

The Effect of Song Lyrics on the Emotional and Physiological Response to Music

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Running title: The Effect of Song Lyrics on Physiological Response

Key words: lyrics, physiological, music

Total words: 2656

Abstract

Music is a large part of most people's lives and can have profound emotional effects. In connection with the emotional effects there may also be subtle physiological effects. For instance, heart rate, blood pressure, and respiration rate are known to increase with arousing music as opposed to calm music. It has yet to be deduced which aspects of music have the largest effect on emotional and thus physiological response, but a few studies have found that it depends on the type of music. Lyrics were shown to detract from emotional response to happy music and enhance that to sad music. In order to test for the effect of lyrics on not only emotion but physiology we separated the lyrics from the instrumental melody of the songs, playing for subjects an arousing song with and without lyrics and a calm song with and without lyrics. We hypothesized that subjects would have a greater physiological response to calm or 'sad' music with lyrics than without, and to arousing or 'happy' music without lyrics than with. Our results show songs without lyrics have a significant effect on heart rate but, respiration rate and respiration depth from baseline had no significant change. There was no significant difference in the change in amplitude of alpha and beta waves in the right hemisphere between lyric and non-lyric conditions; however, there was a significant difference in the left hemisphere as happy without lyrics had a significantly greater change than with lyrics. Also sad music with lyrics had a significantly greater change than without. These are mixed results and do not significantly define whether songs with lyrics effect emotion more than songs without them.

Introduction

Music is all around us, from live performances by famous rock bands to internet downloads of classical pieces. While these songs try to target specific groups of people and arouse certain feelings, they often impact different people in different ways. When asked to describe her feelings about “Call Me Maybe” (Carly Rae Jepsen), Katie Sullivan, a student at the UW, described the song as “annoying” and did not enjoy listening to the song. However, when Aron Stumbras, another student at the UW, was asked the same question his response was that “Call Me Maybe” was one of the best songs of the year. This short survey corroborates with Francis Sparshott’s argument that “a musical experience may give rise in some listener to a subjective feeling or emotion” in his book ‘Music and Feeling’ (Ushedo, 2006).

Changes in emotional states are often accompanied by changes in physiological states. Through its impact on emotion, different types of music have been shown to affect various physiological variables, most of which are usually subconscious. For example, it was found that skin conductance increased following joyful and horrific music (VanderArk et al, 1992). It has also been found that heart rate, blood pressure, and respiration increased more when arousing music was played compared to calm music (Iwanaga, 1999).

While music is known to induce different ranges of emotion, the specific aspects of the songs that arouse these emotions are yet to be understood. Some songs are lyric heavy with complex beats while others feature solo musicians playing lyric-less melodies. How does music with lyrics differ from that without with respect to physiological responses? Many studies have been performed involving the effects of music on emotion and, in turn, physiological states. In his study on emotional responses to music, Omar Ali Syed (2005) played different genres of

music with and without lyrics and had participants rate their emotional states afterwards using a 9-point scale. He found that lyrics detracted from emotional responses to happy and calm music but enhanced emotional responses to sad and angry music. Overall the melody, rather than lyrics, appeared to be more effective in eliciting an emotional response. It has been speculated that positive emotions are associated with activation of the left brain hemisphere and negative with the right (Heilman 1997). Also the semantic meanings of lyrics appear to be processed in the left hemisphere whereas the emotional meanings are processed in the right (Besson et al. 1998). Therefore the emotional processing in the right hemisphere contributes to the processing of the negative emotions, whereas the emotional processing of positive lyrics are done in the right hemisphere and the processing of positive emotions in the left. Larsen et al (2000) lists the physiological effects that these emotions have on our bodies. Negative emotions seem to be associated with greater changes in autonomic activity, specifically sympathetic responses, than positive emotions. Additionally, somatic responses measured by electromyographs (EMG) showed that negative emotions induced more activity over the brow and less over the cheek (Larsen et al. 2000).

After reviewing relevant literature we hypothesize that music associated with negative emotions will cause a greater physiological response when lyrics are present, but music associated with positive emotions will cause greater physiological responses when lyrics are absent. In order to study these responses, we tried to determine which physiological measurements would provide us with clear data of emotional responses to a given stimulus. Besides EEG recordings, it has been found that distinct patterns of cardiorespiratory activity are also associated with basic emotions (Rainville et al, 2005). Therefore, for the purposes of our study, we will be recording not only electroencephalograms (EEG) but measuring heart and

respiration rates as well, as these have all been found to be reliable indicators of psychophysiological changes in response to emotional stimuli, particularly musical emotion (Baumgartner, et. all, 2005).

From our literature review and discussion, we expect to see a greater physiological response to calm or ‘sad’ music with lyrics than without, and to arousing or ‘happy’ music without lyrics than with lyrics. We are interested in seeing how those two groups (calm music with lyrics and arousing music without lyrics) compare to one another and whether we see different ranges of response in some people than in others, i.e., if there are some people who demonstrate a higher physiological or emotional sensitivity to certain kinds of music than others. This would have numerous implications in everyday life, from choosing what music to listen to while driving or exercising, to music companies targeting specific audiences with certain types of music based on the physiological responses that they evoke.

