The Sound of the Key: An Interdisciplinary study of Composition and its Impact on Musical Key Choice

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SENIOR HONORS THESIS

Submitted In Partial Fulfillment of Requirements of the College Scholars Honors Program North Central College

May 17th, 2016

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## Table of Contents

Abstract ..........................................................................................................................3  

Acknowledgements ........................................................................................................4  

Introduction ....................................................................................................................5  

Tuning Strategies ...........................................................................................................7  

Emotion and its Influence on Music Perception ............................................................11  

The Evolution of the Musical ........................................................................................13  

Methodology ..................................................................................................................16  

Results ...........................................................................................................................20  

Analysis ..........................................................................................................................46  

Conclusion/Future Work ...............................................................................................49  

References .....................................................................................................................50
Abstract

From as early as the time of men, music has played an integral role in the evolution of human culture. The American art form of the musical which emerged about a hundred years ago incorporates songs using a wide variety of keys. The overarching question that I present in my research is why different composers have written songs in certain keys, and if the predominance of certain keys has changed over time. Is a musical theatre composer’s choice of key intentional in evoking a subconscious emotional response in the audience or is it dependent on the range of the singer or instruments in the orchestra? By focusing on five different musicals spanning 1940’s to 1980’s, this research conducts an analysis of the different musical keys of the shows.
Acknowledgements

To Dr. David Schmitz, my thesis advisor, for countless hours spent in his office deciphering data and coding musical songs, for 14,000 bars of chocolate and your constant support. I could not have done this without you!

To Dr. Jonathon Kirk and F. Elizabeth Nicholson, my second reader and librarian. Thank you for your support and advice throughout the process.

To my family and friends, thank you for listening to my complaints, worries, and happiness’s tears throughout this whole process. I love each and every one of you so much!
Introduction

“A Spoonful of Sugar Helps the Medicine Go Down!” as the Sherman Brothers wrote in their hit Disney musical, “Mary Poppins”. As Mary Poppins and the Banks children sing the song the lyrics state: “A Spoonful of Sugar Helps the Medicine Go Down”. The pitch of the song goes up as the characters are singing “go down”. In an interview they gave about their writing process for the musical, the Sherman brothers (Sherman [1964] 2001) mentioned how it was very “Mary Poppins-esque” that the melody was to go up when the words were going down. Mary Poppins is the creation of PL Travers, and was adapted by the Sherman brothers to film form in conjunction with Walt Disney. She is prim, proper and strict with the children, but includes magic and fun in everything she does. For example, in singing a bedtime lullaby to the Banks children, Mary Poppins tells them to stay awake when they go to sleep (moviescenes4u 2008) This idea of an oxymoron was continuously used in a very “Mary Poppins-esque” way and was communicated throughout the musical and movie. This is one explanation as to why the composers chose to write the songs in the way that they did, but this research hopes to expand on this idea.

Composers write songs for many reasons. Mainly, composers write in order to make a living for themselves, but also they write because it is what they love to do. They have a passion for writing and hope to make a name for themselves. In writing a musical, there are many factors that may not be known to the general musical theatre-goer. The many members of the production team have their own views on the concepts for a show, and these ideas can conflict. In music composition, many outside factors are present as well. These could be the emotion that the composer is trying to evoke, the instrumentation they want to use, the vocal range of the actors, and how the song will fit into the theme/style of the show. Participating and attending countless musicals, I began to contemplate the reasons composers wrote the musicals in the way that they
This research begins by looking at some general and overarching questions: Why do composers decide to use oxymoron in their compositions? Was it a stylistic choice? Was there an emotional connection?

There are thousands of musical theatre songs that have been written: some that are well known, while others are very obscure and never make it past the first reading. Behind these songs are the creative geniuses of Broadway, the composers. And with that heartbeat and soul comes the crux of this thesis research: the emotional component that is intertwined so perfectly with musical theatre and how it influences the choices of composers. Emotions are an essential part of the human experience, and they dictate many of our actions. Emotions in a musical allow the audience to connect with whatever is occurring on stage on a more personal level. When something tragic occurs, it causes the audience members to feel sad, or a triumphant moment makes the audience members feel happy. Audiences are influenced by what they are viewing on stage and the music that they hear. Let us examine these questions more in depth: What emotional connection does music have that makes an audience feel something so strongly? Emotions play an important role in people’s lives. In feeling a personal or emotional connection to something, people are more likely to believe something is real, like a musical or a fairytale story. For example, having gone through a break-up in our own personal lives gives us a personal connection to a similar event that may be occurring on stage. While the plot of the show may also influence the emotional response of the audience, it is often the music that can more deeply influence the audience’s response.

What emotional connection does music have that makes an audience feel something so strongly? Songs consist of melody, lyrics and chord progressions written by the composer. What the audience hears also involves vocal arrangements for the actors/chorus and instrumental
arrangements for the pit musicians. Any one, or combination of these, could contribute to the audience’s emotional connection to the song. But underlying these elements is the musical key in which the composer or arranger sets the song. Is emotion related to the musical key that it is written in? Do composers write in certain keys to elicit an emotional response? Can keys even elicit emotional responses? Many musicals have gut-wrenching and powerful moments in the show, and while these songs are remembered for their lyrics, the musical keys are overlooked because they are only possibly discernable to those with perfect pitch, about 1 in 10,000 (Adams 2006). This research hopes to find a connection between emotion and the musical key of the song.

