

# Mood Induction Using Non-Musical Stimuli, and its Effects on the Perception of Music and Emotions

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## ABSTRACT

This study considers how mood can be affected by the use of music which is perceived as happy or sad. 24 participants took part in this experiment which investigated the effects of non-musical stimuli on perceptions of emotions in music. Newspaper articles provided the non-musical stimuli and induced the moods (happy or sad), and music (also either happy or sad) was then heard by the participant. All participants did the same tasks in the same order, and 20 examples were completed by each listener. Participants also completed a brief questionnaire about musical listening habits, a GOLD MSI test, and a familiarity rating for each musical excerpt. The results are consistent with the hypothesis that happy articles will make listeners perceive happy music as happier, and sad articles make listeners perceive sad music as sadder, compared to non-congruent combinations. Happy articles and sad music examples were still rated by participants as being perceived as sad, but the number on the scale was closer to neutral. Sad articles and happy music examples were still rated as being perceived as happy, but again, closer to neutral on the scale. To the author's knowledge, this is the first study to consider the impact of text-induced mood on perception of emotion in music.

## 1. INTRODUCTION

This study addresses a novel research question around cross-modal mood induction. However this new research is situated within the context of existing relevant research on mood induction, and the idea of using text and music stimuli in the same experiment has not been explored thus far. The study aims to investigate whether "happy" and "sad" non-musical stimuli (news articles in this case) which acted as an emotional prime can affect our perceptions of "happy" and "sad" music. The hypothesis was that happy news articles read before listening to happy music would cause participants to perceive the music as happier, and sad articles read before listening to sad music would be perceived as being sadder. When the news articles' and musical excerpts' emotions were non-congruent, it was expected that this could be confusing for participants, and results would differ. The hypothesis in this case was that happy articles followed by sad music would still have the music rated as being sad, but closer to neutral, and sad articles followed by happy music would have the music rated as being happy, but again, closer to neutral.

Previous studies have researched the effects of non-musical stimuli influencing our perceptions of emotions in music, but thus far no research involving written stimuli or news articles influencing how we perceive emotion in music have been found. The majority of research to date uses pictures, facial expressions, or images containing humans as the non-musical

stimuli to induce emotions. Most of these studies use pictures from the International Affective Picture System (IAPS), or the Pictures of Facial Affect, and these pictures are supposed to create a positive or negative emotion (Baumgartner, Esslen & Jancke, 2005). Additionally, much of the existing research uses music as a prime, or presents visual and musical stimuli simultaneously, which is why it was interesting in this experiment to investigate the effects of news articles as the emotional prime. Whilst these studies which have used pictures from the IAPS have been shown to induce a positive or negative emotion, there appears to be no such thing for textual stimuli, so a pilot study was carried out in order to choose the articles which induced happy or sad emotions the strongest.

Related studies include Hunter, Schellenberg and Griffith. (2011), where emotional responses to music and preferences to music after mood induction were investigated. Participants were asked to listen to a 30 second excerpt of music and rate how much they liked it, how happy or sad it sounded, and how familiar the excerpt was to them. Two experiments were involved in this study; experiment 1 showed that a sad mood being induced by visual stimuli (pictures) did not give listeners a preference for happy music, and experiment 2 demonstrated that listeners thought that they perceived more sadness in a musical extract after a sad mood was induced, and that after a happy or neutral mood being induced, happy music was preferred. Logeswaran and Bhattacharya (2009) explored the similarities between emotions made by musical and visual stimuli. In this experiment, the visual stimuli were faces displaying emotions which were happy, sad, or neutral, and these faces were primed by happy or sad music. The results showed that musical priming significantly impacted how we perceive faces' emotions to be when the emotions for visual and musical stimuli matched, but most significantly when a neutral face was primed by happy or sad music.

A final study that will be discussed here is by Baumgartner et al. (2005), and relates most specifically to the experiment which is being discussed. The visual stimuli used here were taken from the IAPS, and visual and musical stimuli were shown simultaneously to participants. Emotions investigated were happiness, fear, and sadness, and as well as electroencephalography (EEG) being recorded to inspect oscillatory brain activity levels, participants also rated these emotions on a 9-point scale. Results from the study showed that the classical music created intense emotional responses, which activated areas of the brain also thought to be used in situations of reward, motivation, emotion, and arousal. Ratings were highest and most accurate when visual and musical stimuli were presented simultaneously, intermediate for just visual stimuli, and lowest for just musical stimuli.