Methods and Materials

In this experiment we recorded and analyzed EEG, respiratory rate, and pulse to test changes in participants’ physiological states while listening to various types of music. There were a total of ten participants, six female and four male. To eliminate the need to replicate the experiment multiple times on each participant, the EEG, respiratory rate and pulse were all tested at the same time. To test the respiration rate, each participant was fitted with a BIOPAC respiratory transducer placed tightly under the armpits and above the nipples with the sensor connected to the BIOPAC systems unit on the computer. To measure the pulse, a pulse oximeter was used and clamped onto the participants’ pointer finger with the pulse displayed on the pulse

oximeter itself. The pulse was recorded manually every ten seconds to obtain enough data on each participant. Six EEG electrodes were used to measure brain waves from the frontal lobe: two electrodes placed above the eyebrows, two electrodes placed above the first two and two ground electrodes placed behind their respective ears. The electrodes were connected to a BIOPAC Systems unit on a different computer as the respiratory transducer to measure both respiration and EEG at the same time. Each participant was instructed to close their eyes and given 60 seconds to relax and acclimate to the equipment. After the relaxation time, baseline data for each of the physiological variables was taken to later be compared to the experimental data. Each participant listened to four sound bits, each lasting 120 seconds: one fast, upbeat song with lyrics, the same song without lyrics, one slow, calm song with lyrics and again, the same one without lyrics. To reduce biases that might arise from personal preferences, we chose from several different genres of music including rock, country, rap and pop. Additionally, a 60 second break was given to each participant between the upbeat and calm music segments, in order to minimize possible skewing of the physiological measures arising from one or the other type of music.

We analyzed the data obtained from the BIOPAC system for EEG and respiratory rate as well as from the pulse oximeter. The average frequency and wavelength of the EEG from the baseline measurement was compared to that from each of the four song sections: fast song with lyrics; fast song without lyrics; slow song with lyrics; slow song with lyrics. The average pulse and the average breaths (recorded every ten seconds per song section for the pulse and breaths per song section for respiration) were compared to the baseline of each participant. This data was organized into a spreadsheet and compared to determine the effect of lyrics in music on emotion.

Results

The average baseline BPM (beats per minute) for all ten subjects was 75 BPM. The greatest changes in heart rate occurred listening to the slow song with lyrics with an average change of -0.32 BPM while the lowest change in heart rate occurred listening to the slow song without lyrics with an average change of +0.04 BPM (Table 1). The fast song with lyrics and fast song without lyrics were in between the slower songs with average changes of +0.13 and -0.49 BPM respectively. Songs with lyrics had an average change of 0.08 BPM while the average change for the songs without lyrics was -0.40 BPM. Fast songs had an average change of -0.18 BPM and slow songs had an average change of -0.14 BPM.

Respiration rate changed the greatest from baseline data during the fast songs with an average difference of +1.78 breaths during the fast song with lyrics and +1.83 during the fast song without lyrics (an average of +1.81 collectively) while the slow songs recorded an average change of +0.77 and -0.26 breaths respectively with an average of +0.25 breaths collectively (Table 1). As a group, songs with lyrics showed a larger increase in breaths with an overall average increase of +1.27 breaths compared to +0.79 during songs without lyrics. The greatest change in respiration depth occurred with the fast song with lyrics (-0.13), while the other songs had similar changes in depth (Figure 2). These differences seen in respiration rate and depth were not statistically significant due to overlapping error bars (Figures 4 & 5). The greatest changes, seen by EEG, in mean amplitude of alpha and beta waves of the the right hemisphere occurred with slow music with lyrics. Slow music without lyrics also had a large change occur. Both types of slow music had significantly greater changes in amplitude than the two fast categories (Figure 7). In the fast music categories there was greater change without lyrics, but this change was not

significantly different from that with lyrics (Figure 7). In the left hemisphere fast music without lyrics had significantly greater changes in amplitude than with lyrics. Slow music with lyrics had significantly greater changes in amplitude than without lyrics (Figure 6).

Discussion

We hypothesized that music associated with negative emotions will cause a greater physiological response when lyrics are present. Our data suggests that songs without lyrics have a larger effect on heart rate and that softer slower songs have a greater effect on EEG readings . However the respiration data was not significant enough to add to our conclusions, and there were no significant differences in sad songs vs. fast songs in heart rate. Additionally there was no significant difference in data when comparing lyrics to no lyrics in EEG recordings. Heart rate deviates more for songs without lyrics over songs with lyrics, which disproves this hypothesis, however, the difference between the data was not overwhelming (differences of less than 1%).

Our second hypothesis of fast songs without lyrics having a large impact on physiological variables was not fully supported in our data. Although heart rate did deviate more during songs without lyrics and respiration deviated more during faster songs, both results were too small to be significant. It had been previously found that arousing music increased respiration rate more than calm music (Iwanaga, 1999). It had also been previously found that lyrics detracted from the emotional response in happy music, but enhanced the emotional response with sad music (Syed 2005). This disagrees with our results.

Respiratory rate and depth also displayed no significant difference in the change from baseline among the four songs. There were slight differences in that the arousing music had greater change in respiration rate than the calm music, which was expected as shown in Iwanaga's study in 1999. Also slow music with lyrics had a slightly greater change in respiration

rate than without lyrics. This agrees with our hypothesis and with Syed's study(2004). However, these differences are not significant.

A large contributor to our inconclusive results was the sample size. Each of our subjects participated in our study for about 25 to 30 min which allowed us to only tests ten subjects Also a contributing factor to the increased error may have been the fact that we collected data on three different days, and on each of those days a different EEG monitor, respiratory transducer, and pulsometer were used. It was impossible to ensure that we used the same equipment each day. Lastly, the testing room we used was quite noisy and this background noise may have caused some physiological changes itself, contributing to error.

