ABSTRACT

A NEW AGE OF FILM MUSIC: EMOTIONAL RESPONSES TO MIDI MOCKUPS VERSUS ORCHESTRAL RECORDINGS

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Music software is becoming advanced enough to make it difficult for the average person to tell the difference between a MIDI mockup and a recording of an orchestra. This study compares the emotional responses subjects have to electronically created recordings to the emotional responses subjects have to orchestral recordings. Little research has been done on this subject. I hypothesized that the two recordings would communicate the same emotions, but the live recordings would create more emotional intensity. 65 subjects between the ages of 18 and 24 from various musical backgrounds were tested. They listened to both types of recordings of three pieces (six recordings total). They filled out a survey using the GEMIAC emotional intensity checklist to record which emotions they felt and how much they felt each emotion. The data from each MIDI recording was compared with the data from the orchestral recording of the same piece. The music communicated the same feelings and approximately the same intensity of feeling regardless of type of recording. This result was the same for each piece. This suggests that MIDI mockups are as effective at communicating emotions as orchestral recordings.
I would like to thank everyone on my thesis committee. I would have been lost without their expertise, connections, and encouragement. I would like to thank the composers John Hayward and Matthew J. Webster who gave me permission to use their music for this research. Lastly, thank you to Liam Abbot for helping me analyze and organize my findings.
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**Introduction:**

Music has an important role in visual storytelling. The plentiful research has been done on the role of emotions and music in film proves that music contributes a lot to storytelling in visual media. Music has the power to inform audiences of the way characters on screen are feeling (Tan, 2007), help them make moral judgements about actions taken on screen (Stephens, 2020), convey important plot elements (Kuchinke, 2013), and help them connect emotionally to the story.

This musical communication primarily takes place through influencing the emotions of the audience. There are many musical elements that can be manipulated to affect the emotions of an audience. Composers carefully choose between different instrumentation, keys, tonalities, tempos, and many other things to create a certain atmosphere for a scene. Another technique film composers use is creating melodies that refer specifically to certain emotions. This technique was first introduced by Richard Wagner in the 19th century. He called these melodies Leitmotifs and used them to refer to certain characters, themes, and emotions to increase the storytelling capabilities of his scores. Composers often use the Leitmotif in their film scores to bolster the story-telling and create meaningful connections. For example, John Williams is famous for writing melodies for each of his characters. In films like Harry Potter, Star Wars, and Indiana Jones, these melodies are used often as a storytelling device. One of the most famous themes from Star Wars is the “Imperial March” theme Williams wrote for Darth Vader. This theme is used to suggest the appearance of that character, add drama to his time on screen, and create a
greater emotional connection to that character. Star Wars fans can immediately recognize this character from the music alone.

A movie that uses a melody to represent love is Pride and Prejudice (2005), composed by Dario Marianelli. Marianelli includes that theme in scenes where the director wants the audience to feel particularly inspired and romantic. At one point, this theme is played by the main character on the piano, and it returns to suggest the love between Elizabeth Bennet and Mr. Darcy. This theme transforms scenes picturing close ups of hands and longing looks into the distance into some of the most iconic romance moments of all time. A musical score that lacks this sort of emotionally influential music can make a movie much less moving and enjoyable, and a movie with a weak plot can be bolstered by good musical writing.

Traditionally, movie scores are performed by a full orchestra, recorded, and edited into the film. The video game industry, on the other hand, has been using electronically created scores since their creation. In the early days of Nintendo, for example, they used “8 bit music”, named after the 8-bit sound processors that early gaming consoles used. These pieces of music have no dynamics, phrasing, or realistic sounding orchestration, yet that has not kept certain video game scores from becoming very popular. The “Ground Theme” from Nintendo’s Super Mario Bros is perhaps the most iconic example of this. Koichi Kondo, the composer of this piece, was always particularly interested in 8 bit music. He recalls often playing arcade games specifically for the music, "because they were the only place where you could find the kind of sound creation I was looking for." Obviously, many other people shared his love of the 8-bit sound. Kondo was on the Billboard ringtone charts for 125 weeks (Kohler, 2022).
However, that game is not trying to communicate a story, unlike films. Have video games with grand, emotional stories used electronic recordings as their final scores? Yes, and they have been very successful at communicating their stories. One example of this is Final Fantasy XII. It was released on the PlayStation 1 in 1997. It has a compelling story with well developed characters, much like a TV show does. It was hugely popular at the time, and continues to be played in its original form to this day. It has a score that is over 4 hours long. The music was written with an orchestra in mind, but it is clear upon listening to the soundtrack that the instruments are music samples, not live musicians. That did not stop this game’s story from successfully connecting with its audience. The music was also beloved. The original score was, and even is, still listened to on its own.