**Tuning Strategies**

For centuries, humans have been listening to music out of tune. Pre-recorded music may sound in tune to our ears, but in reality, the notes and keys are ever so slightly out of tune. Equal temperament, the current method of tuning, is where all the notes of the scale are spaced equidistant apart in terms of ratios of wavelengths. Tuning has taken many different forms over the centuries, but each is used to create the music from those periods. While the Ancient Greeks are attributed with having the first sense of equal temperament and music that was written down, the ideas of equal temperament were theorized in China prior to this. Pythagoras, a Greek mathematician, is credited with introducing the first instance of whole number ratio tunings for the octave, the perfect fourth and the perfect fifth. The Harmonists, who came after Pythagoras, created hundreds of different tuning styles, but many were lost. Another basic harmonic component of music is a triad. It consists of three different notes which are blended to create a chord. They consist of a root note, or the base of the triad, a major third above the root, and a
perfect fifth above the root (which is also a minor third above the major third) (Music Theory 2016).

Of these many methods, Pythagorean tuning survived. It focuses on ratios, and is based on differing intervals. These intervals are agreed on with consonance—which means “a simultaneous combination of tones conventionally accepted as being in a state of repose” (Dictionary.com 2016). The ratios of the sound wavelengths corresponding to the consonant intervals are:

1:1 unison
2:1 octave
3:2 perfect 5th
4:3 perfect 4th
4:1 double octave
8:1 tripe octave.

It is conjectured that these intervals of notes sound “in tune” to our brains because of these small whole number ratios. (Reginald 2003) These ratios are derived from the harmonic series, which comes from Pythagorean tuning. This series is “a series of numbers related by whole-number ratios” (Reginald 2003).

A good way to understand these ratios is by looking at string length. Take the violin for example. The violin has four strings and is tuned in perfect fifths. In thinking of these ratios as being violin strings, unison is represented by the 1/1 ratio, so the length of the entire string. The octave is played by shortening the string to half of the length by pressing down with a finger. A perfect fifth above the “open string” note is produced by pressing down with a finger to shorten the string to 2/3 of its original length.
The twelve semitones used in the so-called chromatic scale can be explained through these ratios. First, let us start with an arbitrary starting note, \( N_0 = 1 \) (where we identify the note with the string length).

Let \( N_1 \) be a perfect fifth above \( N_0 \) (so \( N_1/N_0 = 2/3 \)).

Let \( N_2 \) be a perfect fifth above \( N_1 \) (so \( N_2/N_1 = 2/3 \), and \( N_2/N_0 = 4/9 \)).

Let \( N_3 \) be a perfect fifth above \( N_2 \) (so \( N_3/N_2 = 2/3 \) and \( N_3/N_0 = 8/27 \)).

This sequence of perfect fifths is continued until you arrive at a double/triple/quadruple/…… octave above the starting pitch. Since perfect fifths come from \( \frac{2}{3} \) ratios and octaves come from \( \frac{1}{2} \) ratios, we arrive at the equation \( \left( \frac{2}{3} \right)^n = \left( \frac{1}{2} \right)^m \) where \( m, n \) are whole numbers. Unfortunately, this equation cannot be solved (because 2 and 3 are differing primes). However, \( \left( \frac{2}{3} \right)^{12} \approx \left( \frac{1}{2} \right)^{7} \). In other words, a sequence of 12 perfects fifths equals about 7 octaves, but not exactly. Thus we get a circle of 5ths \( N_0 \rightarrow N_1 \rightarrow N_2 \rightarrow N_3 \rightarrow \cdots \rightarrow N_{11} \rightarrow N_{12} \approx 7 \) octaves above \( N_0 \).

To get the 12 semitone chromatic scale, we take each pitch down enough octaves (by multiplying each string length by an appropriate power of two) to fit between \( \frac{1}{2} \) and 1 (from \( N_0 \) to an octave above \( N_0 \)). If we reorder these adjusted fractions from high to low (string length) i.e. low to high (pitch sound), after removing the octave differences we get

<table>
<thead>
<tr>
<th>( N_0 )</th>
<th>( N_7 )</th>
<th>( N_{12} )</th>
<th>( N_9 )</th>
<th>( N_{11} )</th>
<th>( N_4 )</th>
<th>( N_6 )</th>
<th>( N_1 )</th>
<th>( N_8 )</th>
<th>( N_3 )</th>
<th>( N_{10} )</th>
<th>( N_5 )</th>
<th>( N_{12} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2048/2187</td>
<td>16/9</td>
<td>16831/19683</td>
<td>64/81</td>
<td>131072/177147</td>
<td>512/729</td>
<td>2/3</td>
<td>4096/6561</td>
<td>16/27</td>
<td>32768/59049</td>
<td>128/243</td>
<td>524288/531441</td>
</tr>
<tr>
<td>A</td>
<td>A# = Bb</td>
<td>B</td>
<td>C</td>
<td>C# = Db</td>
<td>D</td>
<td>D# = Eb</td>
<td>E</td>
<td>F</td>
<td>F# = Gb</td>
<td>G</td>
<td>G# = Ab</td>
<td>A</td>
</tr>
</tbody>
</table>

\[ \text{A} \]
As an interesting fact, if you look at the subscripts present on the N`s they are the sequence (0,7,14,21,28,35…..) mod 12! Finally, we now give names to the scale notes more or less in alphabetical order.

