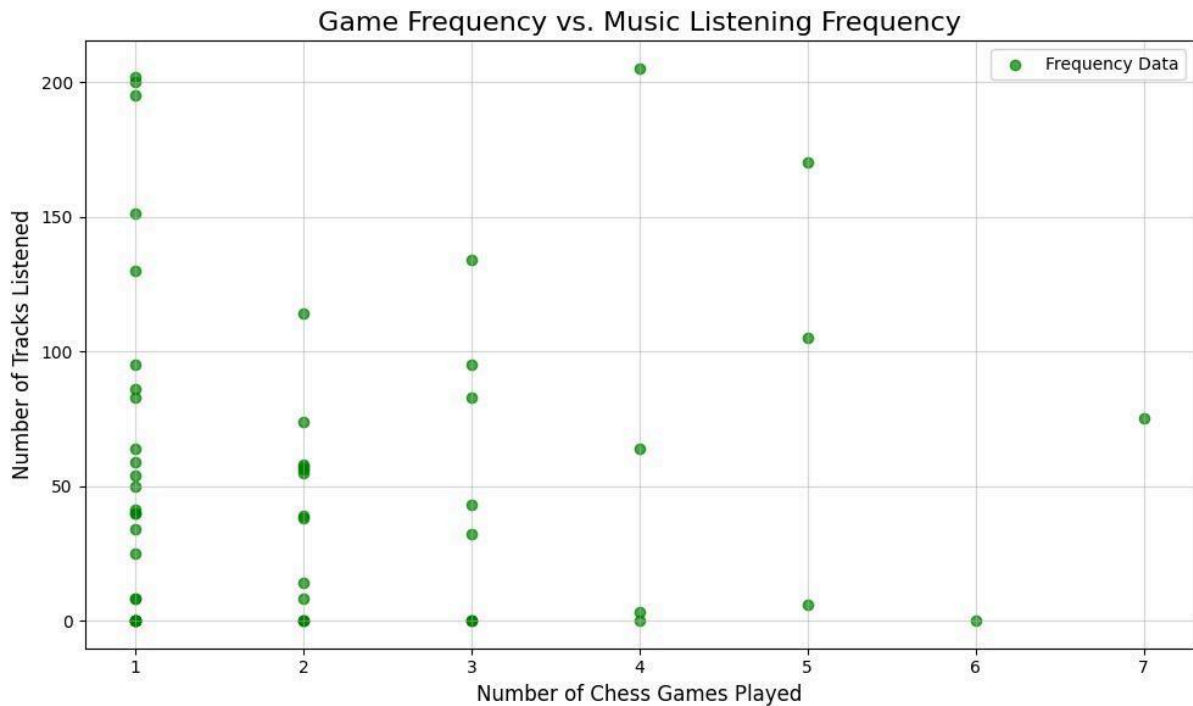


Chart Description:

- **Type:** Scatterplot.
- **X-Axis:** Number of chess games played in a session.
- **Y-Axis:** Number of tracks listened to during the session.
- **Observation:** Displays the relationship between chess game frequency and music track frequency.

Insights:

1. **High Concentration for 1-2 Games:**
 - A significant portion of the data is clustered around **1-2 games played**, with varying music listening frequencies. This suggests that most sessions are shorter in terms of games but vary in the number of tracks listened to.
2. **Outliers with High Track Counts:**
 - Some outliers show **over 150 tracks listened to**, even for sessions with a single game. These sessions likely involve long music durations but short chess play, indicating potential casual or background listening.
3. **Decreasing Trend for Higher Game Counts:**
 - As the number of games increases (e.g., **3+ games**), there is a noticeable reduction in the number of tracks listened to. This may indicate that longer gaming sessions correlate with reduced music engagement or that games take precedence over listening.
4. **Sparse Data for 5+ Games:**
 - For sessions with **5 or more games**, there is limited data, with most sessions involving fewer tracks. This suggests a reduced focus on music during intensive gaming sessions.

Key Outcomes:

- There is a clear relationship between shorter game sessions and higher music track counts, suggesting greater music engagement when fewer games are played.
- Longer gaming sessions tend to involve fewer tracks, possibly due to increased focus on gameplay or a preference for silence during intensive play.