The score of the game Undertale, by Toby Fox, is a recent example of electronically created music used to tell a story. It was released in 2015 by an independent creator, Toby Fox, and became a massive success, selling nearly 1.5 million copies to this date. This game also has a huge, emotional story, and it tells that story through 8-bit graphics and electronic music. This game has touched millions of people, and the score became very popular even among those who had not played the game. Many of the songs on the soundtrack have been streamed over 10 million times on Spotify.

From these examples, it is clear that electronic music can be used to tell stories. This doesn’t mean that these scores would not have been more emotionally effective if they were orchestrated. When Final Fantasy VII was rebooted in 2021, the original score was arranged for
and recorded by an orchestra. Even the soundtrack of Undertale has been played by several orchestras around the world. Are these versions of the scores more emotionally moving?

One could argue that the synthetic sounding music of Mario, Undertale, and Final Fantasy VII suit the retro graphics of those games, but that those same sounds would not work for a blockbuster movie. Electronic music might not be a viable option for film.

Before the invention of computers, the only way to record a score was to hire an orchestra to play it. However, as computers became more and more accessible in the 80s, musical notation software began to develop (Byram-Wigfield, 2022). In the early days, both computers and notation software were rather expensive, and the music samples that were available sounded synthetic. Even up until very recently, MIDI recordings were a poor imitation of a real orchestra. The instrument samples were unrealistic and it was impossible to control dynamics and phrasing. In the film industry, these MIDI mockups\(^1\) were only used to get an idea of the way harmonies sounded together. They are useful to catch mistakes and make last minute changes before passing the score on to an orchestra to record.

However, with the rise of the digital age, musical software is both more accessible and produces more realistic sounding samples. For example, the notation software Finale cost $750 when it first released on the Macintosh computer in the mid 80s, and that doesn’t even account for inflation. Now, it costs $99 and is much more advanced. There are also several free notation programs, such as Musescore and Noteflight.

\(^1\) For the purposes of this paper, orchestra recordings will be called live recordings, and digital recordings will be called MIDI mockups.
Along with notation software, composers use Digital Audio Workstations to produce recordings of their music. Websites like Midi Film Scoring, Waveform, and many others are highly accessible and inexpensive DAWs. These options are certainly more accessible than hiring an orchestra to learn and record a score.

Most movies and TV shows are still using orchestras to record their scores, but many smaller composers are publishing their music using MIDI mockups as their final version. For example, Cody Fry is a famous songwriter who uses orchestration in his songs. To publish his first few albums, he used online software to create the sound of an orchestra. However, even among independent composers like him, this is considered an inferior method to having a live orchestra record your music. Cody Fry became famous through his TikTok account. He received a Grammy nomination in 2021. Due to his newfound fame, he was able to get his music recorded by a 60 piece orchestra. He was very excited to be able to have his music recorded this way. When commenting on his love for orchestral music, he said, "I think the most amazing things humans do are the things that we do together in large groups. When else in music do you have 60 people in the same room all working together to make the same piece of art simultaneously? There is an energy that only happens in that setting."

There is an unmistakable energy to listening to music live. Is that energy reflected in a recording? According to my research, no study has been done to compare MIDI mockups to live recordings up to this point. This is most likely due to the only very recent development in musical notation software, and the assumption that music is inherently better when recorded by live musicians. Up until a few years ago, there was no question that live recordings sounded
better. MIDI mockups usually sounded flat, unrealistic, and lacked nuance. However, as music software improves, composers are creating more and more realistic recordings every year. They now include dynamics, tempo changes, and more realistic sounding instrumental sounds.

If MIDI mockups are proven to be as effective as live recordings, what would that mean? It might call into question the need for live orchestras to record scores for visual media. It challenges assumptions about the need for humans to be directly responsible for music for that music to be moving. In practical terms, smaller budget video games, films, and tv shows could use MIDI mockups as their scores, trusting that they are as effective as live recordings. That is why there is such a need for this research.

For MIDI mockups to have the same storytelling effectiveness as live recordings, the two recordings need to (1) communicate the same emotions and (2) create the same amount of emotional intensity. This criteria is based on all of the research I have done on music’s role in story telling as it relates to film, including Sui-lan Tan’s research on music’s effect on viewers' interpretations of film characters' emotions (2007), Jochen Steffens research on the influence of film music on moral judgements of movie scenes and felt emotions (2020), and Lars Kuchinke’s research on emotions and music from a neuroscience perspective (2013).