EEG data of the right hemisphere also showed no statistically significant difference in the change in amplitude of alpha and beta waves among lyric and non-lyric conditions. Usually, alpha waves predominate with wakeful relaxation while beta waves are more associated with day to day wakefulness (Westminster Psychology 2013). There was a significant difference in the change of amplitude among fast and slow songs overall. This implies that in the right hemisphere lyrics do not have a significant effect on amplitude of brain waves, rather the type of music or melody affect the right hemisphere. In the left hemisphere there were significant differences among lyric and non-lyric conditions. Fast songs without lyrics had significantly greater changes in amplitude than with lyrics, and slow songs with lyrics had significantly greater changes in amplitude than without lyrics. This is in agreement with our hypothesis and with the results from Syed's 2005 study, suggesting that lyrics have a large effect on brain waves in the left hemisphere.

There were slight differences in physiological changes, including pulse, respirations, and right hemisphere brain wave amplitude, among our four conditions, but most of these differences

were not statistically significant. This infers that lyrics did not have a significant effect on the physiological response of the subjects. The only variable that showed significant differences in change from baseline was brain wave amplitude in the left hemisphere and heart rate for lyrics. This implies that emotion of the song has important in responses in the left hemisphere only. These are very mixed results. This could simply have been due to the fact that our experiment did not include a large enough sample size for an effect to be seen. Thus, a further area of research could be to repeat our study with a much larger sample size. Other possible areas of further study could be in investigating different parts of music other than lyrics and the effects they have on physiological response. For example, the speed of the melody or each individual instrument sound making up the melody.

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Acknowledgements

We would like to thank the University of Wisconsin-Madison for allowing us to use their facilities and resources to conduct and complete our research. We would also like to thank Dr. Andrew Lokuta and the Physiology 435 teaching assistants for their help and guidance throughout the research process. We are funded by the University of Wisconsin-Madison Physiology Department.

Tables

	Fast w/lyrics	Fast w/o lyrics	Slow w/ lyrics	Slow w/o lyrics
Average change from baseline BPM	0.1267	-0.4856	0.04203	-0.3222
Average percent change (BPM) from baseline	0.1688%	-0.6469%	0.0560%	0.4292%
Average change in respiration rate from baseline	1.773	1.839	0.77	-0.264
Average percent change in respiration rate from baseline	7.135%	7.320%	3.073%	-1.026%
Average change in depth of breath from baseline	-0.1284	-0.0171	0.0461	-0.0630

Table 1: A table of the average change and percent change in heart rate, respiration rate, and respiration depth recorded during the four different music conditions.

	Fast w/ lyrics	Fast w/o lyrics	Slow w/ lyrics	Slow w/o lyrics
Average percent change from baseline maximum amplitude	108.10	45.01	41.11	40.99
Average percent change from baseline minimum amplitude	0.56	2.45	25.87	33.51
Average percent change from baseline mean amplitude	6.37	13.89	10.45	4.60

Table 2: A table of the average percent changes in amplitude of alpha and beta waves from baseline data. Recordings were made in the left hemisphere.

	Fast with lyrics	Fast without lyrics	Slow with lyrics	Slow without lyrics
Average percent change from baseline maximum amplitude	66.83	68.29	-2.63	36.86
Average percent change from baseline minimum amplitude	132.46	78.20	87.33	105.18
Average percent change from baseline mean amplitude	-190.47	-360.49	-560.59	-556.43

Table 3: A table of the average percent change in amplitude of alpha and beta waves from baseline data. Recordings were made in the right hemisphere.

Figures

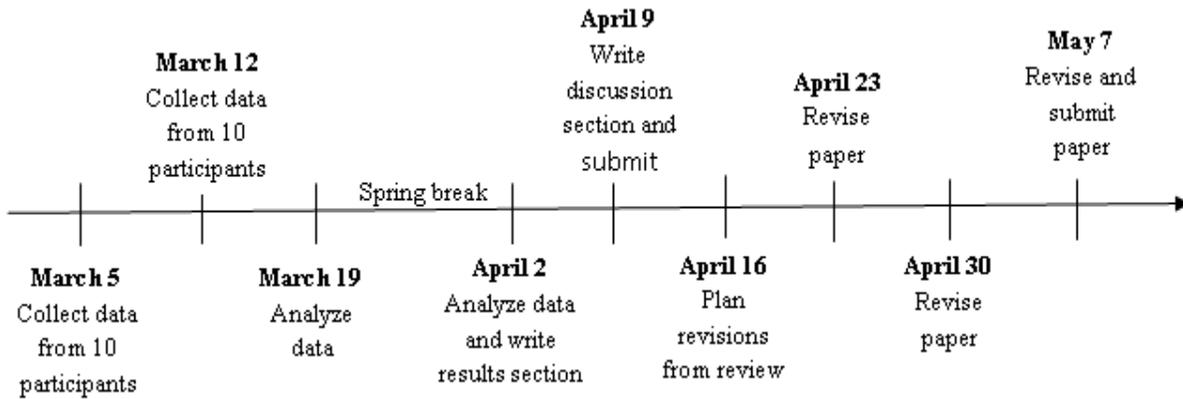


Figure 1: A timeline dating progress of our experiment from data collection to final submission.