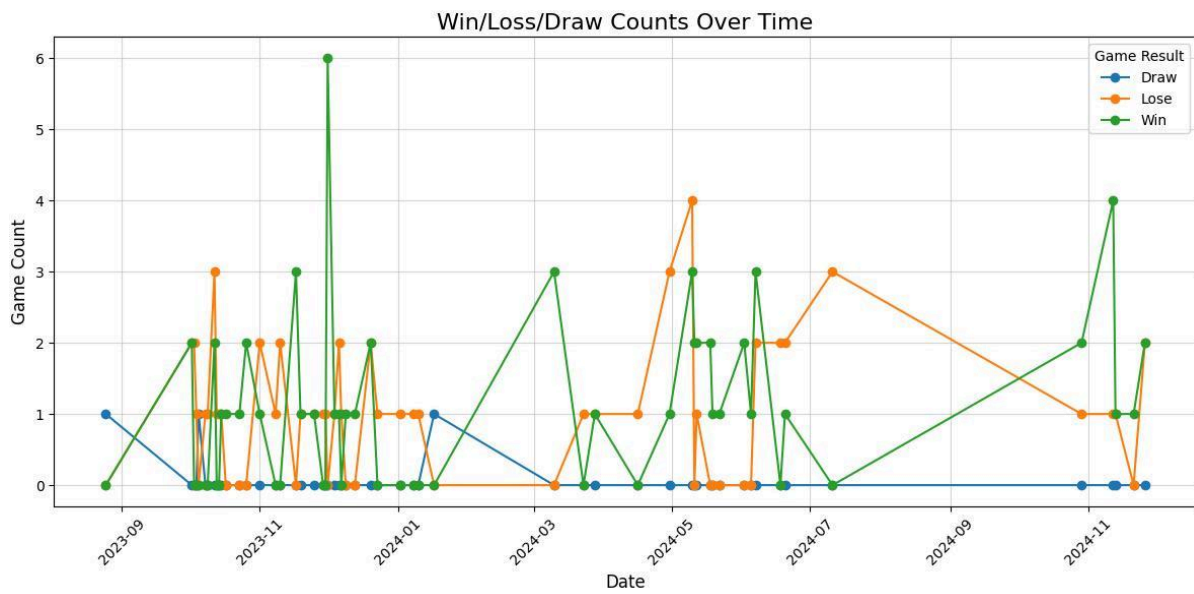


Chart Description:

- **Type:** Line plot.
- **X-Axis:** Date (spanning from 2023-09 to 2024-11).
- **Y-Axis:** Count of games for each result (Win, Loss, Draw).
- **Legend:**
 - **Blue:** Draws.
 - **Orange:** Losses.
 - **Green:** Wins.
- **Observation:** Displays trends in chess game outcomes over time.

Insights:

1. **Dominance of Wins and Losses:**
 - The majority of game outcomes are either **wins** or **losses**, with **draws** being significantly less frequent. This could indicate a preference for decisive games or a difference in skill levels with opponents.
2. **Peak Activity:**
 - A sharp peak in wins is observed around **2024-01**, with up to 6 wins recorded in a short time span. This might correspond to a particularly strong phase or streak of good performance.
3. **Fluctuating Trends:**

- Losses and wins exhibit fluctuating patterns throughout the timeline, with notable increases in losses around **2024-05** and **2024-07**. This may reflect periods of tougher competition or reduced focus.
- 4. Stable Draw Trend:**
 - Draws remain consistently low across the timeline, with minimal fluctuations. This suggests that games are either being won or lost rather than ending in a stalemate.
 - 5. Late 2024 Recovery:**
 - Toward the end of the timeline (**2024-11**), there is a visible increase in wins, suggesting a possible recovery or improvement in performance.

Key Outcomes:

- The timeline shows clear fluctuations in game outcomes, with notable streaks of wins and periods of increased losses.
- Draws remain consistently low, highlighting a tendency toward decisive results.