In this study, I compare the emotional responses of research subjects to the two types of recordings. My hypothesis is that the two recordings will communicate the same categories of emotions, but the live recordings will create more emotional intensity.
Methodology

Phase 1: Finding a Method to test Emotional Responses to Music

The first part of this process was finding what other researchers have used to measure people’s emotions when listening to music. In the past, researchers have used the more subjective method of asking their research subjects to write about their emotions in their own words. I decided not to use that method because I wanted numbers to use to more easily compare the recordings to each other.

Eduardo Coutinho and Klaus R. Schere, a Lecturer in Music Psychology at the University of Liverpool and a Professor of Psychology at the University of Geneva, conducted a study to create a list of emotions that are most commonly described by their study participants when listening to music. They created this list specifically for future use on studies on emotions and music. This method is called the GEneva Music-Induced Affect Checklist, or GEMIAC (Coutinho, 2017). It includes a list of fourteen emotions and specific instructions to rate personally felt intensity of said emotions from a scale of 1 (not at all) to 5 (very much). Figure 1 depicts the GEMIAC intensity checklist that was used.²

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² This chart was used as a reference, but the chart given to research participants was reformatted to fit a google form.
This method worked well for this study because subjects could easily quantify which emotions they were feeling and the intensity of said emotions.

**Phase 2: Pick Music**

Three criteria were put into place for the music selection process. First, this study is looking specifically at film music, so music written by film composers needed to be selected. If not actual film music, it should sound like an orchestrated film score. Second, it was decided that

<table>
<thead>
<tr>
<th>Emotional State</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>filled with wonder, amazed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>moved, touched</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>enchanted, in awe</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>inspired, enthusiastic</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>energetic, lively</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>joyful, wanting to dance</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>powerful, strong</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>full of tenderness, warmhearted</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>relaxed, peaceful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>melancholic, sad</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>nostalgic, sentimental</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>indifferent, bored</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>tense, uneasy</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>agitated, aggressive</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
the music chosen should be unrecognizable to the study participants so the emotions of the study participants would be affected only by the music, and not by the property associated with the music. Thus, the music needed to be obscure or new. Lastly, the piece needed to have a live recording and a MIDI mockup that the composer was willing to donate to the project.

It was also decided that three contrasting pieces should be chosen.

- A calm, peaceful score
- An upbeat, inspiring score
- An intense score, like something that would play over a battle

With two recordings per score, that is a total of six pieces.

After reaching out to numerous composers, two agreed to donate their music. The first is John Paul Hayward. He gave permission to use his pieces “Stormlight”, an original composition, and his cover of “Battle of the Frozen Flames” from his album *Cross Symphonic: A Symphonic Tribute to Chrono Cross*. “Stormlight” is calm and peaceful. “Battle of the Frozen Flames” is intense battle music. The other composer who contributed is Matthew J. Webster, who donated the recordings of his piece “Cassini”, which is upbeat and inspiring. These three pieces fit criteria for the pieces I needed.

**Phase 3: Finalize and Organize Materials**

One of the factors that could have affected study participants’ emotions is the order of music, therefore it was decided that the music would be played in four different orders. Because of this, four sessions were scheduled for the study. I established order for the first session and
assigned each piece a number. From there, I scrambled the order of those numbers to create a
different sequence of pieces for the other three sessions. At each session, 1) none of the
recordings for the same piece were played next to each other, and 2) the type of recording
alternated. Table 1 lists the order of pieces for the different sessions.

**Table 1**

<table>
<thead>
<tr>
<th>Session 1-1-6</th>
<th>Cassini, MIDI</th>
<th>Stormlight, Live</th>
<th>Battle, MIDI</th>
<th>Cassini, Live</th>
<th>Stormlight, MIDI</th>
<th>Battle, Live</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 2-6-1</td>
<td>Battle, Live</td>
<td>Stormlight, MIDI</td>
<td>Cassini, Live</td>
<td>Battle, MIDI</td>
<td>Stormlight, MIDI</td>
<td>Cassini, MIDI</td>
</tr>
<tr>
<td>Session 3-3-1, 6-4</td>
<td>Battle, MIDI</td>
<td>Stormlight, Live</td>
<td>Cassini, MIDI</td>
<td>Battle, Live</td>
<td>Stormlight, MIDI</td>
<td>Cassini, Live</td>
</tr>
<tr>
<td>Session 4-4-6, 1-3</td>
<td>Cassini, Live</td>
<td>Stormlight, MIDI</td>
<td>Battle, Live</td>
<td>Cassini, MIDI</td>
<td>Stormlight, MIDI</td>
<td>Battle, MIDI</td>
</tr>
</tbody>
</table>

The google form was the same for all of the sessions, so the order the pieces were played in was written down so the data could be reorganized after the study was over so each piece had the appropriate responses.