While the Pythagorean tunings keeps the perfect fifths perfect, other intervals are no longer perfectly consonant (i.e. a ratio of small whole numbers). The octave (A to A) is 531441:524288 which is not exactly 1:1. The 4\text{th} (A to D) is 177147:131072 ≈ 4:3, but it is imperfect. The major 3\text{rd} (A to C#) from the triad is 81:64 ≈ 5:4 and the minor 3\text{rd} (A to C) from the triad is 19683:16831 ≈ 6:5. The major 6\text{th} (A to F#) is 27:16 ≈ 5:3 and the minor 6\text{th} (A to F) is 6561:4096 ≈ 8:5.

The dissonance in the major 6\text{th} can be illustrated on a violin, which is tuned using perfect 5\text{ths}. In playing the violin, the musician can shorten the D-string with her finger, producing an E in tune with the neighboring A string (perfect 4\text{th}). However, this will not produce a major 6\text{th} (E and G) with the neighboring G string. To see this, taking the length of the G string as 1, then open D = 2/3, open A = 4/9, and E = (4/9) x (4/3) = 16/27 ≠ 3/5.

Eventually Walter Odington set the major and minor 3\text{rds} and 6\text{ths} as the following ratios, so that the intervals would be regarded as consonant:

- 8/5 minor 6\text{th}
- 5/3 major 6\text{th}
- 5/4 major 3\text{rd}
- 6/5 minor 3\text{rd}

These ratios brought more intervals into consonance, but resulted in other intervals being out of tune.
Pythagorean tuning (based on perfect fifths) has some in-tune intervals, and many that are not. Other tunings try to get certain intervals in tune (4ths, 5ths, 3rds, 6ths) at the expense of others being out of tune. In meantone tuning, for example the 3rds and 6ths are exactly in tune therefore making the triads in tune. The 5ths are slightly flat in certain keys. This form of temperament makes almost 8 perfect scales, and scales in 4 keys that are mis-tuned. This scale is meant to make the 3rds better, thus improving all of the triads in the scale. In short, no perfect tuning is possible, but equal temperament, the tuning we currently use, allows all keys to sound equally approximately in tune.

Equal temperament is where all the consecutive notes are equidistant, specifically $\sqrt[12]{2}: 1$. Therefore, every interval, except the octave is out of tune. So, you are able to play in any major or minor key or any scale and it will sound as in tune (or out of tune) as if you played it in any other key. The out-of-tuneness inherent in the scale is spread out evenly but the out-of-tuneness is slight. Equal temperament made it essentially impossible, for the vast majority of listeners without perfect pitch, to judge the key of a piece of music only by the out-of-tuneness bias that other tunings imparted to certain keys (especially on instruments with fixed tunings such as pianos or organs). Conversely, composers were now free to write in any key - and to transpose between keys - without sacrificing (near) consonance.

**Emotion and its Influence on Music Perception**

As humans, we interact with emotion constantly. For example, happiness is associated with falling in love or eating an ice cream cone, while sadness occurs over the loss of a family member or getting a bad grade on a test. Humans are constantly experiencing a variety of emotions on daily basis, influencing the outcomes of situations. The recent Pixar movie, *Inside*
Out, examines our brain’s influence on emotions (Kluger 2015). These emotions transfer to memories and can help us remember things associated with emotion. While memories can be associated with emotion, music is also influenced by emotion. Composers use specific musical keys to elicit certain emotional responses. Major keys which sound more pleasing to the human ear are often associated with happiness and minor keys are often associated with emotions that are sad. Christian Schubart, a German composer, associated each major and minor key with an extensive description of the emotion he felt each key evoked. Being unable to find the source for this work, I do not know how Schubart made these connections to emotion. Since there is not much research that has been done on musical keys and emotion, these descriptions were used in the coding of our research.

Baroque period composers used different techniques to influence emotion in a song. Two theories emerged: “1) A theory based on musical cues, and 2) a theory based on extended musical structure” (Emotional Ornamentation 4). Musical cues appear in two different forms: acoustic or structural. Timmers and Ashley state that “Acoustic cues include speed, loudness, pitch, timbre, attack and decay of events, while structural cues include tonal mode (major or minor), melodic contour, and harmonic and melodic intervals” (5). Structural cues can be used to explain the composer’s connection to emotion in this time period. If there is tension in the piece, such as dissonance or the shift of a key, from major to minor, this can translate into different emotions for the listeners. Timmers and Ashley in their article Emotional Ornamentation studied 41 musical bars of Handel’s Sonata in G minor. Instrumentalists were instructed to play these bars with different forms of classical ornamentation. In doing so, the researchers asked respondents which emotions they associated with the ornamentation styles. Happy performances were associated with turns, loving performances were associated with
slides, and many more emotions were positively and negatively associated with appoggiaturas and other musical structures (Timmers and Ashley 20). While this research only looked at classical music and the associated emotions, we aim to extend it into the musical theatre realm.

The Evolution of the Musical

Prior to the evolution of the modern musical, there were many different performing troupes that came over to America from Europe in the late 1700’s. These troupes eventually transformed into the very popular genre of melodrama. Melodrama can be defined as “the use in drama of short musical passages to heighten emotional effect, either in alternation with or underlying spoken dialogue” (Preston 7).

