Silence vs. Sound: Investigating How Background Music and Noise Influence Study Retention

Justin Beshay
Department of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, Canada.

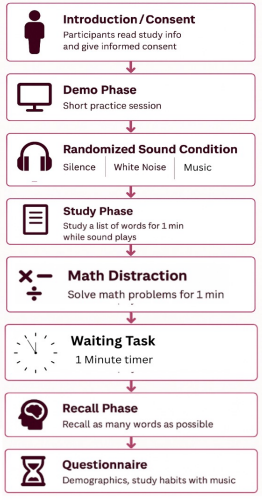
Introduction

- Many students believe that listening to music improves study performance
- Research findings on background sound and memory are **mixed**
- Most studies compare only **two conditions** (e.g., music vs. silence)
- Few studies test **silence, music, and white noise** within the same experiment
- This study addresses that gap using a **within-subjects design**
- Also explores effects of individual differences

Objective

- To examine how different background sound conditions (**silence**, **white noise**, and **music**) affect **verbal memory recall accuracy**
- To test the hypothesis that **silence** would lead to the **highest recall**, while **music** would lead to the **lowest**
- To explore whether individual differences (e.g., **music familiarity** and **study habits, Recall time**) relate to performance in the music condition
- To inform evidence-based study strategies based on how auditory environments and personal habits influence memory

Subjects, Methods, And Procedure



Design:
One-way repeated measures, Within-subjects

Participants:
Simulated data model of 3 groups of 58 participants (174) equally divided into three sound conditions.

Measures:
Primary DV: Recall accuracy (percentage of correctly recalled words)

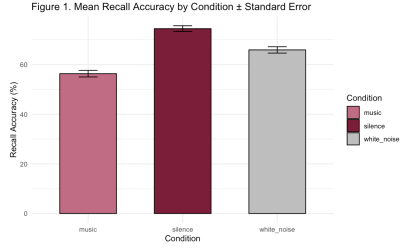
Secondary measures:
- Recall response time
- Music familiarity
- Study habits (e.g., whether participants typically study with music)

Analysis:
One-way ANOVA, one-tailed t-tests

Results

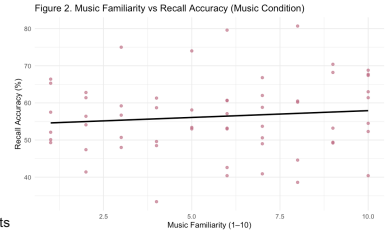
- A **one-way repeated measures ANOVA** revealed a **significant effect** of background sound condition on recall accuracy:
  - **F(2, 114) = 52.26, p < .001**
  - **Effect size**: $\eta^2 = 0.38$,
  (Shows a large effect of condition)
- **Mean recall accuracy**:
  - **Silence**: 74.47%
  - **White Noise**: 65.91%
  - **Music**: 56.33%

Figure 1. Mean Recall Accuracy by Condition ± Standard Error



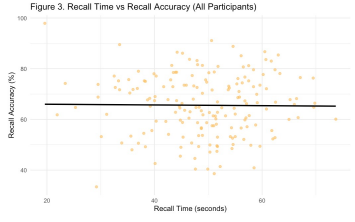
Music Familiarity vs. Recall Accuracy in the music condition showed a very weak positive trend.

Figure 2. Music Familiarity vs Recall Accuracy (Music Condition)



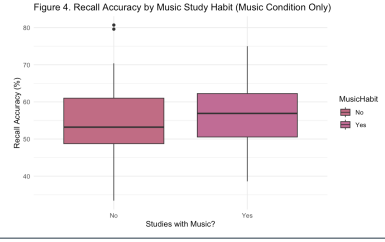
Recall Time vs. Accuracy: No clear relationship.

Figure 3. Recall Time vs Recall Accuracy (All Participants)



- **Study Habits vs. Music Condition Performance**: Participants who regularly study with music scored slightly higher in the music condition, but not significantly.

Figure 4. Recall Accuracy by Music Study Habit (Music Condition Only)



Discussion/Conclusion

- The silence condition produced the highest recall accuracy, supporting the primary hypothesis that background noise negatively affects memory performance. As shown in Figure 1, participants in the silence condition had a mean recall accuracy of 74.47%, which was significantly higher than both the white noise group (M = 65.91%) and the music group (M = 56.33%). These differences were statistically confirmed by a one-way ANOVA ($F(2, 174) = 52.26$, $p < .001$, $\eta^2 = .38$) and follow-up t-tests:
- Silence > Music: $t(114.19) = -10.35$, $p < .001$ (one-tailed)
- Silence > White Noise: $t(114.75) = 4.94$, $p < .001$ (one-tailed)
- White Noise > Music: $t(115.95) = -5.21$, $p < .001$ (one-tailed)
- Results support the hypothesis: **silence has better memory recall** compared to both music and white noise.
- How well you know the song did not impact memory.
- This suggests that **auditory distractions**, especially structured ones like music, may impair verbal memory performance.
- Implications for students: **Studying in silence may optimize memory performance**.
- **Limitations**: Simulated data; real participant variability and preferences may influence results.

Next steps: Apply the same analysis to **real participant data.** Extend the design to include **different types of music** (e.g., instrumental vs. lyrical). Explore **longer study/retention intervals** or **other cognitive tasks** (e.g., comprehension, attention)

References

Carr, S. M., & Rickard, N. S. (2016). The use of emotionally arousing music to enhance memory for subsequently presented images. Psychology of Music, 44(5), 1145-1157. https://doi.org/10.1177/0305735615613846
Chew, A. S.-Q., Yu, Y.-T., Chua, S.-W., & Gan, S. K.-E. (2016). The effects of familiarity and language of background music on working memory and language tasks in Singapore. Psychology of Music, 44(6), 1431-1438. https://doi.org/10.1177/0305735616636209
Christopher, E. A., & Shelton, J. T. (2017). Individual differences in working memory predict the effect of music on student performance. Journal of Applied Research in Memory and Cognition, 6(2), 167–173. https://doi.org/10.1016/j.jarmac.2017.01.012
Echaide, C., del Río, D., & Pacios, J. (2019). The differential effect of background music on memory for verbal and visuospatial information. The Journal of General Psychology, 146(4), 443–458. https://doi.org/10.1080/00221309.2019.1602023
Furnham, A., & Strbac, L. (2002). Music is as distracting as noise: The differential distraction of background music and noise on the cognitive test performance of introverts and extraverts. Ergonomics, 45(3), 203–217. https://doi.org/10.1080/00140130210121932
Gonzalez, M. F., & Aiello, J. R. (2019). More than meets the ear: Investigating how music affects cognitive task performance. Journal of Experimental Psychology: Applied, 25(3), 431-444. https://doi.org/10.1037/xap0000202
Lehmann, J. A. M., & Seufert, T. (2017). The influence of background music on learning in the light of different theoretical perspectives and the role of working memory capacity. Frontiers in Psychology, 8, 1902. https://doi.org/10.3389/fpsyg.2017.01902