The first question on the form asked about people’s musical experience. The next six questions were formatted according to the GEMIAC: Intensity Checklist guidelines (see figure 1 and Appendix 3). The last section of the form had a place where they could put in their emails if they would like to receive compensation.

**Phase 4: Find Study Participants**
Each study participant was a Brigham Young University student between the ages of 18-24. Posters advertising the study were printed and posted on and around Brigham Young University campus. Participants were offered $10 for participating in the study. Only a few people signed up under that price, so a new price of $15 was offered. There was a QR code leading to a google form that asked the participants for their contact information as well as their level of musical experience since it was hypothesized that musical experience may affect the participants’ responses. They could choose from four options: None, 1-4 years of musical lessons, 4+ years of musical lessons, or professional musician/music major (see Appendix A).

I was hoping 89 participants signed up, but 65 people attended the study. Of those 65, 2 had no musical experience, 20 had 1-4 years of musical lessons, 26 had 4+ years of musical lessons, and 17 were music majors.

**Phase 5: Conduct Study**

I decided to conduct the study in person to have a more controlled environment. Subjects were monitored to make sure they listened to all the pieces in their entirety and were not distracted while listening to the pieces and answering questions.

There were four in-person sessions conducted in a classroom with a quality sound system. Each session lasted from between 20-30 minutes. At the beginning of each study, participants were welcomed and given instructions. First, they were told to open up a link to a google form, which was used to record their responses. They were asked to not look at anything else or perform any other activity on their device while the study was conducted. Next, I walked them through the google form and the fourteen different categories of emotions. They were told
to respond in a way that reflected how the music made *them* feel, and not how they thought the music sounded. They were also informed that some of the pieces may sound the same, but they are all different.

After instructions were given, the room was darkened to provide a space free of distractions. Cassini and Battle for the Frozen Flame are close to four minutes long, and Stormlight is around two minutes long. Because these pieces are so short, they were played in their entirety. The pieces were played one after the other, with a few minutes between examples to give subjects a chance to finish recording their emotional responses.

At the end of the sessions, study participants were thanked for their time and asked to provide an email to receive compensation.

**Phase 6: Configure Data**

The survey results were taken from the google form into a spreadsheet. Since the four survey sessions listened to the pieces in different orders, the data had to be carefully reorganized into sets so MIDI mockups and live recordings of the same piece were side by side. From there, they were put into bar graphs (see figures 2-4) so the responses to the two recordings could be compared to each other. The x-axis of the graph separates the responses into the fourteen emotional categories. The y-axis indicates the average intensity of each emotion from 1 to 5. The last graph, figure 5, shows averaged emotional intensity. To get those numbers, the results for each emotion was added together, then divided by fourteen.
Results

My hypothesis was that the two recordings would communicate the same emotions, but the live recordings would create more emotional intensity. The first part of that hypothesis was correct. As seen in figures 2-4, the same categories of emotions were felt by research subjects for each of the three pieces.

The second part of my hypothesis was incorrect. The live recordings created a slightly higher intensity of emotion than the MIDI mockups, but only in certain categories (see Appendix 2 for raw data). For example, in the results for the piece Battle for the Frozen Flame (see figure 4), which is the most intense sounding music, the MIDI recording created more emotional intensity in five emotional categories (specifically: inspired/enthusiastic, energetic/lively, powerful/strong, tense/uneasy, and agitated/aggressive).
Figure 2: Cassini

- [moved, touched]
- [enchanted, enthusiastic]
- [energetic, lively]
- [powerful, strong]
- [relaxed, peaceful]
- [melancholic, sad]
- [indifferent, bored]
- [tense, uneasy]
- [agitated, aggressive]