This form of theatre, melodrama, presented itself in the nineteenth century and took the American theatre world by storm. These melodramas used pantomime in conjunction with underlying music. Opera then began making its way across the ocean to America. The troupes were groups of actors who performed as backups to a leading artist who was touring. They also began performing many melodramas, which had a significant emotional connection to music as well. For example, Shapiro states “instrumental music was now used to heighten ‘strong emotional moments of the play when speech was inadequate or even - as in a fight scene - realistically impossible’”. This can be noticed as an important connection to the American musical today. As a fight scene progresses, the music underneath the scene reflects the action on stage. Through many eras of melodrama, minstrels, pantomime, burlesque, and then opera, the American musical was born. The first credited American musical is Little Johnny Jones which was a vaudevillian production that had “fast-paced dialogue, streetwise humor, and the vernacular slant of his lyrics” which differed extremely from the operas which were present at
the time. Following a jockey named Johnny Jones across the ocean to race, he confronts losing the race and attempting to rescue his love, Goldie Gates. Once this musical graced the Broadway stage, many different composers emerged from this era such as Jerome Kern, B. G. DeSylva, George and Ira Gershwin, and Richard Rodgers and Lorenz Hart, just to name a few.

Since the introduction of Little Johnny Jones, there have been numerous composers who have written musicals. With a wide berth of musicals with many different themes and genres, this research only focuses on a small portion of this group. Originally, this research hoped to analyze the entirety of the works of Rodgers and Hammerstein, Stephen Sondheim, and Andrew Lloyd Webber in terms of emotional content and key choices. But due to the sheer amount of data collected and the time restraints of the project, I decided to sample 5 shows, from different decades and from different composers. In choosing one show from each of the decades, this analysis spans the decades of the 1940’s – 1980’s. The five shows chosen were *Carousel* by Rodgers and Hammerstein (1945), *My Fair Lady* by Alan Jay Lerner and Frederick Loewe (1956), *Mame* by Jerry Herman (1966), *A Little Night Music* by Stephen Sondheim (1973), and *The Phantom of the Opera* by Andrew Lloyd Webber (1983). Each show has an intricate and creative story line, told through the plot and the musical numbers.

*Carousel* begins as Billy Bigalow meets Julie Jordan and the two are soon married. The town warns against the marriage, and as a result, Billy loses his job. In a failed robbery attempt, Billy is confused, upset and eventually ends his own life. Fifteen years later, he is given a chance to return to earth to redeem himself. He ends up slapping his daughter when she refuses a gift from him, and both Julie and Louise, the daughter, understand. In order to reach heaven, he must commit a good deed. At Louise’s high school graduation, Billy urges her to believe in herself...
and tells her he loves her. After this is completed, he is escorted to heaven (Rodgers and Hammerstein 2016).

*My Fair Lady* features two main characters: Professor Henry Higgins and Eliza Doolittle. Professor Higgins attempts to turn Eliza into a duchess in part by teaching her to speak English properly. Her big debut moment is at the Embassy ball, where Freddy Eynsford-Hill falls desperately in love with her. After Eliza notices that Professor Higgins disregards her, she leaves him. Eventually at the end of the musical, she decides to return and forgives him (*My Fair Lady* 2016).

*Mame* is about a New York City woman named Mame who has a large personality and who adopts her brother’s son, Patrick. Patrick is eventually sent to a boarding school, and then Mame loses all of her large fortune in the stock market crash of 1929. Soon after, she meets and marries a rich Southern gentleman named Beauregard Jackson Picket Burnside and they set off on a world tour. Beau tragically dies on the Matterhorn and Mame is forced to return to New York and confronts Patrick, by claiming his betrothed is not right for him. In trying to reconcile the relationship between herself and Patrick, she throws an engagement party at which he realizes that he’s not meant to be with his fiancée and falls in love with Mame’s decorator (*Musical Heaven* 2016).

*A Little Night Music* has a whole cast of characters. Anne is a young bride married to Fredrik, a man much her senior. Her step-son, Henrik, is a year older than she is. Desiree, who used to be involved with Fredrik, is a touring actress who is having an affair with Carl-Magnus. Carl-Magnus is in the military and he is married to Charlotte. Lastly Madame Armfeldt, Desiree’s mother, is an elderly woman whose granddaughter is Fredrika. She begins and ends the
show with the idea of the summer night smiling three times: first at the young, second at the fools who know too little and third at those who know too much (A Little Night Music 2016).

From the official website of the Phantom of the Opera it states the synopsis of the show as, “Far beneath the majesty and splendor of the Paris Opera House, hides the Phantom in a shadowy existence. Shamed by his physical appearance and feared by all, the love he holds for his beautiful protégée Christine Daaé is so strong that even her heart cannot resist.” (2016). After a series of events, the Phantom takes Christine into his lair and bribes the members of the opera house to perform his own composition, with Christine as the lead (Phantom of the Opera 2016).

**Methodology**

In each musical studied, there are approximately 20-25 musical numbers, including the music for the scene changes, the overture and the finale. While music without words is also able to emit emotion, this research only focuses on songs with lyrics. It only includes the first occurrence of each of the songs, not the reprises. Each of the songs with lyrics was then coded with the emotions categorized by Schubart. A song was not restricted to having one emotion. We compiled this information in an “association table”. If an emotion is coded to be present, it is represented with a “1” in the table, and if it is not present there is a “0”.

Christian Schubart’s categorization of emotion in musical keys is the coding for this research. This table is interpreted from his work.

