REACTION TIME LAB REPORT

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I. INTRODUCTION

Reaction time is a way to measure the time between a stimulus and an action caused by the interpretation of the stimulus. The path it takes is from the afferent (sensory) neurons to the efferent (motor) neurons. The purpose of the experiment was to test if there was a significant difference between this time caused by three sense perceptions: vision, hearing, and touch. Also, to test if the variable, types of music, had a significant effect on this time.

For vision, photons reflected from surface of an object are refracted into the eye by the lens where they strike the retina's photoreceptors where they isomerize rhodopsin to cause a reaction involving two intermediate molecules, which eventually causes an enzyme to shut the ion channel of the receptor cell, causing it to stop the release of the neurotransmitter. Depending on the bipolar cell, light or no light may be perceived when the neurotransmission ceases. Sound are air pressure waves which oscillate the ear drum causing the hammer, anvil, and stirrup bones of the inner ear to cause waves in the cochlea, causing the organ of Corti to move where hairs stimulate the mechanoreceptors. Touch is simpler in that pressure on the skin causes the change in membrane permeability of mechanoreceptors.

The hypothesis is that the reaction time will be the fastest for vision, because humans are more dependent on vision than any other sense to navigate successfully the natural world. Touch will be the slowest because the density of receptors varies on the body and hearing is generally more sensitive than touch. Various studies have suggested that music, specifically Classical music causes significant changes in the body, mostly having to do with the brain. It causes much stimulation in the growing brain of a child, and certain compositions to certain people may even cause elevated levels of dopamine. The music was tested against another type, the newest product of the era called "techno," which typically uses many computer generated sounds and is the furthest development from Classical. Due to Classical music's interesting effect on the brain, the hypothesis is that it will significantly lower reaction time.

II. Materials and Methods (Procedure)

Materials:

- Meter stick
- Level wall
- *Piano Concerto No. 21 in C Major, KV. 467 :II. Andante* by Wolfgang Amadeus Mozart
- *Waltz* from *The Sleeping Beauty* Ballet by Pyotr Ilyich Tchaikovsky
- Techno Remix by 9elle9

Procedure:

1.) The meter stick was positioned on a noted part of the wall. The hand met the end of the meter stick, but was two centimeters away from the wall.
2.) The subject was looking at the meter stick, and the experimenter remained silent and did not make contact with the subject. The experimenter released the meter stick and the subject, with quickest speed, pushed his hand against the wall, stopping the fall of the meter stick. The point of measurement at the top of the hand was recorded.
3.) Five practice sessions were taken. Ten trials were then taken.
4.) In the same manner of preparation, the subject then shut his eyes and the experimenter, trying to keep the length, volume, and tone of voice constant, said the word "now." Five practices and ten trials taken.
5.) In the same preparation including the closed eyes, this time the experimenter touched the subject's shoulder at the same area. Five practice plus ten trials.
6.) Twenty-four hours were allowed to pass and the two classical songs were listened to, totaling about 10 minutes. Steps one through five were repeated.
7.) Another 24 hours passed. The techno was listened to, again about 10 minutes. One through five were repeated.
8.) The measurements were converted into time using the equation:
time = $\sqrt{}$(measurement/490)

III. RESULTS

All results are in seconds.

No Music

Sight	Sound	Touch
0.186	0.239	0.296
0.175	0.239	0.23
0.212	0.256	0.239
0.192	0.26	0.175
0.192	0.175	0.202
0.23	0.235	0.235
0.175	0.239	0.252
0.181	0.239	0.136
0.257	0.344	0.192
0.202	0.271	0.275

Classical

Sight	Sound	Touch
0.226	0.23	0.286
0.207	0.247	0.275
0.217	0.252	0.267
0.221	0.235	0.239
0.186	0.226	0.23

0.197	0.226	0.243
0.207	0.207	0.256
0.212	0.217	0.212
0.186	0.207	0.207
0.226	0.23	0.286

Techno

Sight	Sound	Touch
0.212	0.226	0.271
0.202	0.243	0.26
0.217	0.235	0.23
0.197	0.217	0.239
0.136	0.202	0.23
0.186	0.212	0.243
0.175	0.221	0.256
0.186	0.226	0.207
0.192	0.197	0.212
0.186	0.207	0.217

$T = \sqrt{\frac{x}{490}}$

$\sqrt{\frac{17}{490}} = 0.186s$

Music Effectiveness

Anova: Two-Factor With Replication

SUMMARY	Sight	Sound	Touch	Total
No Music				
Count	3	3	3	9
Sum	0.573	0.734	0.765	2.072
Average	0.191	0.244667	0.255	0.230222
Variance	0.000361	9.63E-05	0.001281	0.00132
Count	3	3	3	9
Sum	0.614	0.67	0.612	1.896
Average	0.204667	0.223333	0.204	0.210667
Variance	0.000481	0.001908	0.000903	0.000913
Count	3	3	3	9
Sum	0.613	0.822	0.58	2.015
Average	0.204333	0.274	0.193333	0.223889
Variance	0.002089	0.003675	0.003365	0.003718
Count	3	3	3	9
Sum	0.635	0.748	0.836	2.219
Average	0.211667	0.249333	0.278667	0.246556
Variance	0.00016	0.000424	4.03E-05	0.001002
Count	3	3	3	9
Sum	0.624	0.713	0.736	2.073
Average	0.208	0.237667	0.245333	0.230333
Variance	0.000367	0.000174	0.000372	0.00052
Count	3	3	3	9
Sum	0.616	0.65	0.711	1.977
Average	0.205333	0.216667	0.237	0.219667
Variance	5.83E-05	9.03E-05	0.000511	0.000358
Count	3	3	3	9
Sum	0.624	0.663	0.764	2.051
Average	0.208	0.221	0.254667	0.227889
Variance	0.000412	0.000151	0.00176	0.001016

