

# Sad Lyrics on Happy Instrumentals: How music influences emotion

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# Word Count

6,646

# Abstract

Research on music and emotion has largely been focussed on the overall effects a ‘happy’ or ‘sad’ sounding song can have on emotions (Juslin, 2011), but there has been little research around how vocal and instrumental content of a song may elicit completely different emotions in the same song. Mori & Iwanaga (2014) studied how listeners responded to instrumentally happy sounding songs with vocally sad lyrics in a foreign language, they found that regardless of whether participants were given a translation of the lyrics or not they still felt happy after listening to it. In this study it is reasoned that sad vocal features of a song must contain audibly perceived rhythmic qualities to allow participants to emotionally process the vocals fully. 115 participants listened to a happy sounding instrumental song, and then another happy sounding song but with sad lyrics in their native language to see whether the lyrics were enough to reduce positive emotions. Overall, and positive emotions were reduced while negative emotions increased when participants listened to sad vocal versions of the songs compared to happy instrumentals, however, issues with choices of stimuli may have led there to be biases in the responses to certain songs.

# Intro

Music is so prevalent in modern life that it is rare for one to go a day without experiencing it in some way or another (North, Hargreaves, & Hargreaves, 2004), though the way we listen to music may vary from a very active viewing to a very passive one. What constitutes as musical listening is often determined by experiences the listener associates with it, not just the matter of hearing sounds (Gaver, 1993) and depending on this the impact music may have on one’s daily life will vary. Emotional experiences tied to music are key characteristics that define how music may be used, for example it may be used passively to sell a product with ‘advert jingles’ (Hecker, 1984), or it could be used actively to help alleviate symptoms of certain mental illnesses (DeNora & Ansdell, 2014). While these are only two examples of the use of music they perfectly express the importance of understanding its effects on our daily lives and any other potential uses of it. Music can sway our lives in ways that go unnoticed on a daily basis, but how does is this achieved? While it is known that well-crafted music can arouse many different types of feelings in the listener, ranging from ‘basic’ emotions (happiness, sadness, etc) to more ‘complex’ emotions (melancholy, nostalgia) (Juslin, 2011), the way this occurs falls to a combination of multiple factors. Songs which typically elicit ‘happy’ feelings are acoustically characterised by faster, more upbeat tempos and a major mode, whereas songs which elicit more ‘sad’ feelings are typically characterised by slower tempos and a minor mode (Pallesen et al, 2005; Patel, 2010). According to Scherer (2004), music is successful in eliciting emotion due to mental associations made from previous times the song was heard, reliving how the listener felt in the context it was originally heard and evoking a similar but weaker emotional response to that memory. By this logic songs which have been heard by the listener before will bring back biased emotions regardless of the song content, a sad song may still make someone happy if they associate it in such a way. This is not the only explanation for a song evoking an emotion unrelated to the contents of the music, a significant difference between levels of reported ‘felt’ emotions can be found compared to ‘perceived’ emotional content when listening to music. While sad emotions may be perceived (I.E., noticed but not felt by the listener), they are less likely to be felt by the listener than positive emotions are (Zentner, Meylan, & Scherer, 2000). This could be due to the idea that while sad music can be perceived as tragic, the feelings a listener may get are more romantic in nature and lead to a positive emotion despite song content (Kawakami et al, 2013). This effect can be found in someone at any level of musical proficiency, but research has shown that the more musically trained a person is, the stronger the emotional response they get from listening is. This may predict a higher chance of the listener reporting positive emotions to a sad song if they are musically proficient (Kawakami et al, 2012), but this may only be to a slight degree as other studies have failed at supporting this hypothesis (Kawakami et al, 2013). The context in which music is played also changes the expected emotional impact on listeners, being with a close friend or partner can increase the levels of reported emotional response as opposed to listening alone, as well as listening to music of one’s own preference as opposed to randomly chosen songs (Sloboda, 2001; Liljeström, Juslin, & Västfjäll, 2013). Personality may also affect the emotional responses of listeners, when subject to a personality test, such as the Ten Item Personality Inventory (TIPI) (Gosling, Rentfrow, & Swann Jr, 2003), listeners who score more highly on the personality trait “openness to experience” typically report higher levels of emotional response than those scoring lower (Liljeström, Juslin, & Västfjäll, 2013). Listeners who have a large emotional reaction to music may also show emotions one would not expect to certain songs, such as music that listeners have rated as ‘sad’ producing a happy emotion (Kallinen, & Ravaja, 2006), but why is this the case? Brattico et al (2011) studied the results of MRI scans on the brain when listening to music and found that the acoustic and lyrical elements of a song are processed in different regions of the brain, and that different combinations of the two in a song may elicit different emotions. Happy sounding music without lyrics aroused stronger happy emotions in listeners than happy songs with lyrics, and sad music with lyrics aroused stronger sad emotions in the participant than without; pointing to the idea that lyrical elements of a song are more important for producing a sad emotion and acoustic elements are more important for producing a happy emotion (Brattico, et al, 2011). Though as previously stated, sad emotions aren’t often elicited from music (Zentner, Meylan, & Scherer, 2000), and considering that sad emotions are more due to lyrical than acoustic elements (Brattico, et al, 2011), how important are lyrics in music for arousing emotion in general? Ali & Peynircioğlu (2006) looked into this by researching reported emotions from listeners when the sung vocal melody of a song is either made completely monotone (no variations in pitch) or is replaced with an instrument to remove the vocals, leaving only the melody. They found that reported emotions were weaker when the vocal melody was made monotone, and stronger when replaced with an instrument in every genre of song tested overall, suggesting that the melody of a song is more important than lyrical content in creating emotional response. This is supported by fMRI scans on the brain which showed more activation across the brain when sounds with a melody were played, compared to less activation for monotone or sounds with no pitch (Patterson, et al, 2002). Ali & Peynircioğlu (2006) also found that when lyrics were present in happy songs they detracted from positive feelings in the participants, and when lyrics were present in sad songs they enhanced the negative feelings, suggesting that vocal lyrics are more important in creating a negative emotional response than positive. While these studies support the idea that acoustic elements, in this case a main melody with varying pitch, are more important for producing a stronger emotional response across all genres of music, conflicting research has found that emotional responses are stronger when both vocal and melodic aspects are coupled together (Galizio & Hendrick, 1972). These studies in particular show that lyrics have a special importance in producing stronger negative emotions than acoustic elements do, however this may not be generalisable to every population. Research by Loui et al (2013) found that females were typically more influenced by vocals when reporting emotional responses to music than other genders, and that this difference was stronger in older participants. This contrasts with research by Beveridge & Knox (2018) who found high levels of generalisability across genders for songs with rhythmic vocals to produce emotion in the listener, with features including melody and rhythm. The study by Loui et al (2013) only had 50 participants and compared to the 198 participants in the Beveridge & Knox (2018) study is much less representative. The Loui et al (2013) study shows that at least within one population there was variability on emotional responses due to vocals in music and it cannot be assumed everyone will react similar enough to extrapolate results to larger populations. With all these studies which argue over the effect of certain features on songs enhancing or diminishing the intended emotional effect of the song depending on whether its perceived as ‘happy’ or ‘sad’, how would one react to a song with conflicting emotional intentions? A study by Mori & Iwanaga (2014) looked into this by playing participants happy sounding songs in languages they could not understand either with or without a translation, without the translation all the participants would hear was a happy sounding song and vocals they couldn’t understand, but with the translation they would read and find that the lyrics contrasted the happiness of the instrumental, having previously shown that the lyrics were considered sad outside of a musical context. Participants were taught to discriminate between felt and perceived emotions so as to not mix them up, and though perception of negative emotions increased with a translation, feelings of them did not and participants reported happy emotions for both versions of songs played. Since participants could not understand the language they had to rely on a visual representation of the sad lyrics rather than an audial one embedded in the song, which may have reduced the effect of the sad lyrics as it was only tangentially associated with the song, their results contrast the findings of previous studies that showed a decrease in positive emotions when lyrics were present (Ali & Peynircioğlu, 2006) which could be due to the fact that listening and reading comprehension in language are processed in separate areas of the brain with some overlap in the amodal left inferior frontal and middle temporal gyri (Buchweitz, et al, 2009). Research on film media has shown that visually impaired viewers who require audio descriptions of films report weaker perception of emotions than typical viewers (Ramos, 2015), and since audience reactions to films follow a pattern of “perception, emotion, cognition, movement and finally action” (PECMA flow) (Grodal, 2009). The inhibition of audial perception of sad lyrics in Mori & Iwanaga’s (2014) study at the first stage may decrease emotional reaction and extrapolating the PECMA flow from a context in film media could suggest this may confound how the participants emotionally process the stimuli.