<table>
<thead>
<tr>
<th>Key</th>
<th>Emotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>C Major</td>
<td>Completely Pure. It’s character is: innocence, simplicity, naivety, children’s talk</td>
</tr>
<tr>
<td>C Minor</td>
<td>Declaration of love and at the same time the lament of unhappy love. All languishing, longing, sighing of the love-sick soul lies in this key</td>
</tr>
<tr>
<td>Key</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Db Major</td>
<td>A leering key, degenerating into grief and rapture. It cannot laugh, but it can smile; it cannot howl, but it can at least grimace its crying--Consequently only unusual characters and feelings can be brought out in this key.</td>
</tr>
<tr>
<td>C# Minor</td>
<td>Penitential lamentation, intimate conversation with God, the friend and help-meet of life; sighs of disappointed friendship and love lie in its radius.</td>
</tr>
<tr>
<td>D Major</td>
<td>The key of triumph, of Hallelujahs, of war-cries, of victory-rejoicing. Thus, the inviting symphonies, the marches, holiday songs and heaven-rejoicing choruses are set in this key.</td>
</tr>
<tr>
<td>D Minor</td>
<td>Melancholy womanliness, the spleen and humours brood.</td>
</tr>
<tr>
<td>Eb major</td>
<td>The key of love, of devotion, of intimate conversation with God.</td>
</tr>
<tr>
<td>D# minor</td>
<td>Feelings of the anxiety of the soul's deepest distress, of brooding despair, of blackest depression, of the most gloomy condition of the soul. Every fear, every hesitation of the shuddering heart, breathes out of horrible D# minor. If ghosts could speak, their speech would approximate this key.</td>
</tr>
<tr>
<td>E major</td>
<td>Noisy shouts of joy, laughing pleasure and not yet complete, full delight lies in E Major.</td>
</tr>
<tr>
<td>E minor</td>
<td>Naive, womanly innocent declaration of love, lament without grumbling; sighs accompanied by few tears; this key speaks of the imminent hope of resolving in the pure happiness of C major.</td>
</tr>
<tr>
<td>F major</td>
<td>Complaisance and Calm</td>
</tr>
<tr>
<td>F minor</td>
<td>Deep depression, funereal lament, groans of misery and longing for the grave.</td>
</tr>
<tr>
<td>F# Major</td>
<td>Triumph over difficulty, free sigh of relief uttered when hurdles are surmounted; echo of a soul which has fiercely struggled and finally conquered lies in all uses of this key.</td>
</tr>
<tr>
<td>F# Minor</td>
<td>A gloomy key: it tugs at passion as a dog biting a dress. Resentment and discontent are its language.</td>
</tr>
<tr>
<td>G Major</td>
<td>Everything rustic, idyllic and lyrical, every calm and satisfied passion, every tender gratitude for true friendship and faithful love,—in a word every gentle and peaceful emotion of the heart is correctly expressed by this key.</td>
</tr>
<tr>
<td>Key</td>
<td>Description</td>
</tr>
<tr>
<td>-----</td>
<td>-------------</td>
</tr>
<tr>
<td>G Minor</td>
<td>Discontent, uneasiness, worry about a failed scheme; bad-tempered gnashing of teeth; in a word: resentment and dislike.</td>
</tr>
<tr>
<td>Ab Major</td>
<td>Key of the grave. Death, grave, putrefaction, judgment, eternity lie in its radius.</td>
</tr>
<tr>
<td>Ab Minor</td>
<td>Grumbler, heart squeezed until it suffocates; wailing lament, difficult struggle; in a word, the color of this key is everything struggling with difficulty.</td>
</tr>
<tr>
<td>A Major</td>
<td>This key includes declarations of innocent love, satisfaction with one's state of affairs; hope of seeing one's beloved again when parting; youthful cheerfulness and trust in God.</td>
</tr>
<tr>
<td>A Minor</td>
<td>Pious womanliness and tenderness of character.</td>
</tr>
<tr>
<td>Bb Major</td>
<td>Cheerful love, clear conscience, hope aspiration for a better world.</td>
</tr>
<tr>
<td>Bb Minor</td>
<td>A quaint creature, often dressed in the garment of night. It is somewhat surly and very seldom takes on a pleasant countenance. Mocking God and the world; discontented with itself and with everything; preparation for suicide sounds in this key.</td>
</tr>
<tr>
<td>B Major</td>
<td>Strongly coloured, announcing wild passions, composed from the most glaring coulors. Anger, rage, jealousy, fury, despair and every burden of the heart lies in its sphere.</td>
</tr>
<tr>
<td>B Minor</td>
<td>This is as it were the key of patience, of calm awaiting ones's fate and of submission to divine dispensation.</td>
</tr>
</tbody>
</table>

While Schubart’s work came from over a century ago (1839), to my knowledge no other research of this kind has been studied by anyone. In addition to the musical numbers being coded by these emotions, each song was also coded for the musical key appearing on the left hand side of this chart. In a similar fashion, if the key was present it was coded with a “1” and if not, a “0”. After these two tables were created, they were combined to complete a bi-variate analysis. Using the SPSS Statistics software by IBM, I cross-tabulated the musical keys with each of the emotions coded. In this example, we are looking at the cross-tabulation of the Key of F major and the emotion that was coded Gloomy/Anxiety/Distress(Ghosts). The rows represent the
musical key, while the columns represent the emotion. In looking where the row and the column are both “1” we also have a “1” present in this intersection.