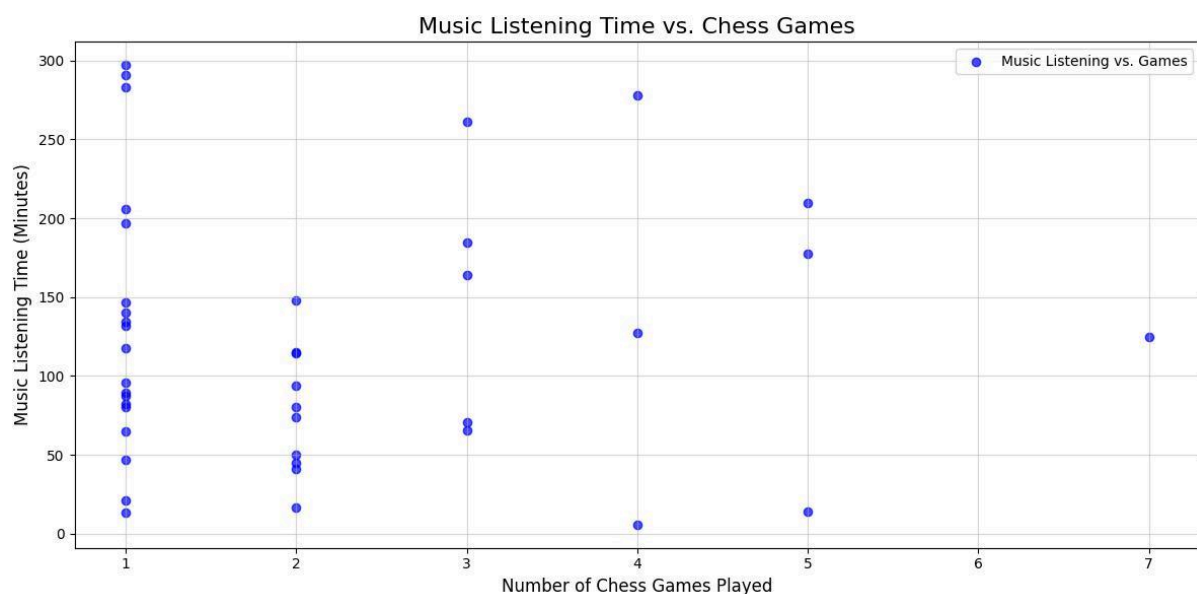


Chart Description:

- **Type:** Scatterplot.
- **X-Axis:** Number of chess games played in a session.
- **Y-Axis:** Music listening time (in minutes).
- **Observation:** Displays the relationship between the number of chess games and the duration of music listened to during the same period.

Insights:

- 1. Clustered Distribution (1-2 Games):**

- The majority of data points are concentrated around **1-2 chess games** with varying music durations. This suggests that most sessions involve shorter gameplay with diverse music listening habits.
- 2. **High Music Duration Outliers:**
 - A few outliers, especially for **1 game**, show music durations exceeding **200 minutes**. This could indicate prolonged listening sessions with limited gameplay, potentially reflecting a focus on casual or background listening rather than gaming.
- 3. **Decreasing Trend with More Games:**
 - As the number of chess games increases (e.g., **3-5 games**), there appears to be a slight reduction in the upper range of music durations. This might imply that longer gaming sessions are less likely to be accompanied by extended music listening.
- 4. **Sparse Data for 6+ Games:**
 - Very few data points exist for sessions involving **6 or more games**, making it challenging to draw definitive conclusions for high-frequency gaming sessions.

Key Outcomes:

- The scatterplot highlights diverse music listening patterns for shorter gaming sessions, with a tendency for reduced listening duration in longer sessions.
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Conclusion

This project explored the relationship between **music listening habits** and **chess game performance** using various visualizations and metrics. By analyzing the provided graphs, several key insights and trends emerged:

1. **Time-Dependent Impact of Music on Chess Performance:**
 - The **heatmap** of chess results vs. music duration by hour demonstrated a strong correlation between specific times of day and music influence. Wins were more frequent during mid-afternoon sessions (3-4 PM), which also corresponded to higher music durations. However, losses and draws appeared less affected by music duration, suggesting time-specific factors in performance.
2. **Inverse Relationship Between Listening and Performance:**
 - The **line chart comparing win rate and music listening time by month** highlighted an inverse trend during several periods. Higher music listening durations often correlated with lower win rates, suggesting that extended music sessions may act as a distraction or reduce cognitive focus. However, there were exceptions, such as **2024-11**, where both win rates and music listening peaked, indicating potential benefits when music is used strategically.