The aim of the current study is to address the issues with Mori & Iwanaga’s (2014) study altering the methodology to reduce potential confounding factors, hypothesising that negative emotions will be felt more strongly when participants are presented with a happy sounding song with sad lyrics in their native language, and that positive emotions will be felt more strongly for instrumental versions of the songs. This will be achieved through three sets of analysis, the first being a test to compare emotions reported to two different instrumental songs which is hypothesised to show no significant difference in emotions elicit as they will only contain acoustic features representative of positive emotions described earlier by Pallesen et al (2005) and Patel (2010). The second test is to compare emotions elicit from the same set of instrumental songs, but with the original sad vocals in the audio mix and presented for participants to read as lyrics that are intended to elicit negative emotions, both songs are hypothesised to elicit the same emotions with no significant difference between the two stimuli. The final set of analysis will combine the results from both instrumental and both vocal songs to compare them against each other, hypothesising that the songs with sad vocal content will elicit a significantly greater negative emotional response, while significantly reducing reported positive emotions. To date there has been little research on this niche field of music and emotion, and with this study I hope to advance research on music and emotion and demonstrate further considerations to make when designing studies for this field.

# Method

## Design

The study is split into two separate groups who go through the same procedures but with different stimuli to allow for counterbalancing the overall results, participants will all be required to answer four questionnaires which include information to characterise the sample (age, gender, ethnicity) and to report their emotional responses to stimuli.

Instrumental songs will be presented to participants before the lyrical song to help reduce the chance of participants guessing the aim of the study. Participants will report their emotional responses to listening to these songs as the main dependent variable, as well as their familiarity with the songs.

## Participants

A total of 115 participants were recruited by means of an online distribution of the survey through convenience sampling, with the majority of the responses being from university students and middle-aged participants (57% recruited via social media, 43% recruited anonymously). The sample population were majority female (75 female, 31 male, 8 other, 1 prefer not to say, mean age = 38.139, SD = 15.301) and were largely from white backgrounds (110 White, 3 Black/African/Caribbean/Black British, 1 White Asian, 1 Other) and all reported English to be their first language.

## Stimuli

Participants will listen to two short clips of music, both 1 minute and 3 seconds in length to give participants enough time to process the song emotionally while allowing the song to end naturally at the end of a verse. In total there are four clips of music derived from two songs, both songs producing an instrumental version and a full version with lyrics, participants will only listen to two of these in the order of an instrumental track followed by a track with lyrics. The songs chosen for presentation were specifically picked due to them meetings the categories of having both a happy sounding, upbeat instrumental intended to make the listener happy, and sad lyrics intended to make the listener sad. Due to the specific and uncommon nature of songs required for the study, songs were chosen through online submissions over discussion platforms in which anyone who responded submit suggestions of applicable songs. Once a list of songs was compiled, the submissions were vetted on the requirements that they must have a traditionally ‘happy’ instrumental (Pallesen et al, 2005; Patel, 2010) while having traditionally ‘sad’ lyrics which would evoke negative emotional responses if read on paper, as in line with Mori & Iwanaga’s approach (2014). This resulted in two songs being chosen, Paramore’s “Hard Times” and Less Than Jake’s “The Science of Selling Yourself Short”, as they both fit the criteria well and had easily available instrumental versions without lyrics.

## Materials

The Study uses a variety of questionnaires developed by previous research to aid the analysis of results, the first questionnaires provided were the ‘Goldsmith Musical Sophistication Index’ (Müllensiefen, et al, 2014) and the ‘Short Test of Music Preferences’ (STOMP) (Rentfrow & Gosling, 2003). These were designed to measure the participants engagement with music on a daily basis and to report their musical preferences, which may influence their enjoyment of the stimuli (Sloboda, 2001; Liljeström, Juslin, & Västfjäll, 2013) and potentially reduce emotional response (Rentfrow & Gosling, 2003), similarly people who are more engaged in music may report stronger emotional responses (Kawakami et al, 2012).

The types of questions involved in the GoldMSI questionnaire revolved around how much the participant enjoyed listening to music in their free time, and how often they attend music concerts or how long they actively engage with music on average per day. The STOMP questionnaire allowed participants to report their enjoyment of five different genre groupings, including:

 Classical, Jazz, World Heavy metal, Punk rock Pop, Soft Rock, Soul/RnB Rock & roll, Country, Folk, Singer-songwriter Rap, Hip-hop, Electronica

‘Live attendances’ and ‘Average listening time’ results from the GoldMSI questionnaire will be edited from their original formats into arbitrary numbers for easier analysis of results and calculations of means and standard deviations.

For ‘Live performance attendance in the past two years’ the translations were as follow:

0 Live attendances = 1, 1 Live attendance = 2, 2 Live attendances = 3, 3 Live attendances = 4, 4-6 Live attendances = 5, 7-10 Live attendances = 6, 11+ Live attendances = 7

And for ‘Average time spent listening to music per day’ the translations were as follow:

0-15 min = 1, 15-30 min = 2, 30-60 min = 3, 60-90 min = 4, 2 hrs = 5, 2-3 hrs = 6, 4 hrs = 7

The next questionnaire provided was Ten Item Personality Inventory (TIPI) (Gosling, Rentfrow, & Swann Jr, 2003) designed as a simple method of understanding an individual’s personality which is important in understanding emotional response to musical stimuli as individuals who are more ‘open to experiences’ tend to report stronger emotional responses to music in general (Liljeström, Juslin, & Västfjäll, 2013).

The personality features being analysed in this questionnaire are as follow:

 Extraversion, Stableness, Conscientiousness, Emotional Stability Openness to experience

Furthermore, the GEneva Music-Induced Affect Checklist (GEMIAC) (Coutinho & Scherer, 2017) was used to record a range of possible emotions and feelings typically elicited by listening to music, allowing participants to report their feelings towards the song accurately.

For analysis, the emotional responses are grouped into ‘positive emotions’ and ‘negative emotions’, the more positive emotions included:

Wonder, Amazed, Moved, Touched, Enchanted, in Awe, Inspired, Enthusiastic, Joyful, Wanting to dance, Powerful, Strong, Full of tenderness, Warmhearted, Relaxed, Peaceful, Nostalgic, Sentimental,

And the more negative emotions included:

Melancholic, Sad, Indifferent, Bored, Tense, Uneasy, Agitated, Aggressive

‘Enjoyment of song’ was also measured, but as this is not an emotion it is not hypothesised to be significantly different between any of the stimuli.