<table>
<thead>
<tr>
<th></th>
<th>Gloomy/Anxiety/Distress(Ghosts)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>F major</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>4</td>
</tr>
</tbody>
</table>

The “1” is present in this intersection because there was one instance in the data gathered that both the key of F major and this specific emotion were coded together. I generated tables similar to this for every key and each emotion coded.

In coding the emotions of songs, I identified some emotions in the sample songs that were not represented in Schubart’s list. In this case, the three emotions that I coded which were not directly associated with the keys and emotions of Schubart were Deception, Seduction and Jealousy. While the addition of these emotions did not add a significant amount of data to this set, it was important in the coding process.
Results

In total, this research looked at 648 different cross-tabulations. Schubart provided 24 musical keys in his analysis, and then from those keys, there were 27 emotions that were coded. From the five musicals studied, there were 65 musical numbers coded by musical key and emotion. Of these 648 cells, over half of them are represented with a zero, meaning Schubart’s emotion was never correlated with the musical key in our coding system. The largest number to appear in our chart is a count of 6, which appears in the intersection between F major, and the emotion coded as Resentment/Dislike/Regret.

<table>
<thead>
<tr>
<th></th>
<th>Resentment/Dislike Regret</th>
</tr>
</thead>
<tbody>
<tr>
<td>F major</td>
<td>0  37  5  42</td>
</tr>
<tr>
<td></td>
<td>1  17  6  23</td>
</tr>
<tr>
<td>Total</td>
<td>54 11 65</td>
</tr>
</tbody>
</table>

In looking across the rows, C major appears to be associated with the widest variety of emotions as it has the lowest number of zeros, 10. In some of the cross-tabulations, there is no association with any emotions. The apparently uncommon keys of D# minor, F# minor, Bb minor, and Ab minor did not occur in any of the musical songs sampled and thus were not associated with any emotion. Many other keys were commonly associated with emotion, having only between 10-15 zeros in their rows. The minor keys in the analysis all had less than 5 correlations in their rows, which is consistent with their appearance in the musical numbers. The keys of F major, C major and G major appear the most frequently, 23, 21 and 18 times respectively.
On the other side, there were more emotions associated with keys, meaning a smaller number of zeros in their column. The emotion coded as Wild Passion (Anger, Jealousy……) only had 5 zeros in the entire column and the highest correlation of 3 which was associated with the key of G major. The emotion that was coded Depression and Death had no association with keys and these columns consisted of all zeros.

From this graph of emotional frequency, there are peaks at Resentment/Dislike/Regret with 11, Innocent Love (Longing) Satisfaction with 10, Triumph over Difficulty/Relief with 9, and Cheerful Love (Hope for a Better World) with 8. On the low end, the emotions of Melancholy Womanliness, Love/Devotion, Lament without Grumbling, and Calm all appear only twice in the emotional coding.
We can also look at the key frequency by specific musical. By separating the totals out by musical, we can see interesting correlations.

While it has been previously shown that there are some keys that do not appear at all in the musicals we sampled, through this chart there are only 7 musical keys that appear in all five of the shows studied. Those are C major, Db major, Eb major, F major, G major, A major, and Bb major. Interestingly enough, these keys are also the most prominent keys in looking at the overall graph of shows (see graph on pg.22). It can also be noted that these keys are all major keys, and many of the minor keys studied to do not even come close to these numbers.
This chart separates the emotional coding out by musical, and we are able to see correlations here. In this chart, there are only two emotions that are associated with every musical studied, and those are coded as Resentment/Dislike/Regret and Innocent Love (Longing) Satisfaction. These two keys are emotionally coded with G minor and A major respectively according to Christian Schubart. Every key except Death and Depression are represented in at least one musical. In totaling the different emotions that are present in each of the musicals, we have Carousel with 12, My Fair Lady with 24, Mame with 22, A Little Night Music with 23, and Phantom of the Opera with 20. In looking at this, there could be a trend that speaks to the
incorporation of a wider range of emotions in musicals over time. More recent musicals tend to
deal with more intense emotions, while shows from the 1930’s, 1940’s and 1950’s were less
emotionally complex.

By arranging the keys in this next format, an interesting pattern emerges from the data. In
the center of the curve, we graphed C major because it has no flats or sharps. To the right of C
major, each key increases by one sharp, so the order of sharps is shown in the chart. In the
opposite direction we have the order of flats, where each key increases by one flat as it moves
outward from center. From this data, we get a graph that looks similar to a Bell Curve but not
perfect. Instead of C major being used in the most songs, F major appeared two more times in the
data, so 23 times. The Bell Curve shape follows through with the keys until Db major and Gb
major/ F# major, which both break up the curve.
In another form of analysis, this research looked at the combined bi-variate tables that were generated. In creating pie charts, we are able to separate the musical keys out and look at them individually in regards to the frequency in which the various Schubart emotions occurred in a particular key. I chose not to include the charts of Eb minor, F# minor, Ab minor and Bb minor because they do not have any data to graph.
C minor

- Lament without grumbling
- Triumph over difficulty/Relief
- Death
- Wild Passion (Anger, Jealousy...)

Durava 27
C# minor

- Discontent with Self and Everything
- Wild Passion (Anger, Jealousy...)