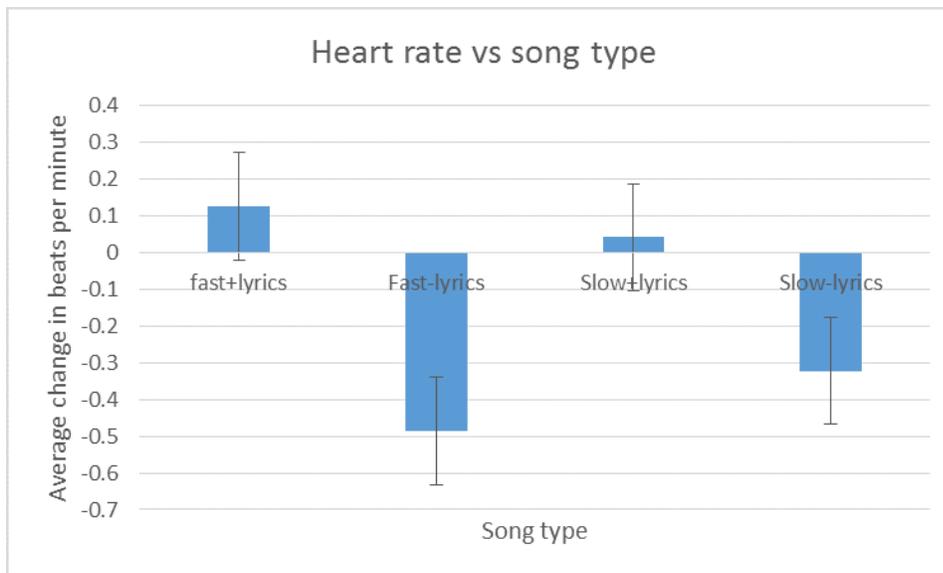


Figure 2: A graph of the average change in heart rate vs. the type of music. Standard error bars are displayed.

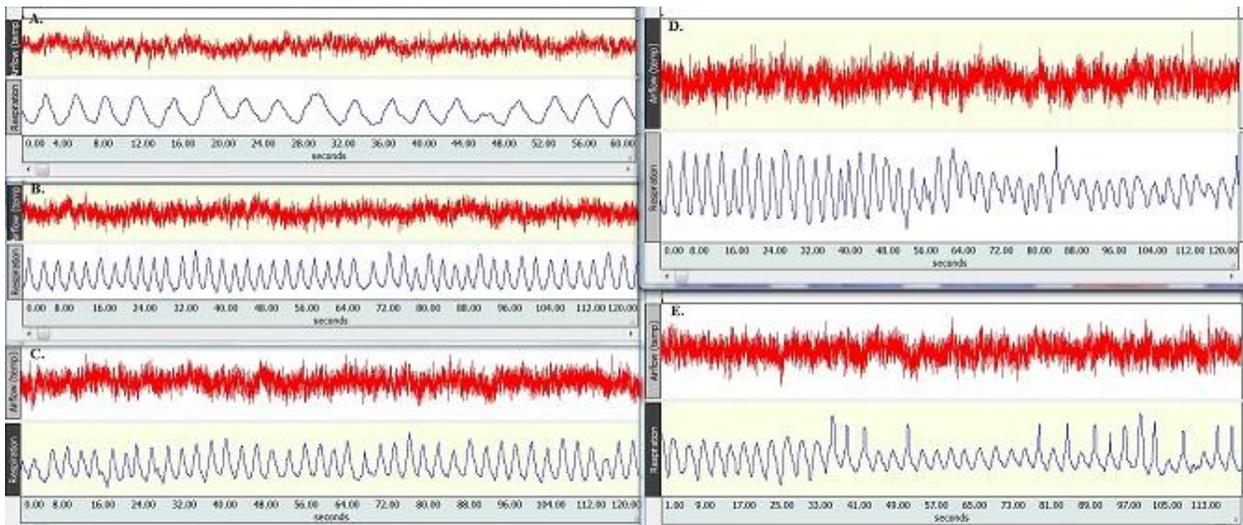


Figure 3: A graph of the raw respiration data taken from one female subject. A). Respiration rate at baseline with no music playing. B). Respiration rate during slow song without lyrics. C). Respiration rate during slow song with lyrics. D). Respiration rate during fast song with lyrics. E). Respiration rate during fast song without lyrics.