The final scale involved was a measure of familiarity with the song using a 1-4 Likert scale devised by Bachorik et al (2009), ranging from ‘Never heard the song before’ to ‘Heard many times actively (I.E., in a playlist of yours)’. This is important to understand as a participant who has heard any song used as stimuli in the study may simply be reflecting biased emotions tied to previous memories they have had with the song, potentially confounding results (Scherer, 2004).

Power:

Analysis of previous studies on this subject (Mori & Iwanaga, 2014; Liljeström, Juslin, & Västfjäll, 2013) showed an average partial eta squared (np­2) of over 0.14, indicating a large effect size according to Cohen (1988), so for calculations a np­2 of 0.14 was used to calculate the effect size (f).

**F tests -** ANOVA: Repeated measures, between factors

**Analysis:** A priori: Compute required sample size

**Input:** Effect size f = 0.4034733

 α err prob = 0.05

 Power (1-β err prob) = 0.80

 Number of groups = 2

 Number of measurements = 14

 Corr among rep measures = 0.3

**Output:** Noncentrality parameter λ = 9.3023259

 Critical F = 4.4138734

 Numerator df = 1.0000000

 Denominator df = 18.0000000

 Total sample size = 20

 Actual power = 0.8222387

*(Appendix A)*

This shows that a minimum of 20 participants are required to reach a power of 0.80.

## Procedure

Participants begin the study with a brief overview and are asked for confirmation of their voluntary participation, they are then prompted to fill in their age (dd/mm/yyyy), gender (male, female, other, prefer not to say), and ethnic origin (White, Mixed/Multiple ethnic groups, Asian/Asian British, Black/African/Caribbean/Black British, Other). Once complete, participants complete a measure of musical engagement (GoldMSI), measure of musical preference (STOMP), and a measure of personality (TIPI), they then proceed onto the stimuli.

The figure below shows the order of presentation:



 *(Figure 1)*

The page of the survey presenting the stimuli will not allow participants to move on until they have listened to the songs in their full length, participants are prompted to give full attention to the song. Once they have listened participants move onto a page where they can click on a 1-10 Likert scale how much the song elicit any of the 14 different emotions from the GEMIAC scale (Coutinho & Scherer, 2017), this step is repeated for the second song presented. Participants are then debriefed and thanked for participating.

### Ethics

All responses are anonymous, and participants are only distinguished by characterisation (age, gender, ethnicity). All Data is be stored electronically on a password protected computer only accessible by researchers, and securely destroyed 5 years after the end of the study. Participants will be able to withdraw their data up until the end of data collection and advised of this before they complete the study. This study was given approval by the Student Project Ethics Committee (SPEC).

# Results

Characterisation
Below is a table showing the total percentage of participants who recognised any of the songs used as stimuli:

| **Number of participants who recognised songs (%)** |
| --- |
|  | **Song 1**  | **Song 2** |
| Instrumental  |  | 0.03 |  | 33.40 |  |
| Vocal |  | 0.05 |  | 40.81 |  |
|  |

*(Appendix B)*

Participants scored an average of 28.643 (SD = 7.640) on the ‘Gold MSI: Active Engagement’ scale, which according to data from Müllensiefen et al (2014) places them on the 11% percentile (ranging from 4% to 27% including SD), meaning 89% of an average population would score higher than the participant population sampled for this study.

Participants on average reported attending two live events in the past two years (M = 3.2, SD = 1.723), and on average listen to 60-90 minutes of music per day (M = 3.739, SD = 1.836). The means and standard deviations reported here are based on the arbitrary numbers assigned to ranges of results discussed in the materials section.

## Test 1: Instrumental song validity results

To begin analysis, the validity of both instrumental songs and vocal songs must be compared against each other to ensure they produce a comparable effect as to not influence the combined results.

To compare differences in ‘enjoyment of song’ between the Song 1 instrumental and the Song 2 instrumental an independent samples T-test was carried out:

| **Independent Samples T-Test**  |
| --- |
|  | **t**  | **df**  | **p**  |
| Enjoyment of song  |  | -0.210  |  | 113  |  | 0.834  |  |
|  |
| *Note.*  Student's t-test.  |

*(Appendix C.1)*

The 55 participants who were subject to Song 1 Instrumental (*M =* 6.273, *SD* = 2.164) compared to the 60 participants who were subject to Song 2 Instrumental (*M* = 6.367, *SD* = 2.591) reported a non-significant difference in ‘enjoyment of song’, t(113) = -0.210, *p* = 0.834.

To test for significant differences in emotional response between Song 1 Instrumental and Song 2 Instrumental a MANOVA test was ran:

| **MANOVA: Wilks Test**  |
| --- |
| **Cases**  | **df**  | **Approx. F**  | **Wilks' Λ**  | **Num df**  | **Den df**  | **p**  |
| Type of song  |  | 1  |  | 2.263  |  | 0.774  |  | 13  |  | 101.000  |  | 0.012  |  |
| Residuals  |  | 113  |  |  |  |  |  |  |  |  |  |    |  |
|  |

*(Appendix C.2)*

The MANOVA test proved significant showing an overall effect of ‘Type of song’ on the emotional responses reported between instrumentals, *F*(1) = 2.263, *p* = 0.012, Wilk’s Λ = 0.774. This significant result requires that post hoc ANOVAS be studied for significance on individual factors.

The first significant effect was ‘Type of song’ on ‘Feel: Relaxed, Peaceful’:

| **ANOVA: Feel: Relaxed, Peaceful**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 79.276  |  | 1  |  | 79.276  |  | 12.411  |  | < .001  |  |
| Residuals  |  | 721.820  |  | 113  |  | 6.388  |  |  |  |    |  |
|  |

*(Appendix C.3)*

Participants who were subject to Song 1 Instrumental (*M =* 5.145, *SD* = 2.453) compared to participants who were subject to Song 2 Instrumental (*M* = 3.483, *SD* = 2.594) reported significantly higher levels of feeling ‘Relaxed, Peaceful’, F(1) = 12.411, *p* < 0.001.

The last significant effect found was ‘Type of song’ on ‘Feel: Melancholic, Sad’:

| **ANOVA: Feel: Melancholic, Sad**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 12.294  |  | 1  |  | 12.294  |  | 7.357  |  | 0.008  |  |
| Residuals  |  | 188.836  |  | 113  |  | 1.671  |  |  |  |    |  |
|  |

*(Appendix C.3)*

Participants who were subject to Song 1 Instrumental (*M =* 1.255, *SD* = 1.578) compared to participants who were subject to Song 2 Instrumental (*M* = 0.600, *SD* = 0.960) reported significantly higher levels of feeling ‘Melancholic, Sad’, F(1) = 7.357, *p* = 0.008.

No other effect was found to be significant (*p* = <.05), so they can be considered to have no significant difference in scores between Song 1 and Song 2 instrumentals.

## Test 1: Discussion

The results from the first set of analysis showed that there was a slight variance in reported emotions between the two instrumental songs with two significant differences in emotional responses being found: ‘Feel: Relaxed, Peaceful’ and ‘Feel: Melancholic, Sad’. The direction of significance shows that in both cases Song 1 instrumental had higher levels of reported emotions for these differences *(Appendix C.4)*, which goes against the hypothesis that there will be no significant differences between the instrumental stimuli. However, only two differences were found which is still relatively low considering the fact that there were twelve non-significant results between them.

An issue which could potentially confound the results is the fact that 33.40% of participants recognised the instrumental of Song 2, compared to only 0.03% recognising the instrumental of Song 1 *(Appendix B)*. This could lead participants to report biased emotions based on previous experiences they have had with the song (Scherer, 2004), which could explain why in both cases the more recognised song was significantly lower for both a positive (Feel: Relaxed, Peaceful) and negative (Feel: Melancholic, Sad) emotion.