Categories of Emotions

Emotional intensity
Figure 3: Stormlight

- Live Recording
- MIDI Mockup

Categories of Emotion
Figure 4: Battle for the Frozen Flames

Categories of Emotion

<table>
<thead>
<tr>
<th>Emotional Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>[filled with wonder, amazed]</td>
</tr>
<tr>
<td>[moved, touched]</td>
</tr>
<tr>
<td>[enchanted, in awe]</td>
</tr>
<tr>
<td>[inspired, enthusiastic]</td>
</tr>
<tr>
<td>[energetic, lively]</td>
</tr>
<tr>
<td>[joyful, wanting to dance]</td>
</tr>
<tr>
<td>[powerful, strong]</td>
</tr>
<tr>
<td>[relaxed, peaceful]</td>
</tr>
<tr>
<td>[nostalgic, sentimental]</td>
</tr>
<tr>
<td>[indifferent, bored]</td>
</tr>
<tr>
<td>[tense, uneasy]</td>
</tr>
<tr>
<td>[agitated, aggressive]</td>
</tr>
</tbody>
</table>

Live Recording vs. MIDI Mockup
The average emotional intensity is slightly higher for the live recordings, but not enough to be statistically significant (see Table 2). In each case, the average emotional intensities of each recording are within 1% of each other.

**Table 2: Average Emotional Intensity**

<table>
<thead>
<tr>
<th>Recording</th>
<th>Emotion Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassini Live Recording</td>
<td>2.6</td>
</tr>
<tr>
<td>Cassini MIDI Mockup</td>
<td>2.55</td>
</tr>
<tr>
<td>Stormlight Live Recording</td>
<td>2.59</td>
</tr>
<tr>
<td>Stormlight MIDI Mockup</td>
<td>2.55</td>
</tr>
<tr>
<td>Battle for the Frozen Flame Live Recording</td>
<td>2.25</td>
</tr>
<tr>
<td>Battle for the Frozen Flame MIDI Mockup</td>
<td>2.24</td>
</tr>
</tbody>
</table>

Upon receiving this result, I considered if there was a difference in the music major’s responses. Their results were consistent with the other demographics (see figure 7) with one
exception: the music majors felt much more intensity of emotion when listening to the MIDI recording of Cassini than the live recording of Cassini (see figure 6). This data suggests that even the most musically educated of the subjects did not prefer the live recording of this piece.
Discussion

The data of this study suggests that MIDI mockups can tell stories just as effectively as live recordings, as they influence the same emotions and influence these emotions as intensely.

How can this be? I would assume it’s because there are few differences between the two recordings of each piece. They are hard to tell apart. I would be interested to see if subjects could tell them apart if they were told to try to pick which is which.

There were some limitations to this study. My sample size was small, and consisted of students from the same university. I am a piano performance major, which makes me biased towards live music.
This study was conducted in a medium sized room. Since MIDI mockups are not currently made to be played in a movie theater, they may not hold up against live recordings if a study was conducted there.

Although the room where the study was conducted was free of distraction, subjects may have not paid close attention to the way the music made them feel. The survey response answers are, by their nature, somewhat subjective. Some people may not have been completely accurate when describing their emotions. Some people may feel more deeply when listening to music. I addressed these problems by comparing the responses of each recording to the other. If someone’s responses had these problems, both recordings reflect that.

Much more research is needed on this subject. This study would benefit from a larger sample size and a more diverse demographic. This study would also benefit from incorporating visual media. For example, this study could be repeated with movie scenes playing along with the music. One group could be shown the movie scenes with the original music, and the other group could be shown the scene with the MIDI mockup. The participants could respond using the GEMIAC method that was used in this study. They could also be asked questions about the scene, such as how they interpreted the characters’ emotions and how much they liked the clip.

It would be interesting to find out if people from each musical background can tell the difference between a MIDI recording and a live recording, although that does not seem as applicable to visual media. Most people are not listening for the “realness” of a score when they are consuming media.
Lastly, this study should be replicated with music from blockbuster films that the subjects are familiar with. People tend to notice more details and nuance in a piece the more they listen to it. If this study was done with music that the subjects knew and loved, the results may be affected.

**Conclusion**

Based on the results of this study, MIDI mockups seem to create the same emotions and emotional intensity as live recordings. What does this mean for the future of filmmaking? Projects with a smaller budget can use a high quality MIDI mockup as their music and still have an effective and emotional film score.