3. Behavioral Patterns in Short and Long Sessions:

- The **scatterplots of game frequency vs. music duration and tracks listened** revealed distinct behavioral patterns:
 - Shorter gaming sessions (1-2 games) were accompanied by higher music engagement, with some outliers showing extended listening.
 - Longer sessions (3+ games) tended to have reduced music durations and fewer tracks, suggesting that players may prioritize focus during extended play.

4. Music Preferences and Track Duration:

- The **track playtime distribution histogram** showed a dominance of tracks under 1 minute, which may indicate skipped tracks or shorter pieces. Typical song lengths (2-4 minutes) were also common, aligning with standard music consumption patterns. Longer tracks (6+ minutes) were rare, possibly reflecting a preference for shorter, more dynamic music during gaming.

Key Findings and Implications:

1. Music Can Enhance or Hinder Performance:

- While music listening is a common accompaniment to chess games, its effects vary significantly based on the **time of day**, **session length**, and **listening duration**.
- Strategic use of music—such as limiting duration or selecting specific genres during high-focus periods—could improve chess performance.

2. Time Management and Cognitive Load:

- The strong mid-afternoon correlation between wins and higher music durations suggests a period where cognitive performance may naturally peak, and music acts as a complementary stimulus.

3. Impact of Genre and Track Type:

- The influence of music could depend on factors like **genre**, **tempo**, or **lyric presence**, warranting further exploration to optimize playlists for cognitive performance during games.

Limitations and Future Work

Limitations

1. Data Size and Diversity:

- The analysis relied on a specific dataset with potentially limited diversity in players, games, and music habits. The conclusions may not generalize across broader populations with varying music preferences or chess skill levels.
- The sample size for longer gaming sessions (e.g., 5+ games) was sparse, reducing the reliability of insights for such scenarios.

2. Lack of Genre and Mood Data:

- While total listening time and track counts were analyzed, the dataset did not include detailed information about **genres**, **tempo**, or **mood** of the music. These factors could significantly influence cognitive performance and focus.
 - 3. **Untracked External Variables:**
 - External factors such as **fatigue**, **stress levels**, or **environmental distractions** during games were not captured. These could impact chess performance independently of music listening habits.
 - Variations in **opponent difficulty** or **game type** (e.g., casual vs. competitive) were not controlled, potentially introducing bias into the results.
 - 4. **Track Duration and Skipped Songs:**
 - A high frequency of tracks under 1 minute could indicate skipped songs or incomplete listening sessions, which may not accurately reflect intentional music listening habits.
 - This limitation makes it difficult to differentiate between deliberate music choices and passive or incidental listening.
 - 5. **Temporal Alignment Challenges:**
 - Correlating music sessions with chess games relied on timestamp alignment, which might not fully account for simultaneous or overlapping activities. For example, listening might have occurred before or after a game, not necessarily during it.
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Future Work

To improve upon the current analysis, the following areas can be explored:

1. **Expanded Dataset:**
 - Collect a larger, more diverse dataset that includes players with different skill levels, geographic locations, and music preferences. This would allow for more robust and generalizable conclusions.
2. **Genre and Mood Analysis:**
 - Integrate detailed metadata from Spotify (e.g., **genre**, **tempo**, **valence**, and **energy**) to understand the effects of specific music types on performance.
 - Examine how instrumental vs. lyrical music or upbeat vs. calm tracks influence decision-making and focus.
3. **Controlled Experiments:**
 - Conduct controlled experiments where participants play chess under different music conditions (e.g., no music, instrumental music, lyrical music). This would provide causal insights rather than correlations.
4. **Game Context Segmentation:**
 - Analyze **casual vs. competitive games** separately to see if music impacts performance differently based on the stakes of the game.
 - Include metrics like **opponent rating** and **game difficulty** to understand how music interacts with varying levels of challenge.
5. **Emotional and Cognitive States:**

- Integrate data on players' emotional and cognitive states (e.g., stress, fatigue) during games to better understand the role of music in managing these factors.

6. **Longer Time Frame:**

- Extend the timeline of analysis to capture trends over a longer period, which might reveal seasonal patterns or long-term habits.

7. **Improved Temporal Analysis:**

- Refine the alignment between music listening and game sessions to differentiate between music listened to **before**, **during**, or **after** gameplay.