Though despite the fact that more participants recognised the instrumental for Song 2, the majority of results were non-significant, suggesting that recognition of the song did not have much of an overall effect on the results.

## Test 2: Vocal song validity results

To compare differences in ‘enjoyment of song’ between the Song 1 instrumental and the Song 2 instrumental an independent samples T-test was carried out:

| **Independent Samples T-Test**  |
| --- |
|  | **t**  | **df**  | **p**  |
| Enjoyment of song  |  | -2.411  |  | 113  |  | 0.018  |  |
|  |
| *Note.*  Student's t-test.  |

*(Appendix D.1)*

The first significant effect between the samples was the 60 participants who were subject to Song 1 Vocal (*M =* 5.550, *SD* = 2.925) compared to the 55 participants who were subject to Song 2 Vocal (*M* = 6.855, *SD* = 2.870) reported significantly lower levels of enjoyment from listening, t(113) = -2.411, *p* = 0.018.

To test for significant differences in emotional response between Song 1 Vocal and Song 2 Vocal a MANOVA test was ran:

| **MANOVA: Wilks Test**  |
| --- |
| **Cases**  | **df**  | **Approx. F**  | **Wilks' Λ**  | **Num df**  | **Den df**  | **p**  |
| Type of song  |  | 1  |  | 2.053  |  | 0.791  |  | 13  |  | 101.000  |  | 0.024  |  |
| Residuals  |  | 113  |  |  |  |  |  |  |  |  |  |    |  |
|  |

*(Appendix D.2)*

The MANOVA test proved significant showing an overall effect of ‘Type of song’ on the emotional responses reported between vocals, *F*(1) = 2.053, *p* = 0.024, Wilk’s Λ = 0.791. This significant result requires that post hoc ANOVAS be studied for significance on individual factors.

The first significant effect between the vocals was for ‘Feel: Enchanted, In awe’:

| **ANOVA: Feel: Enchanted, in Awe**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 25.733  |  | 1  |  | 25.733  |  | 4.268  |  | 0.041  |  |
| Residuals  |  | 681.311  |  | 113  |  | 6.029  |  |  |  |    |  |
|  |

*(Appendix D.3)*

Participants who were subject to Song 1 Vocal (*M =* 2.417, *SD* = 2.486) compared to Participants who were subject to Song 2 Vocal (*M* = 3.364, *SD* = 2.422) reported significantly lower levels of feeling ‘Enchanted, in Awe’, F(1) = 4.268, *p* = 0.041.

The second significant effect was for ‘Feel: Inspired, Enthusiastic’:

| **ANOVA: Feel: Inspired, enthusiastic**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 53.123  |  | 1  |  | 53.123  |  | 5.869  |  | 0.017  |  |
| Residuals  |  | 1022.842  |  | 113  |  | 9.052  |  |  |  |    |  |
|  |

*(Appendix D.3)*

Participants who were subject to Song 1 Vocal (*M =* 3.767, *SD* = 2.825) compared to participants who were subject to Song 2 Vocal (*M* = 5.127, *SD* = 3.198) reported significantly lower levels of feeling ‘Inspired, Enthusiastic’, F(1) = 5.869, *p* = 0.017.

The third significant effect was for ‘Feel: Joyful, Wanting to dance’:

| **ANOVA: Feel: Joyful, Wanting to dance**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 85.163  |  | 1  |  | 85.163  |  | 8.185  |  | 0.005  |  |
| Residuals  |  | 1175.759  |  | 113  |  | 10.405  |  |  |  |    |  |
|  |

 *(Appendix D.3)*

Participants who were subject to Song 1 Vocal (*M =* 4.550, *SD* = 3.033) compared to participants who were subject to Song 2 Vocal (*M* = 6.273, *SD* = 3.424) reported significantly lower levels of feeling ‘Joyful, Wanting to dance’, F(1) = 8.185, *p* = 0.005.

The final significant effect was for ‘Feel: Indifferent, Bored’:

| **ANOVA: Feel: Indifferent, Bored**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 52.181  |  | 1  |  | 52.181  |  | 5.929  |  | 0.016  |  |
| Residuals  |  | 994.515  |  | 113  |  | 8.801  |  |  |  |    |  |
|  |

*(Appendix D.3)*

Participants who were subject to Song 1 Vocal (*M =* 3.167, *SD* = 3.142) compared to participants who were subject to Song 2 Vocal (*M* = 1.818, *SD* = 2.763) reported significantly higher levels of feeling ‘Indifferent, Bored’, F(1) = 5.929, *p* = 0.016.

No other interactions proved significant (*p <* 0.05), and so it is assumed that both songs evoked equal levels of emotional response in these interactions.

## Test 2: Discussion

This set of analysis, similar to the first test, also found an overall significant difference in reported emotions between the two vocal songs, but unlike the first test it also found a significant difference in ‘Enjoyment of songs’ between the stimuli. Participants on average enjoyed listening to the vocal version of Song 2 (*M* = 6.855, *SD* = 2.870) more than they did Song 1 (*M =* 5.550, *SD* = 2.925) *(Appendix D.1)*, and though the means of these are very close this could be due to the fact that 40.81% of participants recognised the vocal version of Song 2 compared to only 0.05% recognising Song 1 *(Appendix B)*.

Likewise with test 1, more participants recognising the song could lead to them reporting a higher level of enjoyment when listening to it if they have enjoyable memories associated with listening to it in the past (Scherer, 2004), meaning that Song 2 may not have been an appropriate stimulus for the vocal test since recognition may have had a large effect on the results. Aside from enjoyment of song, participants also reported significant differences in emotions for ‘Feel: Enchanted, in Awe’, ‘Feel: Inspired, Enthusiastic’, ‘Feel: Joyful, Wanting to dance’, and ‘Feel: Indifferent, Bored’.

In all significantly different measurements, aside from ‘Feel: Indifferent, Bored’, participants reported higher averages for the vocal of Song 2 compared to Song 1, which likewise with ‘Enjoyment of song’ could be due to recognition of the stimulus. All directionally positive significances between Song 1 and Song 2 were for more positive emotions, and the only directionally negative significance was for ‘Feel: Indifferent, Bored’, a more negative emotion. Out of fourteen measurements for differences between the songs, five of them proved significant which disproves the hypothesis that there would be no significant differences between vocal stimuli, this may also have an effect on the combined results in test three as nearly half the measurements were not equal.

## Test 3: Combined Results

To compare overall enjoyments of combined instrumental and vocals scores, a paired sample T-Test was ran:

| **Paired Samples T-Test**  |
| --- |
| **Measure 1**  |  | **Measure 2**  | **t**  | **df**  | **p**  |
| (Vocals) Enjoyment of song  |  | -  |  | (Instrumental) Enjoyment of song  |  | -0.400  |  | 114  |  | 0.690  |  |
|  |
| *Note.*  Student's t-test.  |

*(Appendix E.1)*

There proved to be no significant difference between enjoyment of vocal songs (M = 6.174, SD = 2.960) when compared to the enjoyment of instrumental songs for all 115 participants (M = 6.322, SD = 2.386), *t*(114) = -0.400, *p* = 0.690.

For the main effect of sad vocals on happy sounding instrumentals, the combined scores of both instrumentals are put together and calculated against the combined scores of both vocal songs in a series of Repeated Measures ANOVAs

The first significant effect was ‘Type of song’ for ‘Feel: Inspired, Enthusiastic’:

| **Within Subjects Effects**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 46.126  |  | 1  |  | 46.126  |  | 5.113  |  | 0.026  |  |
| Residuals  |  | 1028.374  |  | 114  |  | 9.021  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares *(Appendix E.2)* |

participants reported lower levels of feeling ‘Inspired, Enthusiastic’ when listening to the vocal songs (*M* = 4.417, *SD* = 3.072) than when listening to the instrumental songs (*M* = 5.313, *SD* = 2.860), F(1) = 5.113, *p* = 0.026.