As time progresses, MIDI technology will only continue to advance. While the experience of listening to a concert in person can never be replicated, it is strange to think of living in an age where a computer program will create music as realistically as human musicians. Will there still be a need for musicians in the film industry? Only time, and much more research, will tell.
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https://search.lib.byu.edu/byu/record/edsbyu.edsjsr.edsjsr.26417355


Appendix A: Information About Survey Participants

Participants were all students at Brigham Young University. They were all between the ages of eighteen and twenty-four. 65 people were surveyed. Of those 65, 2 had no musical experience, 20 had 1-4 years of musical lessons, 26 had 4+ years of musical lessons, and 17 were music majors (see figure 8).
This is the questionnaire that participants filled out to sign up for the study.

Emotions and Music Study Sign-up

Study to be conducted by Amberlee Woodhouse, a BYU school of music student

There are four sessions available. Each will take place on BYU campus. Which would you like to sign up for?

- Thursday, January 20th: 1:00-1:50
- Thursday, January 20th: 2:00-2:50
- Friday, January 21st: 2:00-2:50
- Friday, January 21st: 3:00-3:50

What type of music training have you received?

- No music lessons
- 1-4 years of music lessons
- 4+ years of music lessons
- Music Major or Professional Musician

Please provide your email below to secure your spot and receive further details about the study.

Short answer text
### Appendix B: Raw Data

**Table 2: Average Intensity for Emotion Categories**

<table>
<thead>
<tr>
<th>Emotion Category</th>
<th>Cat. #1</th>
<th>Cat. #2</th>
<th>Cat. #3</th>
<th>Cat. #4</th>
<th>Cat. #5</th>
<th>Cat. #6</th>
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<th>Cat. #10</th>
<th>Cat. #11</th>
<th>Cat. #12</th>
<th>Cat. #13</th>
<th>Cat. #14</th>
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</thead>
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<td><strong>Cassini Live Recording</strong></td>
<td>3.75</td>
<td>3.4</td>
<td>3.52</td>
<td>3.13</td>
<td>2.1</td>
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<td>3.03</td>
<td>2.73</td>
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<td>4.07</td>
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<td><strong>Stormlight MIDI Mockup</strong></td>
<td>3.66</td>
<td>2.95</td>
<td>3.72</td>
<td>3.34</td>
<td>3.29</td>
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<td>2.6</td>
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<td>2.35</td>
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<td>1.4</td>
<td>3.78</td>
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</tbody>
</table>

**Emotion Categories Legend for Table 2**

1. Filled with wonder, amazed
2. Moved, touched
3. Enchanted, in awe
4. Inspired, enthusiastic
5. Energetic, lively
6. Joyful, wanting to dance
7. Powerful, strong
8. Full of tenderness, warmhearted
9. Relaxed, peaceful
10. Melancholic, sad
11. Nostalgic, sentimental
12. Indifferent, bored
13. Tense, uneasy
14. Agitated, aggressive
Table 3: Average Emotional Intensity

<table>
<thead>
<tr>
<th></th>
<th>Average Emotional Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassini Live Recording</td>
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<tr>
<td>Cassini MIDI Mockup</td>
<td>2.55</td>
</tr>
<tr>
<td>Stormlight Live Recording</td>
<td>2.59</td>
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<tr>
<td>Stormlight MIDI Mockup</td>
<td>2.55</td>
</tr>
<tr>
<td>Battle for the Frozen Flame Live Recording</td>
<td>2.25</td>
</tr>
<tr>
<td>Battle for the Frozen Flame MIDI Mockup</td>
<td>2.24</td>
</tr>
</tbody>
</table>
Appendix C: Survey Questionnaire

Honors Thesis Study Participant Form

What is your level of musical training?

- None
- Music lessons for 1-4 years
- Music lessons for 4+ years
- Music major
- Other...
Example of form filled out for each piece.

<table>
<thead>
<tr>
<th>Feeling</th>
<th>1 - Not at all</th>
<th>2 - Somewhat</th>
<th>3 - Moderately</th>
<th>4 - Quite a lot</th>
<th>5 - Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>filled with wonder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>moved, touched</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>enchanted, in awe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>inspired, enthused</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>energetic, lively</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>joyful, wanting</td>
<td></td>
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<td></td>
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<tr>
<td>powerful, strong</td>
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<tr>
<td>full of tenderness</td>
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<tr>
<td>relaxed, peaceful</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>melancholic, sad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nostalgic, sentimental</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>indifferent, bored</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tense, uneasy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>agitated, agitated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Projected on screen in the room so subjects had a big, clear list of emotion categories

1. filled with wonder, amazed
2. moved, touched
3. enchanted, in awe
4. inspired, enthusiastic
5. energetic, lively
6. joyful, wanting to dance
7. powerful, strong
8. full of tenderness, warmhearted
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