Stochastic Resonance and Using Colored Noise to Increase Concentration

Maya Peacock
Ramapo College of New Jersey, Mahwah, NJ, 07430

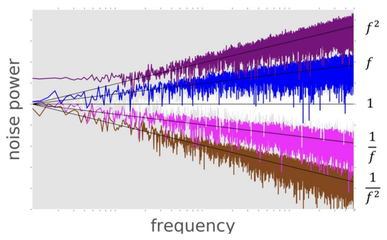
Purpose

The purpose of this study is to assess the efficacy of using specific frequencies bands of auditory signal to facilitate focused and sustained attention in college-aged adults. Stochastic resonance theory suggests that one can amplify, and correctly identify, a signal in the midst of specific frequencies and intensities of noise, thus enhancing the signal to noise ratio (SNR). In humans this serves to facilitate attention to the signal and inhibit attention to irrelevant stimuli.

Background

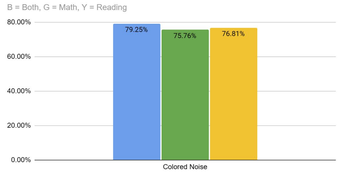
Focused attention is a human's ability to respond to certain stimuli in order to perform a certain task. The kind of attention that will be focused upon is when a human cancels or ignores stimuli in order to put all or most of their attention toward a task at hand. This involves multiple types of attention which includes sustained and selective attention. Selective attention is like described above, to choose which stimuli you want to focus on the most. However, Sustained Focus is just as important, as it is one's ability to maintain attention once it has started. Between these two types of attention, concentration within college students would peak once mastered. However, a challenge most college students are faced with is unwanted sounds and noise surrounding them as they are trying to focus.

There is a process called Stochastic Resonance that is used to amplify a signal through the use of playing noise. As all of our brains transmit signals, it is just a matter of finding the right noise to amply that signal that maximizes focused attention. The right amount of this noise can facilitate a signal transmission in the brain in order to increase the signal-to-noise ratio, and thus improving one's performance on various tasks. There is a link between this beneficial noise and attention explained by the Moderate Brain Arousal Model (MBA) that demonstrates how brains with low levels of internal neural noise, like those with ADHD, require more external noise to work at an optimum level.

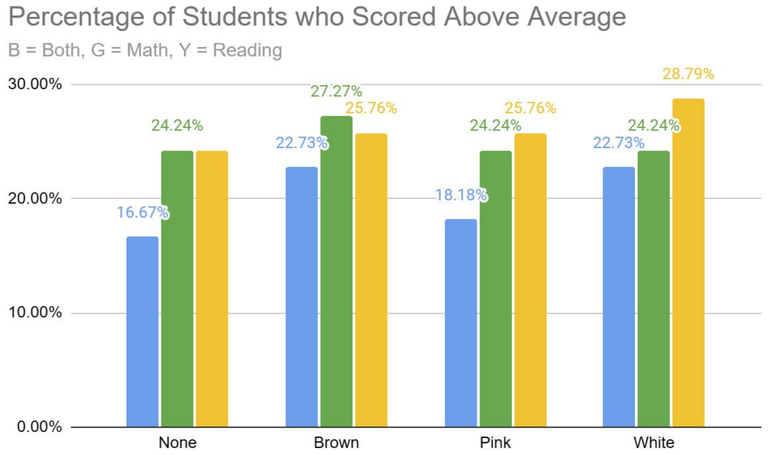


Correlation Coeff.	Felt Focus Level (0-5)
Sound	0.208*
Grade	0.425**
Audio Level	0.242*

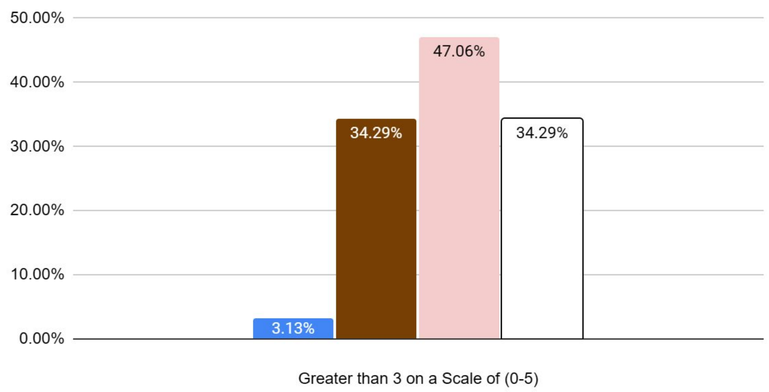
Percentage of Students who Scored Above Average If They Listened to Colored Noise



Percentage of Students who Scored Above Average

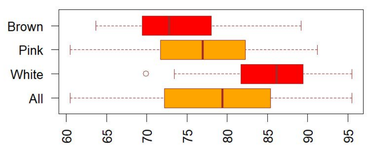


Percentage of Students who felt a FFL Greater Than the Average FFL across All Sound Categories

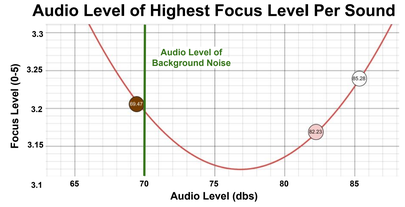


Summary	None (32)	Brown (35)	Pink (34)	White (35)	Total (136)
Median	3	3	3	3	3
Mean	2.419	3.061	3.206	3.029	2.941

Audio Volume Based on Colored Noise



Audio Level of Highest Focus Level Per Sound



Methodology

2X4X2 Factorial Design

Participants
- 136 Students (113 F, 23 M)
- 13 Neurodivergent Students

Sounds
- White, Pink, Brown and No Noise

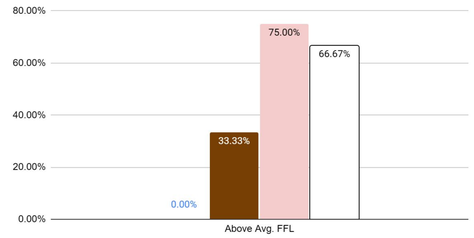
Test
- Reading and Mathematics

All data collected will be based on:
- Pre and Post Questionnaires

During the experiment:
- Students will answer the reading or math questions
- Background Noise (i.e. Conversations, Traffic Noises, Popular Songs, etc.) played at 70 dbs

After the experiment:
- The post-questionnaire will include questions about the auditory noise that was happening around them as they were taking the test.

Percentage of Neurodivergent Students who felt a FFL Greater Than the Avg. FFL across All Sound Categories



Summary	None (3)	Brown (3)	Pink (4)	White (3)	Total (13)
Median	2	2	3	3	3
Mean	1.33	2.667	3	3.333	2.615

Conclusion

Although in this sample Brown Noise let to the highest percentage of students who scored above average on their test, there is not enough evidence yet to prove the listening to colored noises can affect grades. On the other hand, there is enough evidence the listening to colored noise does increase a student's level of concentration when attempting to cancel out distracting environmental noises. In this sample, Pink Noise had the greatest positive affect on a student's level of concentration. A student's level of concentration also depends on the volume of the colored noise they listen to. Although White Noise listened to at 85 dbs led to the high FFL, Brown Noise may be the better choice as students achieved approximately the same FFL listening at a safer volume level.

Citations and Acknowledgements

I would like to thank the SSHS and TAS staff, Ramapo College Honors Program, Dr. Choudhury and Dr. Yuster for their support in this research.