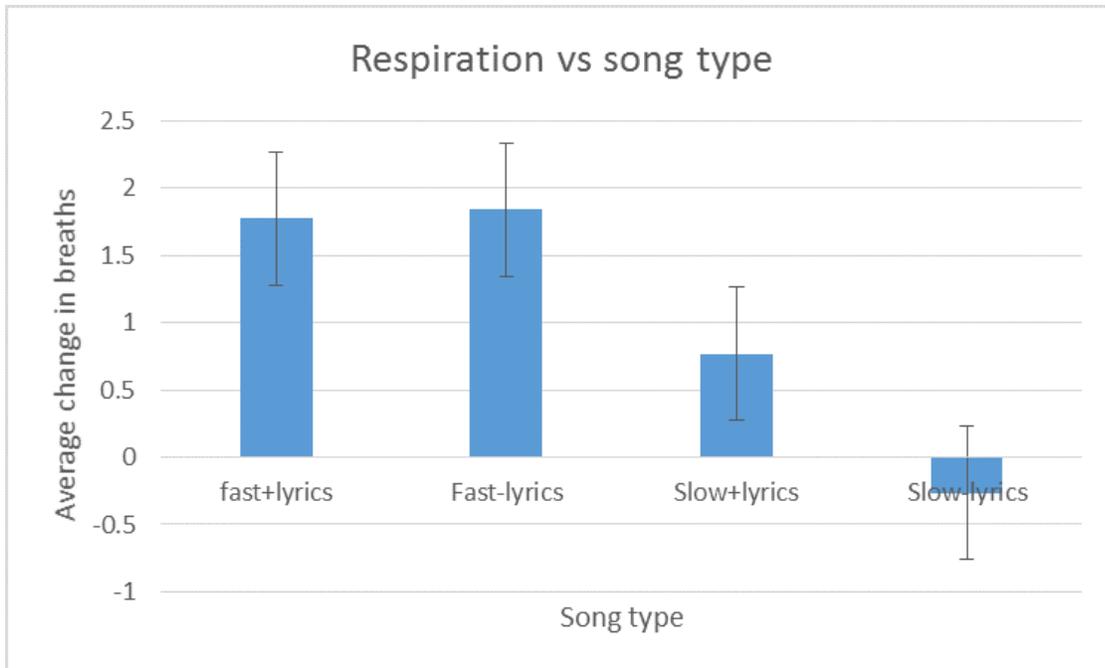


Figure 4: A graph showing the average change in breaths per song compared to the baseline.

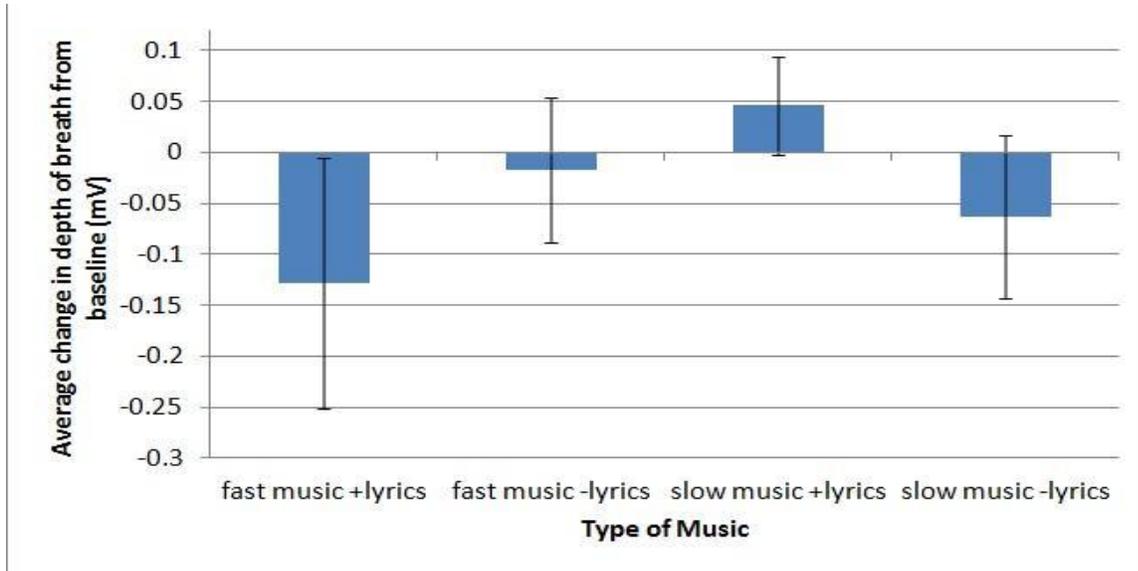


Figure 5: A graph of the average change in respiration depth vs. the type of music. Standard error bars are displayed.

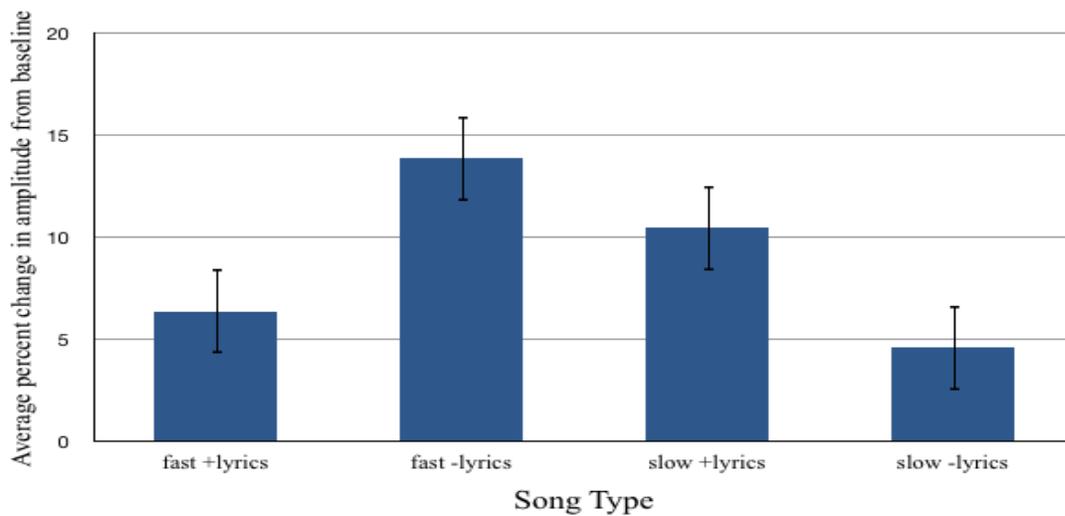


Figure 6: A graph of the average percent change in amplitude of alpha and beta waves in the left hemisphere. Standard error bars are displayed.