Count	3	3	3	9
Sum	0.616	0.695	0.729	2.04
Average	0.205333	0.231667	0.243	0.226667
Variance	0.000108	0.000177	0.000237	0.000411

Count	3	3	3	9
Sum	0.497	0.635	0.729	1.861
Average	0.165667	0.211667	0.243	0.206778
Variance	0.00069	9.03E-05	0.000169	0.001372

Count	3	3	3	9
Sum	0.564	0.63	0.636	1.83
Average	0.188	0.21	0.212	0.203333
Variance	0.000012	0.000217	0.000025	0.000197

Total			
Count	30	30	30
Sum	5.976	6.96	7.098
Average	0.1992	0.232	0.2366
Variance	0.000509	0.000854	0.001232

ANOVA

rce of Varia	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Sample	0.013594	9	0.00151	2.220378	0.032748	2.040098
Columns	0.024958	2	0.012479	18.34338	6.07E-07	3.150411
Interaction	0.020838	18	0.001158	1.701743	0.064334	1.778446
Within	0.040817	60	0.00068			
Total	0.100208	89				

No Music

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Sight	10	1.992	0.1992	0.000576
Sound	10	2.497	0.2497	0.00175
Touch	10	2.152	0.2152	0.001634

ANOVA

rce of Varia	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between G	0.013322	2	0.006661	5.045902	0.013745	3.354131
Within Gro	0.035641	27	0.00132			
Total	0.048963	29				

Classical

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Sight	10	2.085	0.2085	0.000222
Sound	10	2.277	0.2277	0.000223
Touch	10	2.501	0.2501	0.000823

ANOVA

rce of Varia	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between G	0.00867	2	0.004335	10.2566	0.000486	3.354131
Within Gro	0.011412	27	0.000423			
Total	0.020081	29				

Techno

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Sight	10	1.889	0.1889	0.00051
Sound	10	2.186	0.2186	0.000211
Touch	10	2.365	0.2365	0.000456

ANOVA

rce of Varia	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between G	0.011561	2	0.00578	14.72958	4.73E-05	3.354131
Within Gro	0.010596	27	0.000392			
Total	0.022157	29				

Sight

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
No Music	10	2.002	0.2002	0.000692
Classical	10	2.085	0.2085	0.000222
Techo	10	1.889	0.1889	0.00051

ANOVA

rce of Varia	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between G	0.001936	2	0.000968	2.03832	0.149814	3.354131
Within Gro	0.012821	27	0.000475			
Total	0.014757	29				

Sound

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
No Music	10	2.497	0.2497	0.00175
Classical	10	2.277	0.2277	0.000223
Techno	10	2.186	0.2186	0.000211

ANOVA

rce of Varia	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between G	0.005113	2	0.002557	3.512558	0.044067	3.354131
Within Gro	0.019653	27	0.000728			
Total	0.024766	29				

Touch

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
0.296	9	1.936	0.215111	0.001839
0.286	9	2.215	0.246111	0.000747
0.271	9	2.094	0.232667	0.000348

ANOVA

rce of Varia	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between G	0.00435	2	0.002175	2.22444	0.129943	3.402826
Within Gro	0.023466	24	0.000978			
Total	0.027816	26				

IV. CONCLUSIONS

The music effectiveness two-factor ANOVA gives an interaction P-value of .06 which is above the cut-off point. The hypothesis is not supported by this, meaning that the type of music overall does not affect reaction time as a whole, including the three perceptions. The no music ANOVA has a P-value of .01, which may be difficult to analyze. By strict standards, this means there is no significant difference between the reaction times of the three perceptions, but if a cut-off point of .05 is chosen, there is a significant difference. Due to the many variables which were attempted to be removed but may still not perfect, .05 will be chosen, meaning that there is a significant difference. The Classical music ANOVA has a P-value of .0005 meaning that it changes the reaction time of at least one significantly. The greatest difference of variance when compared to the no music test was in sound. Because music is listened to, perhaps the song was still being remembered and the hearing perception was distracted. The techno P-value was 4.7E-05. This means that techno also significantly affected the reaction time of at least two relative to the other two (or one). Again this seems to be sound. Perhaps the variation difference lies again in the existence of the auditory memory. Techno more than Classical because techno seems to be, subjectively and qualitatively of course, more disturbing and distracting of attention, whereas Classical perhaps can be listened to subconsciously/passively. The sight lab report has a P-value of .15, meaning that the music had no significant effect on a sigh-based reaction. Sound was .04. To be consistent with the .05 cut off point, sound was significant, again, this is because music is completely hearing based. Touch was .13. In conclusion, when no music was heard, there is a natural and significant difference in reaction time based on vision, hearing and touch. Classical music also seemed to be significant, but because the interaction P-value was not significant, this is most likely from natural occurrences and not related to the music, the same is for the techno. And sound was the sense affected by the music.

The two songs were chosen to give a variety of Classical music, meaning tempo and style was different, so only the entire genre and its common elements were tested. Mozart's piano concerto is of the Classical era, characterized by clean and organized lines, it is also soft dynamically and of a slow tempo. Tchaikovsky's Sleeping Beauty Waltz is from the Romantic era, featuring freedom of ornamentation and emotion, it varies in dynamics and tempo, but is primarily forte and vivace. Though the variation was carefully chosen, error may arise because of the incredible variation within Classical music. The time for each genre was kept the same. But a lack of knowledge of variation which might exist in the techno genre may cause error.

More trials, types of music, and more songs may be used. To test other parts of the brain, besides reaction time, heart rate and brain waves may be monitored to see effects. Also, the person's musical maturity may limit their ability to feel the effects of certain types of music. Meaning biases and the person's environment are significant variables.