Durava 29
D minor

- Love-Sick/Unhappy Love
- Grief
- Disappointed Friendship
- Triumph over difficulty/Relief
- Resentment/Dislike/Regret
- Cheerful Love (Hope for a better world)
- Wild Passion (Anger, Jealousy...)
Eb major

- Love-Sick/Unhappy Love
- Grief
- Disappointed Friendship
- Triumph
- Gloomy/Anxiety/Distress(Ghosts)
- Delight
- Triumph over difficulty/Relief
- Gentle Peaceful Heart
- Resentment/Dislike/Regret
- Cheerful Love(Hope for a better world)
- Discontent with Self and Everything
- Deception
Durava 33

E major

- Grief
- Disappointed Friendship
- Lament without grumbling
- Triumph over difficulty/Relief
- Gentle Peaceful Heart
- Resentment/Dislike/Regret
- Innocent Love(Longing)Satisfaction
- Cheerful Love(Hope for a better world)
- Wild Passion(Anger, Jealousy...)
Durava 34

E minor

- Triumph over difficulty/Relief
- Wild Passion (Anger, Jealousy...)

[Pie chart with sections as described]
F major

- Pure
- Love-Sick/Unhappy Love
- Grief
- Disappointed Friendship
- Triumph
- Melancholy Womanliness
- Love/Devotion
- Gloomy/Anxiety/Distress(Ghosts)
- Delight
- Triumph over difficulty/Relief
- Resentment/Dislike/Regret
- Lament/Difficulty
- Innocent Love(Longing) Satisfaction
- Cheerful Love(Hope for a better world)
- Wild Passion(Anger, Jealousy...)
Durava 36

F minor

Wild Passion (Anger, Jealousy...)
Seduction
F# major

- Pure
- Love-Sick/Unhappy Love
- Love/Devotion
- Death
- Innocent Love (Longing) Satisfaction
- Wild Passion (Anger, Jealousy...)
G major

- Love-Sick/Unhappy Love
- Triumph
- Melancholy Womanliness
- Delight
- Calm
- Triumph over difficulty/Relief
- Gentle Peaceful Heart
- Resentment/Dislike/Regret
- Innocent Love(Longing) Satisfaction
- Tenderness of Character
- Cheerful Love(Hope for a better world)
- Wild Passion(Anger, Jealousy...)
- Patience/Waiting
Durava 39

G minor

- Innocent Love (Longing) Satisfaction
- Wild Passion (Anger, Jealousy...)
- Patience/Waiting
- Seduction
Ab major

- Love-Sick/Unhappy Love
- Grief
- Disappointed Friendship
- Lament without grumbling
- Resentment/Dislike/Regret
- Innocent Love (Longing) Satisfaction
- Tenderness of Character
- Cheerful Love (Hope for a better world)
- Wild Passion (Anger, Jealousy...)
Durava 41

A major

- Pure
- Love-Sick/Unhappy Love
- Grief
- Delight
- Triumph over difficulty/Relief
- Gentle Peaceful Heart
- Resentment/Dislike/Regret
- Innocent Love (Longing) Satisfaction
A minor

- Resentment/Dislike/Regret
- Death
- Wild Passion (Anger, Jealousy...)

Durava 42
Bb major

- Pure
- Love-Sick/Unhappy Love
- Triumph
- Gloomy/Anxiety/Distress (Ghosts)
- Delight
- Lament without grumbling
- Triumph over difficulty/Relief
- Resentment/Dislike/Regret
- Innocent Love (Longing) Satisfaction
- Cheerful Love (Hope for a better world)
- Wild Passion (Anger, Jealousy...)
B major

- Pure
- Love-Sick/Unhappy Love
- Grief
- Triumph
- Gloomy/Anxiety/Distress (Ghosts)
- Delight
- Lament without grumbling
- Triumph over difficulty/Relief
- Lament/Difficulty
- Innocent Love (Longing) Satisfaction
- Cheerful Love (Hope for a better world)
- Wild Passion (Anger, Jealousy...)
Durava 45

B minor

Triumph over difficulty/Relief
Resentment/Dislike/Regret
Wild Passion(Anger, Jealousy...)
The major keys are more colorful in part because they are more present in the musicals we sampled. There is not an emotion that appears in every key, but these charts show the correlation between the two. The minor keys had fewer appearances, so their pie charts have larger pie pieces of the pies.

Analysis

In this research, we focused on the relationship between emotion and musical key. Through the many forms of analysis and coding that was conducted we did not find significant enough evidence to support a strong correlation between Schubart’s emotional coding and musical key. This is an interesting hypothesis, as there is not much outside research on this subject. While we did not find the results that we were looking for, there are some limitations to this work.

Schubart’s coding of emotions in correspondence with keys was the only concrete emotional association with keys I was able to find. In using this work, I focused on the emotions that Schubart felt were present in the music from his time period. Schubart wrote his book and completed this analysis in the 1800’s and modern musicals have evolved since then. With such a vast time difference, there is a possibility that the emotions Schubart associated with keys in the 1800’s are not the same as what composers typically use today.

In the bivariate analysis that was completed, there was an interesting correlation that I noticed. The key and emotion that had the highest correlation were F major and the Resentment/Dislike/Regret. Schubart coded the emotion “Discontent, uneasiness, worry about a failed scheme; bad-tempered gnashing of teeth; in a word: resentment and dislike.” with the key of G minor. The emotion associated with F major that Schubart coded was “Complaisance and
Calm”. These emotions are the exact opposite of what we thought the coding should be, which supports the idea that Schubart’s key analysis and modern musical theatre songs are not “emotionally compatible”.