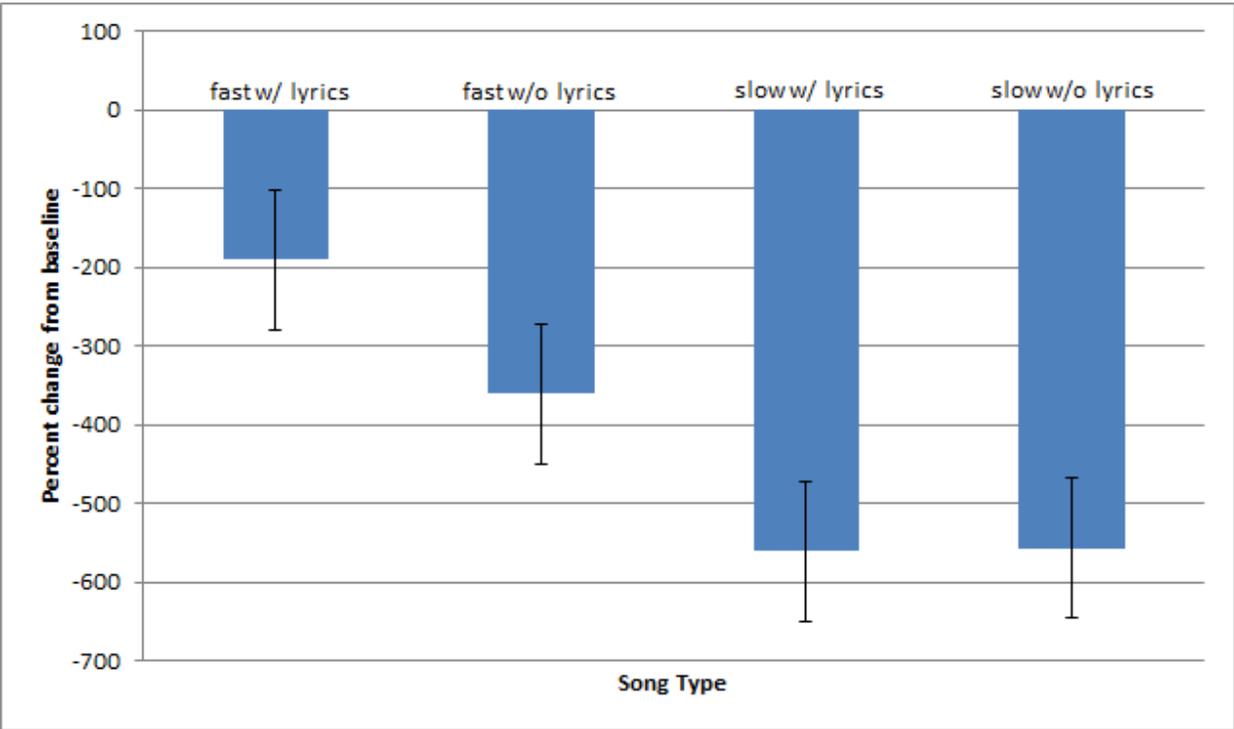


Figure 7: A graph showing the percent change from the baseline mean amplitude of alpha and beta waves in the right hemisphere. Standard error bars are displayed.

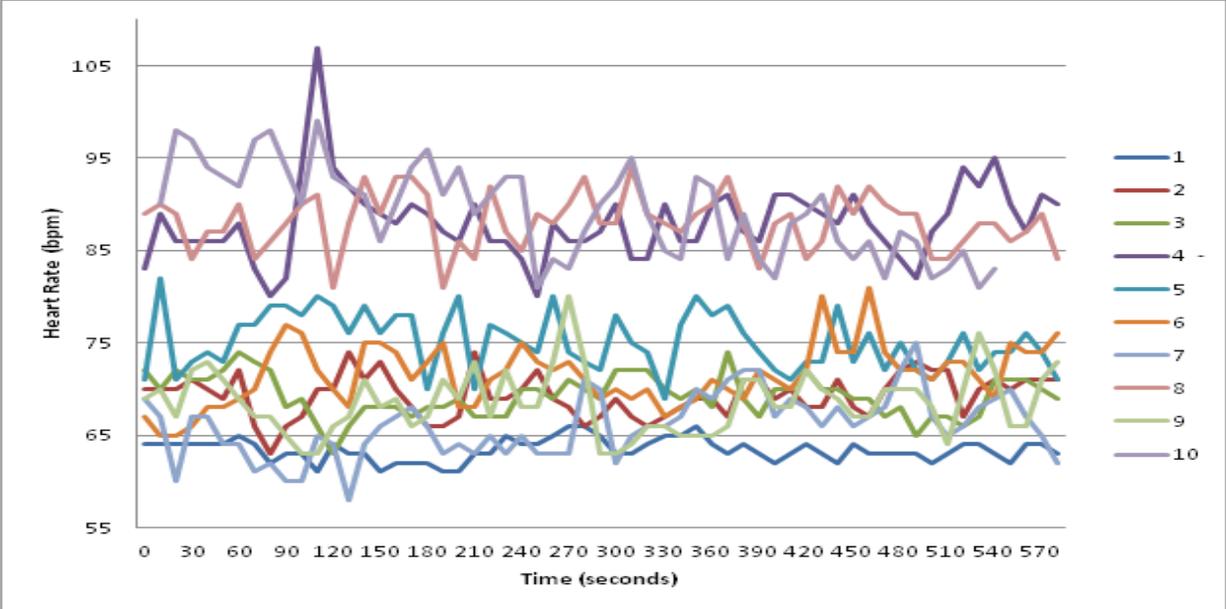


Figure 8: A graph showing individual heart rate fluctuations during the recording period. Subjects are indicated by specific line colors shown on the right side of the graph.