The second significant effect was against ‘Feel: Joyful, Wanting to dance’:

| **Within Subjects Effects**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 81.604  |  | 1  |  | 81.604  |  | 7.118  |  | 0.009  |  |
| Residuals  |  | 1306.896  |  | 114  |  | 11.464  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

*(Appendix E.2)*

participants reported lower levels of feeling ‘Joyful, Wanting to dance’ when listening to the vocal songs (*M* = 5.374, *SD* = 3.326) than when listening to the instrumental songs (*M* = 6.565, *SD* = 3.035), F(1) = 7.118, *p* = 0.009.

The third significant effect was against ‘Feel: Relaxed, Peaceful’:

| **Within Subjects Effects**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 96.526  |  | 1  |  | 96.526  |  | 13.965  |  | < .001  |  |
| Residuals  |  | 787.974  |  | 114  |  | 6.912  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

*(Appendix E.2)*

participants reported lower levels of feeling ‘Relaxed, Peaceful’ when listening to the vocal songs (*M* = 2.983, *SD* = 2.478) than when listening to the instrumental songs (*M* = 4.278, *SD* = 2.651), F(1) = 13.965, *p* < 0.001.

The final significant effect was against ‘Feel: Melancholic, Sad’.

| **Within Subjects Effects**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 79.239  |  | 1  |  | 79.239  |  | 18.203  |  | < .001  |  |
| Residuals  |  | 496.261  |  | 114  |  | 4.353  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

*(Appendix E.2)*

participants reported higher levels of feeling ‘Melancholic, Sad’ when listening to the vocal songs (*M* = 2.087, *SD* = 2.491) than when listening to the instrumental songs (*M* = 0.913, *SD* = 1.328), F(1) = 18.203, *p* < 0.001.

No other interactions proved significant (*p <* 0.05), and so it is assumed that the presence of vocals did not significantly impact the results.

## Test 3: Discussion

This test looked at the main effect of this study by combining both instrumental songs and comparing measurements against the combined vocal songs. Overall, there was no significant difference between enjoyment of instrumental or vocal songs, but out of all the other measurements four were found to have a significant interaction. Vocal songs were reported to have significantly lower levels of ‘Feel: Inspired, Enthusiastic’, ‘Feel: Joyful, Wanting to dance’, ‘Feel: Relaxed, Peaceful’, and significantly higher levels of ‘Feel: Melancholic, Sad’.

Every level of reported emotion for positive emotions were found to decrease when listening to Vocal songs compared to Instrumental, and levels of reported emotion for one negative emotion increased when listening to Vocal songs compared to Instrumental. While only it was only three out of nine positive emotional measurements and one out of four negative emotional measurements, the results are in line with the hypothesis that songs with instrumentally happy songs with vocally sad lyrics reduce feelings of positive emotions and increase feelings of negative emotions when participants can hear and read the sad vocals.

This goes against the results found by Mori & Iwanaga (2014), who tested for the same effect but instead of removing vocals and playing participants an instrumentally happy song with sad lyrics in a language they could not understand and controlled whether participants were given a translation or not. While their study showed no significant difference in reported positive or negative emotions between stimuli, these results showed a significant interaction.

STOMP, TIPI, and correlational analysis.

STOMP preferences showed participants on average liked all types of music including ‘Heavy metal, Punk rock’ (M = 4.513, SD = 2.054), ‘Pop, Soft rock, Soul/RnB’ (M = 6.157, SD = 0.875), ‘Rock & roll, Country, Folk, Singer-songwriter’ (M = 5.652, SD = 1.163), and ‘Rap, Hip-hop, Electronica’ (M = 4.783, SD = 1.757) more than they disliked them.

Correlational analysis between emotional response and TIPI results showed no strong correlations between any of the measurements and personality *(Appendix F.1)*, correlational analysis between STOMP preferences and TIPI results showed a moderate negative correlation between ‘Conscientiousness’ and enjoyment of ‘Heavy metal’ and ‘Punk rock’, *r*(18) = -0.309, *p* < 0.001 *(Appendix F.2)*.

# General Discussion

The final test analysed the combined data and overall proved the main hypothesis that positive feelings are reduced and negative increased when listening to an instrumentally happy song with sad vocals, compared to only the instrumental; but there were issues involved in the choices of stimuli which may have led the data to be biased.

Both test 1 and test 2 showed a significant difference in reported emotions, but to a lesser degree in instrumental songs than vocal. The fact that so many measurements were found to differentiate between the two vocal songs chosen as stimuli shows that they were not suitable songs and were comparable enough to counterbalance results against each other. This may be due to the fact that Song 2 on both instrumental and vocal tracks had more than a third of participants recognise the song, potentially confounding results as they would bring their biases into the study from having heard it prior to the study (Scherer, 2004). The results go against a lot of previous research which has suggested that negative emotions are felt much less in songs that positive ones (Zentner, Meylan, & Scherer, 2000), but our study uses stimuli which are intended to elicit different emotions through their instrumental and vocals, which are processed in different regions of the brain (Buchweitz, et al, 2009) and may elicit different emotions with more success than previous studies (Ali & Peynircioğlu, 2006).

None of the TIPI or STOMP correlations proved to have a large effect on the overall results, participants in theory should not have enjoyed either song more than the other since every genre was enjoyed by the majority of participants, which was found to be true for test 1 on the instrumental tracks but was not found to be the case for the vocal tracks. Once again, this may be due to participants recognising Song 2 more than Song 1, which may increase how much participants like the song since repeated exposure increases enjoyment as long as they are not overly exposed to the stimuli (Szpunar et al, 2004).

The study had a large sample size which more than sufficiently powered the results, meaning the validity of results should not be an issue, but the vast majority of participants identified as female which may influence how the majority of participants were influenced by the stimuli. Loui et al (2013) suggests that females are typically more influenced by vocals when reporting emotional responses to music than other genders, though this is disputed by Beveridge & Knox (2018) who argues there is generalisability across genders for songs with rhythmic vocals to produce emotion in the listener. An issue which may arise from the ‘rhythmic qualities’ of vocals is the fact that most songs with lyrics have their vocalists sing the main rhythm of the song, by removing the vocals entirely to create an instrumental version it may remove some rhythmic aspects of the song and make the instrumental versions less comparable to a song originally wrote without lyrics. Schellenberg et al (2000) found that songs which are intended to convey an emotion most often achieve this through pitch variation in melody, and by removing the vocals a lot of the melodic content may be removed which can reduce emotional impact compared to simply replacing the vocal melody with an instrument (Galizio & Hendrick, 1972).

The majority of the participants were not musically proficient according to the GoldMSI results, with an average of 89% of populations being more proficient than the sample used in this study, but they did report being actively engaged with music on a daily basis. This means that participants in this study may not have reported as high an emotional response to the stimuli as a more musically proficient sample may have (Kawakami et al, 2012), though the extent of this effect is considered to be negligible and should not have affected the results to a significant degree (Kawakami et al, 2013). Despite the large sample size, the study was very polarising in the ethnicity of the participants, with the majority of participants being White-British, meaning the results may only apply to similar populations.

Aside from these issues, the study showed that lyrical content may have a larger importance in eliciting emotion than previously given credit, and supported the idea that lyrics are more effective at eliciting negative emotions while instrumentals are more effective at eliciting positive (Ali & Peynircioğlu, 2006). The lack of a pilot study to check the validity of the stimuli may have affected the results, but these can be avoided through further study and time given to find sufficient stimuli. The results showed that consideration of a combination of factors that can elicit emotion in musical stimuli is important as the majority of musical emotion study focuses on the overall effect a song has on emotions. Songs may have conflicting emotional intentions, but manipulation of instrumental and vocal features when creating a song can influence which emotion is more strongly felt.