The keys that appeared most commonly in this research were C major, G major and F major. What is interesting about these keys is that they have no sharps/flats, one sharp and one flat respectively. Most keys are generally equally easy for vocalists to sing in. Sometimes it can be difficult for singers when keys are too high or too low for their vocal range, but most times they do not have difficulty with the keys if, say, the song were to be transposed up/down a half step. Instrumentalists, on the other hand, prefer to have as few sharps/flats as possible when playing. It is much easier for a vocalist to sing in a key with five flats rather than an instrumentalist to play in it. With the most common keys being C major, G major and F major which all have very few sharps/flats, the composers or arrangers could be thinking of the musicians when choosing a musical key – or, these could be the keys that the composers themselves are most comfortable playing in. As an interesting example, Irving Berlin, a musical composer who emigrated from Russia, could only play in the key of F#. He had a transposing piano that would translate his music into the keys that he desired, while still allowing him to play in the key of F# (Edwards 2008).

Another aspect of emotion is Schubart’s distinction between happy and sad keys. If we separate the keys out into happy and sad, we get these two groups:

**Happy** – C major, D major, Eb major, E major, E minor, F major, F# major, G major, A major, A minor, Bb major, B major, B minor
Sad - C minor, Db major, C# minor, D minor, D# minor, F minor, F# minor, G minor, Ab major, Ab minor, Bb minor

In both of these groups, we see a mixture of both major and minor keys, “Happy” has a predominance of major keys, and “Sad” a predominance of minor keys as the stereotype suggests. It is interesting because the only two keys that I placed in the sad category were Db major and Ab major, which Schubart coded with Grief and Death respectively. If these codings were correct, maybe Schubart had some other correlations that were correct. For instance, in looking at the song, “Oh, What a Beautiful Morning” from Oklahoma!, the song is written in the key of E major which was coded as Delight. Another example is the song “Till We Reach That Day” from Ragtime written in the key of Ab major, which was coded as Death. Lastly, “The Woman’s Dead” from Curtains written in F# minor, the Gloomy key. If Schubart got some of these emotions correct, maybe looking at a larger frame of work would help to support the original thesis. In attempting to support my theory, these correlations may just be coincidence, an attempt to fit the data to this theory.

In our data, we found an outlier in the key of Db when analyzing the number of accidentals used (See chart on pg. 25). In examining just show stopping numbers from musicals, we have noticed that many of these songs are in this key. For example, “Don’t Cry for Me Argentina” from Evita, “Defying Gravity” from Wicked, the climactic chorus of “Memory” from Cats, “Climb Every Mountain” from The Sound of Music, “Someone to Watch over Me” from Oh Kay!, “Send in the Clowns” from A Little Night Music, and the final chorus of “Circle of Life” from Lion King: The Movie and several more are either in the key of Db or modulate into it. We also noticed that many of these songs are located at the end of Act I of the show, or at the
end of the show. These moments are usually where a character may be experiencing a change of heart or a pivotal moment may be occurring.

**Conclusion/Future Work**

There are many future pathways for this work since the research combines many different areas. The body of work of musicals and the composers is a large and ever expanding genre. It will be almost impossible to categorize and analyze all musicals that have been written, but it could be a goal for the future. Currently, there is not a database that exists that contains all the original keys of all songs that appeared in musicals. In completing a few of these musicals, I hope to be able to make this database available to the musical community and it could be a great asset. Being able to look up what key a song was originally written in will be helpful in conducting this future research, and could also benefit the musical theatre community.

In future research, I hope to conduct a similar study to the one done for this research. No other research has been done with the emotions coded by Christian Schubart. It would be interesting to see how these emotions play a role in the entire body of work of the composers. It would be interesting to use data from musicals to update the emotional code (associated with each of the 24 keys) to better match musical emotions. There could maybe be a stronger correlation if the emotions were assigned differently than Schubart did, or if different emotions were incorporated in the model. Another angle would be to compare keys across differing composers. Musical composers are linked by a common goal, and I am interested in seeing the differences between the composers and emotions.

Luckily for this research, three of the composers who I have studied are still living: Stephen Sondheim, Andrew Lloyd Webber and Jerry Herman. I attempted to reach out to them
to see if I could get a composer’s first hand perspective. I also reached out to many other composers, who are still living whose work I did not study. Those composers include: Stephen Schwartz, Lin Manuel Miranda, Mel Brooks, Alan Menken, Jason Robert Brown, Stephen Flaherty, Jeanine Tesori, Marc Shaiman, and Elton John. The only composer I heard back from was Elton John, who unfortunately did not have time for an interview. I hope to hear from other composers in the future and incorporate their thoughts in future research. While I have speculated that emotion plays a role, I would love to hear directly from the composers in regards to what they were thinking during the creative process. While these emotions can be read in the lyrics, I want to examine in the future how this is important in the musical key choice as well.

This research is never done. As I hope to get my doctorate someday, I would like to continue this research well into the future. While it may be just a coincidence, it is thrilling to me to hope that there may be a possibility that this correlation is really present. After working for over a year on this project, I am proud of what I have accomplished. I feel I am a more educated scholar based on the work that I have completed and I hope to inspire future research. Musical theatre is an ever-evolving field, with new research being created each year. Who knows, maybe musical composers have always known about this link to emotion, and we are just starting to uncover their intentions through this research.

References