Appendix

Songs and Lyrics:

1. "Someone like you," Adele

I heard that you're settled down
That you found a girl and you're married now.
I heard that your dreams came true.
Guess she gave you things I didn't give to you.

Old friend, why are you so shy?
Ain't like you to hold back or hide from the light.

I hate to turn up out of the blue uninvited
But I couldn't stay away, I couldn't fight it.
I had hoped you'd see my face and that you'd be reminded
That for me it isn't over.

Never mind, I'll find someone like you
I wish nothing but the best for you too
Don't forget me, I beg
I remember you said,
"Sometimes it lasts in love but sometimes it hurts instead,
Sometimes it lasts in love but sometimes it hurts instead"

You know how the time flies
Only yesterday was the time of our lives
We were born and raised
In a summer haze
Bound by the surprise of our glory days

I hate to turn up out of the blue uninvited
But I couldn't stay away, I couldn't fight it.
I'd hoped you'd see my face and that you'd be reminded
That for me it isn't over.

Never mind, I'll find someone like you
I wish nothing but the best for you too
Don't forget me, I beg
I remember you said,
"Sometimes it lasts in love but sometimes it hurts instead."

Nothing compares
No worries or cares
Regrets and mistakes

They are memories made.
Who would have known how bittersweet this would taste?

Never mind, I'll find someone like you
I wish nothing but the best for you too
Don't forget me, I beg
I remember you said,
"Sometimes it lasts in love but sometimes it hurts instead."

Never mind, I'll find someone like you
I wish nothing but the best for you too
Don't forget me, I beg
I remember you said,
"Sometimes it lasts in love but sometimes it hurts instead,
Sometimes it lasts in love but sometimes it hurts instead."

2. "Thrift Shop," Macklemore

Hey, Macklemore! Can we go thrift shopping?

What, what, what, what... *[many times]*

Bada, badada, badada, bada... *[x9]*

[Hook:]

I'm gonna pop some tags
Only got twenty dollars in my pocket
I - I - I'm hunting, looking for a come-up
This is really awesome

[Verse 1:]

Nah, walk up to the club like, "What up? I got a big !"
I'm so pumped about some s*** from the thrift shop
Ice on the fringe, it's so damn frosty
That people like, "Damn! That's a cold ass honkey."
Rollin' in, hella deep, headin' to the mezzanine,
Dressed in all pink, 'cept my gator shoes, those are green
Draped in a leopard mink, girls standin' next to me
Probably shoulda washed this, smells like R. Kelly's sheets
(Piiissssss)
But s***, it was ninety-nine cents! (Bag it)
Coppin' it, washin' it, 'bout to go and get some compliments
Passin' up on those moccasins someone else's been walkin' in
But me and grungy man
I am stuntin' and flossin' and
Savin' my money and I'm hella happy that's a bargain,

I'ma take your grandpa's style, I'ma take your grandpa's style,
No for real - ask your grandpa - can I have his hand-me-downs? (Thank you)
Velour jumpsuit and some house slippers
Dookie brown leather jacket that I found diggin'
They had a broken keyboard, I bought a broken keyboard
I bought a skeet blanket, then I bought a kneeboard
Hello, hello, my ace man, my Mello
John Wayne ain't got nothing on my fringe game, hell no
I could take some Pro Wings, make them cool, sell those
The sneaker heads would be like "Aw, he got the Velcros"

[Hook x2]

[Verse 2:]

What you know about rockin' a wolf on your noggin?
What you knowin' about wearin' a fur fox skin?
I'm digging, I'm digging, I'm searching right through that luggage
One man's trash, that's another man's come-up
Thank your granddad for donating that plaid button-up shirt
'Cause right now I'm up in her stuntin'
I'm at the Goodwill, you can find me in the (Uptons)
I'm not, I'm not sick of searchin' in that section (Uptons)
Your grammy, your aunty, your momma, your mammy
I'll take those flannel zebra jammies, second-hand, I rock that
The built-in onesie with the socks on that
I hit the party and they stop in that
They be like, "Oh, that Gucci - that's hella tight."
I'm like, "Yo - that's fifty dollars for a T-shirt."
Limited edition, let's do some simple addition
Fifty dollars for a T-shirt - that's just some ignorant s***
I call that getting swindled and pimped
I call that getting tricked by a business
That shirt's hella dough
And having the same one as six other people in this club is a hella don't
Peep game, come take a look through my telescope
Tryna get girls from a brand? Man you hella won't
Man you hella won't

(Goodwill... poppin' tags... yeah!)

[Hook]

[Bridge:]

I wear your granddad's clothes
I look incredible

I'm in this big ass coat
From that thrift shop down the road
I wear your granddad's clothes (damn right)
I look incredible (now come on man)
I'm in this big ass coat (big ass coat)
From that thrift shop down the road (let's go)

[Hook]

Is that your grandma's coat?

3. "Sound of Madness," Shinedown

Yeah, I get it,
You're an outcast.
Always under attack.
Always coming in last,
Bringing up the past.
No one owes you anything.
I think you need a shotgun blast,
A kick in the ass,
So paranoid. . .
Watch your back!!

Oh my, here we go...

Another loose cannon gone bi-polar
Slipped down, couldn't get much lower.
Quicksand's got no sense of humor.
I'm still laughing like hell.
You think that by crying to me
Looking so sorry that I'm gonna believe,
You've been infected by a social disease.
Well, then take your medicine.