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# Appendices

Appendix A: Power Calculations

**F tests -** ANOVA: Repeated measures, between factors

**Analysis:** A priori: Compute required sample size

**Input:** Effect size f = 0.4034733

 α err prob = 0.05

 Power (1-β err prob) = 0.80

 Number of groups = 2

 Number of measurements = 14

 Corr among rep measures = 0.3

**Output:** Noncentrality parameter λ = 9.3023259

 Critical F = 4.4138734

 Numerator df = 1.0000000

 Denominator df = 18.0000000

 Total sample size = 20

 Actual power = 0.8222387

Appendix B: Familiarity Means

| **Number of participants who recognised songs (%)** |
| --- |
|  | **Song 1**  | **Song 2** |
| Instrumental  |  | 0.03 |  | 33.40 |  |
| Vocal |  | 0.05 |  | 40.81 |  |
|  |

Appendix C.1: Enjoyment of instrumental songs

| **Independent Samples T-Test**  |
| --- |
|  | **t**  | **df**  | **p**  |
| Enjoyment of song  |  | -0.210  |  | 113  |  | 0.834  |  |
|  |
| *Note.*  Student's t-test.  |

Appendix C.2: Instrumental MANOVA

| **MANOVA: Wilks Test**  |
| --- |
| **Cases**  | **df**  | **Approx. F**  | **Wilks' Λ**  | **Num df**  | **Den df**  | **p**  |
| Type of song  |  | 1  |  | 2.263  |  | 0.774  |  | 13  |  | 101.000  |  | 0.012  |  |
| Residuals  |  | 113  |  |  |  |  |  |  |  |  |  |    |  |
|  |

Appendix C.3: Instrumental ANOVAs

| **ANOVA: Feel: Wonder, Amazed**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 1.645  |  | 1  |  | 1.645  |  | 0.236  |  | 0.628  |  |
| Residuals  |  | 788.042  |  | 113  |  | 6.974  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Moved, Touched**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 1.079  |  | 1  |  | 1.079  |  | 0.195  |  | 0.660  |  |
| Residuals  |  | 625.842  |  | 113  |  | 5.538  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Enchanted, in Awe**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 1.148  |  | 1  |  | 1.148  |  | 0.191  |  | 0.663  |  |
| Residuals  |  | 679.200  |  | 113  |  | 6.011  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Inspired, enthusiastic**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 8.070  |  | 1  |  | 8.070  |  | 0.986  |  | 0.323  |  |
| Residuals  |  | 924.661  |  | 113  |  | 8.183  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Joyful, Wanting to dance**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 4.284  |  | 1  |  | 4.284  |  | 0.463  |  | 0.498  |  |
| Residuals  |  | 1045.977  |  | 113  |  | 9.256  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Powerful, Strong**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 9.413  |  | 1  |  | 9.413  |  | 1.277  |  | 0.261  |  |
| Residuals  |  | 832.709  |  | 113  |  | 7.369  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Full of tenderness, Warmhearted**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 0.111  |  | 1  |  | 0.111  |  | 0.015  |  | 0.902  |  |
| Residuals  |  | 825.020  |  | 113  |  | 7.301  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Relaxed, Peaceful**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 79.276  |  | 1  |  | 79.276  |  | 12.411  |  | < .001  |  |
| Residuals  |  | 721.820  |  | 113  |  | 6.388  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Melancholic, Sad**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 12.294  |  | 1  |  | 12.294  |  | 7.357  |  | 0.008  |  |
| Residuals  |  | 188.836  |  | 113  |  | 1.671  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Nostalgic, Sentimental**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 6.915  |  | 1  |  | 6.915  |  | 0.968  |  | 0.327  |  |
| Residuals  |  | 806.945  |  | 113  |  | 7.141  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Indifferent, Bored**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 1.113  |  | 1  |  | 1.113  |  | 0.130  |  | 0.719  |  |
| Residuals  |  | 965.461  |  | 113  |  | 8.544  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Tense, Uneasy**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 0.133  |  | 1  |  | 0.133  |  | 0.048  |  | 0.826  |  |
| Residuals  |  | 311.832  |  | 113  |  | 2.760  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Agitated, Aggressive**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 6.168  |  | 1  |  | 6.168  |  | 2.262  |  | 0.135  |  |
| Residuals  |  | 308.127  |  | 113  |  | 2.727  |  |  |  |    |  |
|  |

Appendix C.4: Instrumental descriptives

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

| **Group Descriptives**  |
| --- |
|  | **Group**  | **N**  | **Mean**  | **SD**  | **SE**  |
| Enjoyment of song  |  | 1  |  | 55  |  | 6.273  |  | 2.164  |  | 0.292  |  |
|    |  | 2  |  | 60  |  | 6.367  |  | 2.591  |  | 0.334  |  |
| Feel: Wonder, Amazed  |  | 1  |  | 55  |  | 3.927  |  | 2.340  |  | 0.316  |  |
|    |  | 2  |  | 60  |  | 4.167  |  | 2.889  |  | 0.373  |  |
| Feel: Moved, Touched  |  | 1  |  | 55  |  | 2.873  |  | 2.117  |  | 0.286  |  |
|    |  | 2  |  | 60  |  | 3.067  |  | 2.550  |  | 0.329  |  |
| Feel: Enchanted, in Awe  |  | 1  |  | 55  |  | 3.200  |  | 2.368  |  | 0.319  |  |
|    |  | 2  |  | 60  |  | 3.400  |  | 2.526  |  | 0.326  |  |
| Feel: Inspired, enthusiastic  |  | 1  |  | 55  |  | 5.036  |  | 2.631  |  | 0.355  |  |
|    |  | 2  |  | 60  |  | 5.567  |  | 3.055  |  | 0.394  |  |
| Feel: Joyful, Wanting to dance  |  | 1  |  | 55  |  | 6.364  |  | 2.765  |  | 0.373  |  |
|    |  | 2  |  | 60  |  | 6.750  |  | 3.276  |  | 0.423  |  |
| Feel: Powerful, Strong  |  | 1  |  | 55  |  | 3.927  |  | 2.418  |  | 0.326  |  |
|    |  | 2  |  | 60  |  | 4.500  |  | 2.960  |  | 0.382  |  |
| Feel: Full of tenderness, Warmhearted  |  | 1  |  | 55  |  | 3.945  |  | 2.498  |  | 0.337  |  |
|    |  | 2  |  | 60  |  | 3.883  |  | 2.877  |  | 0.371  |  |
| Feel: Relaxed, Peaceful  |  | 1  |  | 55  |  | 5.145  |  | 2.453  |  | 0.331  |  |
|    |  | 2  |  | 60  |  | 3.483  |  | 2.594  |  | 0.335  |  |
| Feel: Melancholic, Sad  |  | 1  |  | 55  |  | 1.255  |  | 1.578  |  | 0.213  |  |
|    |  | 2  |  | 60  |  | 0.600  |  | 0.960  |  | 0.124  |  |
| Feel: Nostalgic, Sentimental  |  | 1  |  | 55  |  | 3.291  |  | 2.266  |  | 0.306  |  |
|    |  | 2  |  | 60  |  | 2.800  |  | 2.996  |  | 0.387  |  |
| Feel: Indifferent, Bored  |  | 1  |  | 55  |  | 2.436  |  | 2.672  |  | 0.360  |  |
|    |  | 2  |  | 60  |  | 2.633  |  | 3.135  |  | 0.405  |  |
| Feel: Tense, Uneasy  |  | 1  |  | 55  |  | 0.982  |  | 1.421  |  | 0.192  |  |
|    |  | 2  |  | 60  |  | 1.050  |  | 1.854  |  | 0.239  |  |
| Feel: Agitated, Aggressive  |  | 1  |  | 55  |  | 0.636  |  | 1.112  |  | 0.150  |  |
|    |  | 2  |  | 60  |  | 1.100  |  | 2.023  |  | 0.261  |  |
|  |

 |

*Note: Group 1 = Song 1 Instrumental, Group 2 = Song 2 Instrumental*

Appendix D.1: Enjoyment of vocal songs

| **Independent Samples T-Test**  |
| --- |
|  | **t**  | **df**  | **p**  |
| Enjoyment of song  |  | -2.411  |  | 113  |  | 0.018  |  |
|  |
| *Note.*  Student's t-test.  |

Appendix D.2: Vocal MANOVA

| **MANOVA: Wilks Test**  |
| --- |
| **Cases**  | **df**  | **Approx. F**  | **Wilks' Λ**  | **Num df**  | **Den df**  | **p**  |
| Type of song  |  | 1  |  | 2.053  |  | 0.791  |  | 13  |  | 101.000  |  | 0.024  |  |
| Residuals  |  | 113  |  |  |  |  |  |  |  |  |  |    |  |
|  |

Appendix D.3: Vocal ANOVAS

| **ANOVA: Feel: Wonder, Amazed**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 2.661  |  | 1  |  | 2.661  |  | 0.362  |  | 0.548  |  |
| Residuals  |  | 829.686  |  | 113  |  | 7.342  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Moved, Touched**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 1.603  |  | 1  |  | 1.603  |  | 0.233  |  | 0.630  |  |
| Residuals  |  | 775.927  |  | 113  |  | 6.867  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Enchanted, in Awe**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 25.733  |  | 1  |  | 25.733  |  | 4.268  |  | 0.041  |  |
| Residuals  |  | 681.311  |  | 113  |  | 6.029  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Inspired, enthusiastic**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 53.123  |  | 1  |  | 53.123  |  | 5.869  |  | 0.017  |  |
| Residuals  |  | 1022.842  |  | 113  |  | 9.052  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Joyful, Wanting to dance**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 85.163  |  | 1  |  | 85.163  |  | 8.185  |  | 0.005  |  |
| Residuals  |  | 1175.759  |  | 113  |  | 10.405  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Powerful, Strong**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 32.464  |  | 1  |  | 32.464  |  | 3.659  |  | 0.058  |  |
| Residuals  |  | 1002.527  |  | 113  |  | 8.872  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Full of tenderness, Warmhearted**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 7.261  |  | 1  |  | 7.261  |  | 1.001  |  | 0.319  |  |
| Residuals  |  | 819.661  |  | 113  |  | 7.254  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Relaxed, Peaceful**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 3.455  |  | 1  |  | 3.455  |  | 0.560  |  | 0.456  |  |
| Residuals  |  | 696.511  |  | 113  |  | 6.164  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Melancholic, Sad**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 0.111  |  | 1  |  | 0.111  |  | 0.018  |  | 0.894  |  |
| Residuals  |  | 707.020  |  | 113  |  | 6.257  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Nostalgic, Sentimental**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 20.881  |  | 1  |  | 20.881  |  | 2.364  |  | 0.127  |  |
| Residuals  |  | 998.111  |  | 113  |  | 8.833  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Indifferent, Bored**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 52.181  |  | 1  |  | 52.181  |  | 5.929  |  | 0.016  |  |
| Residuals  |  | 994.515  |  | 113  |  | 8.801  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Tense, Uneasy**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 8.070  |  | 1  |  | 8.070  |  | 1.954  |  | 0.165  |  |
| Residuals  |  | 466.661  |  | 113  |  | 4.130  |  |  |  |    |  |
|  |

| **ANOVA: Feel: Agitated, Aggressive**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 3.247  |  | 1  |  | 3.247  |  | 1.218  |  | 0.272  |  |
| Residuals  |  | 301.327  |  | 113  |  | 2.667  |  |  |  |    |  |
|  |

Appendix D.5: Vocal descriptives

| **Group Descriptives**  |
| --- |
|  | **Group**  | **N**  | **Mean**  | **SD**  | **SE**  |
| Enjoyment of song  |  | 3  |  | 60  |  | 5.550  |  | 2.925  |  | 0.378  |  |
|    |  | 4  |  | 55  |  | 6.855  |  | 2.870  |  | 0.387  |  |
| Feel: Wonder, Amazed  |  | 3  |  | 60  |  | 3.550  |  | 2.902  |  | 0.375  |  |
|    |  | 4  |  | 55  |  | 3.855  |  | 2.483  |  | 0.335  |  |
| Feel: Moved, Touched  |  | 3  |  | 60  |  | 3.400  |  | 2.859  |  | 0.369  |  |
|    |  | 4  |  | 55  |  | 3.164  |  | 2.331  |  | 0.314  |  |
| Feel: Enchanted, in Awe  |  | 3  |  | 60  |  | 2.417  |  | 2.486  |  | 0.321  |  |
|    |  | 4  |  | 55  |  | 3.364  |  | 2.422  |  | 0.327  |  |
| Feel: Inspired, enthusiastic  |  | 3  |  | 60  |  | 3.767  |  | 2.825  |  | 0.365  |  |
|    |  | 4  |  | 55  |  | 5.127  |  | 3.198  |  | 0.431  |  |
| Feel: Joyful, Wanting to dance  |  | 3  |  | 60  |  | 4.550  |  | 3.033  |  | 0.392  |  |
|    |  | 4  |  | 55  |  | 6.273  |  | 3.424  |  | 0.462  |  |
| Feel: Powerful, Strong  |  | 3  |  | 60  |  | 3.700  |  | 2.970  |  | 0.383  |  |
|    |  | 4  |  | 55  |  | 4.764  |  | 2.987  |  | 0.403  |  |
| Feel: Full of tenderness, Warmhearted  |  | 3  |  | 60  |  | 3.133  |  | 2.587  |  | 0.334  |  |
|    |  | 4  |  | 55  |  | 3.636  |  | 2.805  |  | 0.378  |  |
| Feel: Relaxed, Peaceful  |  | 3  |  | 60  |  | 2.817  |  | 2.332  |  | 0.301  |  |
|    |  | 4  |  | 55  |  | 3.164  |  | 2.637  |  | 0.356  |  |
| Feel: Melancholic, Sad  |  | 3  |  | 60  |  | 2.117  |  | 2.443  |  | 0.315  |  |
|    |  | 4  |  | 55  |  | 2.055  |  | 2.563  |  | 0.346  |  |
| Feel: Nostalgic, Sentimental  |  | 3  |  | 60  |  | 2.583  |  | 2.866  |  | 0.370  |  |
|    |  | 4  |  | 55  |  | 3.436  |  | 3.084  |  | 0.416  |  |
| Feel: Indifferent, Bored  |  | 3  |  | 60  |  | 3.167  |  | 3.142  |  | 0.406  |  |
|    |  | 4  |  | 55  |  | 1.818  |  | 2.763  |  | 0.373  |  |
| Feel: Tense, Uneasy  |  | 3  |  | 60  |  | 1.567  |  | 2.212  |  | 0.286  |  |
|    |  | 4  |  | 55  |  | 1.036  |  | 1.815  |  | 0.245  |  |
| Feel: Agitated, Aggressive  |  | 3  |  | 60  |  | 1.100  |  | 1.753  |  | 0.226  |  |
|    |  | 4  |  | 55  |  | 0.764  |  | 1.490  |  | 0.201  |  |
|  |