[Chorus:]

I created the Sound of Madness.
Wrote the book on pain.
Somehow I'm still here,
To explain,
That the darkest hour never comes in the night.
You can sleep with a gun.
When you gonna wake up and fight... for yourself?

I'm so sick of this tombstone mentality,
If there's an afterlife,
Then it'll set you free.

But I'm not gonna part the seas
You're a self-fulfilling prophecy.
You think that crying to me,
Looking so sorry that I'm gonna believe,
You've been infected by a social disease.
Well, then take your medicine.

[Chorus]

I created the Sound of Madness.
Wrote the book on pain.
Somehow I'm still here,
To explain,
That the darkest hour never comes in the night.
You can sleep with a gun.
When you gonna wake up...
When you gonna wake up and fight...

[Chorus]

When you gonna wake up and fight... for yourself? *[x3]*

4. "Back at One," Brian McKnight

It's undeniable... that we should be together...
It's unbelievable how I used to say that I'd fall never
The basis is need to know, if you don't know just how I feel,
Then let me show you now that I'm for real...
If all things in time, time will reveal...
Yeah...

One... you're like a dream come true...
Two... just wanna be with you...
Three... girl it's plain to see... that your the only one for me...
Four... repeat steps one through three...
Five... make you fall in love with me...
If ever I believe my work is done... then I start Back at One (yeah)

So Incredible... the way things work themselves out...
And all emotional, once you know what it's all about babe...
And undesirable... for us to be apart...
Never would of made it very far...
Cause you know that you've got the keys to my heart
Cause...

One... you're like a dream come true

Two... just wanna be with you
Three... girl it's plain to see... that your the only one for me
Four.. .repeat steps one through three
Five... make you fall in love with me
If ever I believe my work is done... then I start Back at One.....

Say farewell to the dark of night... I see the coming of the sun...
I feel like a little child... whose life has just begun...
You came and breathed new life
Into this lonely heart of mine...
You threw out the life line... just in the Nick of Time.....

One... you're like a dream come true
Two... just wanna be with you
Three... girl it's plain to see... that your the only one for me... girl and...
Four... repeat steps one through three
Five... make you fall in love with me
If ever I believe my work is done... then I start Back at One.

Pilot Study

	breaths/120 sec	depth of breath (mV)
Baseline	9	1.78
favorite song with lyrics	18	2.49
Favorit without lyrics	19	1.75
Least favorite with lyrics	11	1.9
Least favorite without lyrics	13	2.3

Figure 1: Respiratory data from subject 1

	breaths/120 sec	depth of breath (mV)
Baseline	17	0.26
favorite song with lyrics	37	0.62
Favorit without lyrics	36	0.28
Least favorite with lyrics	35	0.64
Least favorite without lyrics	34	0.3

Figure 2: Respiratory data from subject 2

	breaths/120 sec	depth of breath (mV)
Baseline	8	3.26
favorite song with lyrics	22	2.71
Favorit without lyrics	28	0.84
Least favorite with lyrics	17	2.89
Least favorite without lyrics	22	2.48

Figure 3: Respiratory data from subject 3

	Favorite song w/lyrics	Favorite song w/o lyrics	Least Favorite song w/lyrics	Least favorite song w/o lyrics
Change from average baseline (BPM)	1.71	1.15	-0.315	0.198
Percentage change from average baseline	2.61%	1.75%	-0.48%	.030%

Figure 4: Heart rate data

	Max L	Max R	Min L	Min R	Mean L	Mean R
Baseline	210.1	58.54	419.94	-500	-4.85	5.18
Favorite(Lyrics)	108.85	176.35	-95.57	-93.6	-2.92	-2.3
Favorite (Inst.)	166.75	201.92	-135.28	-334.7	-2.3	-2.96
Least Favorite (Lyrics)	305.89	167.38	-286.52	-231.87	0.312	-5.47
Least Favorite (Inst.)	500	418.06	-500	-500	-0.56	-2.92

Figure 5: EEG Data for Subject 1 comparing maximum, minimum, and mean amplitudes(in microvolts) between left and right hemispheres of the brain.

	Max L	Max R	Min L	Min R	Mean L	Mean R
Baseline	499.98	499.98	-500	-500	-23.01	45.28
Favorite(Lyrics)	499.98	499.98	-500	-431.58	-2.07	4.82
Favorite (Inst.)	499.98	499.98	-500	-175.99	-12.89	12.01
Least Favorite (Lyrics)	253.86	152.82	-352.69	-171.63	2.82	-8.48
Least Favorite (Inst.)	279.56	-352.69	-463.53	-166.07	1.19	-9.12

Figure 6: EEG Data for Subject 2 comparing maximum, minimum, and mean amplitudes(in microvolts) between left and right hemispheres of the brain.

	Max L	Max R	Min L	Min R	Mean L	Mean R
Baseline	99.71	55.45	-101.39	-69.61	3.81	-4.18
Favorite(Lyrics)	88.81	94.54	-46.4	-44.02	0.99	-0.39
Favorite (Inst.)	416.47	93.71	-402.88	-51.48	-0.09	1.03
Least Favorite (Lyrics)	325.5	499.98	-499.63	-31.25	-1.41	8.08
Least Favorite (Inst.)	68.84	66.96	-42.66	-42.92	0.04	0.96

Figure 7: EEG Data for Subject 3 comparing maximum, minimum, and mean amplitudes(in microvolts) between left and right hemispheres of the brain.