*Note: Group 3 = Song 1 Vocal, Group 4 = Song 2 Vocal*

Appendix E.1: Combined Enjoyment

| **Paired Samples T-Test**  |
| --- |
| **Measure 1**  |  | **Measure 2**  | **t**  | **df**  | **p**  |
| (Vocals) Enjoyment of song  |  | -  |  | (Instrumental) Enjoyment of song  |  | -0.400  |  | 114  |  | 0.690  |  |
|  |
| *Note.*  Student's t-test.  |

Appendix E.2: Combined Repeated Measures ANOVAs

| **ANOVA: Feel: Wonder, Amazed**  |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 7.309  |  | 1  |  | 7.309  |  | 1.036  |  | 0.311  |  |
| Residuals  |  | 804.191  |  | 114  |  | 7.054  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Moved, Touched** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 5.635  |  | 1  |  | 5.635  |  | 0.785  |  | 0.378  |  |
| Residuals  |  | 818.365  |  | 114  |  | 7.179  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Enchanted, in Awe** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 10.870  |  | 1  |  | 10.870  |  | 1.580  |  | 0.211  |  |
| Residuals  |  | 784.130  |  | 114  |  | 6.878  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Inspired, Enthusiastic** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 46.126  |  | 1  |  | 46.126  |  | 5.113  |  | 0.026  |  |
| Residuals  |  | 1028.374  |  | 114  |  | 9.021  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Joyful, Wanting to dance** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 81.604  |  | 1  |  | 81.604  |  | 7.118  |  | 0.009  |  |
| Residuals  |  | 1306.896  |  | 114  |  | 11.464  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Powerful, Strong** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 0.017  |  | 1  |  | 0.017  |  | 0.002  |  | 0.964  |  |
| Residuals  |  | 967.983  |  | 114  |  | 8.491  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Full of tenderness, Warmhearted** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 16.713  |  | 1  |  | 16.713  |  | 2.402  |  | 0.124  |  |
| Residuals  |  | 793.287  |  | 114  |  | 6.959  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Relaxed, Peaceful** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 96.526  |  | 1  |  | 96.526  |  | 13.965  |  | < .001  |  |
| Residuals  |  | 787.974  |  | 114  |  | 6.912  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Melancholic, Sad** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 79.239  |  | 1  |  | 79.239  |  | 18.203  |  | < .001  |  |
| Residuals  |  | 496.261  |  | 114  |  | 4.353  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Nostalgic, Sentimental** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 0.109  |  | 1  |  | 0.109  |  | 0.014  |  | 0.908  |  |
| Residuals  |  | 915.391  |  | 114  |  | 8.030  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Indifferent, Bored** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 0.017  |  | 1  |  | 0.017  |  | 0.002  |  | 0.966  |  |
| Residuals  |  | 1065.983  |  | 114  |  | 9.351  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Tense, Uneasy** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 5.026  |  | 1  |  | 5.026  |  | 1.447  |  | 0.232  |  |
| Residuals  |  | 395.974  |  | 114  |  | 3.473  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

| **ANOVA: Feel: Agitated, Aggressive** |
| --- |
| **Cases**  | **Sum of Squares**  | **df**  | **Mean Square**  | **F**  | **p**  |
| Type of song  |  | 0.213  |  | 1  |  | 0.213  |  | 0.072  |  | 0.790  |  |
| Residuals  |  | 339.287  |  | 114  |  | 2.976  |  |  |  |    |  |
|  |
| *Note.*  Type III Sum of Squares  |

Appendix E.3: Combined descriptives

| **Descriptives**  |
| --- |
|  | **N**  | **Mean**  | **SD**  | **SE**  |
| (Vocals) Enjoyment of song  |  | 115  |  | 6.174  |  | 2.960  |  | 0.276  |  |
| (Instrumental) Enjoyment of song  |  | 115  |  | 6.322  |  | 2.386  |  | 0.223  |  |
| (Vocals) Feel: Wonder, Amazed  |  | 115  |  | 3.696  |  | 2.702  |  | 0.252  |  |
| (Instrumental) Feel: Wonder, Amazed  |  | 115  |  | 4.052  |  | 2.632  |  | 0.245  |  |
| (Vocals) Feel: Moved, Touched  |  | 115  |  | 3.287  |  | 2.612  |  | 0.244  |  |
| (Instrumental) Feel: Moved, Touched  |  | 115  |  | 2.974  |  | 2.345  |  | 0.219  |  |
| (Vocals) Feel: Enchanted, in Awe  |  | 115  |  | 2.870  |  | 2.490  |  | 0.232  |  |
| (Instrumental) Feel: Enchanted, in Awe  |  | 115  |  | 3.304  |  | 2.443  |  | 0.228  |  |
| (Vocals) Feel: Inspired, enthusiastic  |  | 115  |  | 4.417  |  | 3.072  |  | 0.286  |  |
| (Instrumental) Feel: Inspired, enthusiastic  |  | 115  |  | 5.313  |  | 2.860  |  | 0.267  |  |
| (Vocals) Feel: Joyful, Wanting to dance  |  | 115  |  | 5.374  |  | 3.326  |  | 0.310  |  |
| (Instrumental) Feel: Joyful, Wanting to dance  |  | 115  |  | 6.565  |  | 3.035  |  | 0.283  |  |
| (Vocals) Feel: Powerful, Strong  |  | 115  |  | 4.209  |  | 3.013  |  | 0.281  |  |
| (Instrumental) Feel: Powerful, Strong  |  | 115  |  | 4.226  |  | 2.718  |  | 0.253  |  |
| (Vocals) Feel: Full of tenderness, Warmhearted  |  | 115  |  | 3.374  |  | 2.693  |  | 0.251  |  |
| (Instrumental) Feel: Full of tenderness, Warmhearted  |  | 115  |  | 3.913  |  | 2.690  |  | 0.251  |  |
| (Vocals) Feel: Relaxed, Peaceful  |  | 115  |  | 2.983  |  | 2.478  |  | 0.231  |  |
| (Instrumental) Feel: Relaxed, Peaceful  |  | 115  |  | 4.278  |  | 2.651  |  | 0.247  |  |
| (Vocals) Feel: Melancholic, Sad  |  | 115  |  | 2.087  |  | 2.491  |  | 0.232  |  |
| (Instrumental) Feel: Melancholic, Sad  |  | 115  |  | 0.913  |  | 1.328  |  | 0.124  |  |
| (Vocals) Feel: Nostalgic, Sentimental  |  | 115  |  | 2.991  |  | 2.990  |  | 0.279  |  |
| (Instrumental) Feel: Nostalgic, Sentimental  |  | 115  |  | 3.035  |  | 2.672  |  | 0.249  |  |
| (Vocals) Feel: Indifferent, Bored  |  | 115  |  | 2.522  |  | 3.030  |  | 0.283  |  |
| (Instrumental) Feel: Indifferent, Bored  |  | 115  |  | 2.539  |  | 2.912  |  | 0.272  |  |
| (Vocals) Feel: Tense, Uneasy  |  | 115  |  | 1.313  |  | 2.041  |  | 0.190  |  |
| (Instrumental) Feel: Tense, Uneasy  |  | 115  |  | 1.017  |  | 1.654  |  | 0.154  |  |
| (Vocals) Feel: Agitated, Aggressive  |  | 115  |  | 0.939  |  | 1.635  |  | 0.152  |  |
| (Instrumental) Feel: Agitated, Aggressive  |  | 115  |  | 0.878  |  | 1.660  |  | 0.155  |  |

Appendix F.1: Emotional responses and TIPI correlations



Appendix F.2: STOMP preferences and TIPI correlations

Figure 1: Procedure Chart