This would suggest that using visual as well as musical stimuli had the strongest impact on how strongly and accurately people rated emotions. This study, however, had flaws. Only females were used, apparently because females demonstrate stronger emotional responses than males. Although this has been supported by further studies (Bianchin and Angrilli, 2012; McRae, Ochsner, Maus & Gabrielli, 2008), this is only accounting for females and so the results could be disproportionate or biased, and it is likely that results would differ if men had been tested as well as females. The study also used well-known music by well-known composers, and participants could have already heard these pieces and have memories or emotions associated with them which could influence results. A solution to this could be researchers composing their own musical excerpts, using unfamiliar pieces, or asking participants to rate how familiar the music was to them so that this familiarity could be accounted for when analysing results.

## 2. METHOD

*2.1 Design.* This experiment used repeated measures. All participants read the same news articles and listened to the same musical excerpts in the same order. A randomised order was not chosen so that the chance of having the same emotion combinations being given consecutively, and therefore possibly making the experiment predictable, was not possible. The only difference between experiments was that some participants took longer to read the news articles than others. The reason for using repeated measures instead of independent measures in this experiment was so that all participants experienced exactly the same order of experiment, in an attempt to make the study more equal for all participants. The study was an experimental design, as the mood priming stimulus (happy or sad articles) was manipulated. In this case, the variables were the emotions (happy or sad) of the news articles and musical excerpts, and the combinations which they were presented in to participants. The dependent variables in this study were the levels of happiness or sadness which participants felt after each example, and the independent variables were the combination of emotions read and heard by the participants. Dependent variables of levels of happiness or sadness felt by participants could have been influenced by a number of multiple outside factors.

*2.2 Participants.* A total of 24 subjects were involved in this study, all of whom were students from Durham University, and were recruited via Facebook by registering for a day and time slot on an online sign-up platform. As the study took place in my home, all participants were people I knew well, and there was always at least one other person in the house during testing. 17 females, 6 males, and 1 who preferred not to disclose their gender, were participants. Ages ranged from 18 to 25, and the mean age of participants was 19.83. Participants were a mixture of musicians and non-musicians, which can be seen through the GOLD MSI test results: the lowest scored 7, the highest 47, and the mean was 33.71 (out of a possible 49 points). Most participants were active listeners of music and frequently experienced emotions whilst listening to music. 91.7% of participants declared that they listened to music several times a day or constantly throughout

the day, and 37.5% of participants very often or always felt emotions such as happiness, sadness, fear, or anger when listening to music. A mixture of musicians and non-musicians was desired for this experiment so that we could study a more realistic and accurate representation of people, and so that any differences in results between musicians and non-musicians, or familiarity with musical excerpts, could be examined.

*2.3 Materials and Stimuli.* Before starting the experiment, participants were asked to complete the Gold-MSI test, which is a tool to measure musical sophistication (Müllensiefen et al., 2014). 20 excerpts of music and 20 news articles were used in the study, and were firstly chosen by searching online and on Spotify to find music which was personally perceived as being happy or sad, and then were narrowed down in a pilot study where 40 excerpts of music and 40 articles were rated by participants on a scale of 1 to 10. 1 was extremely sad, 5 was neutral and 10 was extremely happy, and ratings on the most extreme side of the scale (closest to 1 and 10) were chosen for the main study. Participants were asked to rate emotions based on how it made them feel, not what they thought the music was supposed to perceive. Some musical extracts in the pilot study were used to represent happiness or sadness because it had been said that these particular pieces of music were scientifically proven to invoke happiness or sadness in a listener (Waugh, <http://metro.co.uk>, and Economy, <https://www.inc.com>). These excerpts, however, were not used in the main experiment because the pilot study showed them invoking the opposite emotion to what they were supposed to. All of the musical excerpts were played from the loudspeaker of a laptop at the same volume on Spotify, and extract times were varied but ranged from 25 seconds to 1 minute and 11 seconds, depending on the extract, in order for the listener to be able to hear enough of the music to distinguish how happy or sad it sounded to them. All musical extracts were classical music, and some were very familiar pieces, whilst others had not been heard by participants. News articles were found online and printed out, with pictures, links to other websites, and all colour removed for consistency and to eliminate potential distractions. The text was all changed to the same size for each article, and article lengths ranged from half a page long to one and a half pages long.

*2.4 Procedure.* The experiment consisted of 20 examples, all of which were in the same order for each participant. There were 5 happy article and happy music combinations, 5 sad article and sad music combinations, 5 happy article and sad music combinations, and 5 sad article and happy music combinations. After reading the information sheet and completing a consent form, participants completed a short questionnaire regarding age, gender and music listening habits, before completing the Gold-MSI. Participants then began the experiment by reading the first news article, and listening to the first excerpt of music after they had finished reading it. After the excerpt finished, participants rated on a scale of 1 to 10, where 1 was extremely sad, 5 was neutral, and 10 was extremely happy, how they felt, and rated how familiar the musical excerpt was to them. There was then a brief silence before moving on to the second news article. There was no time limit across any parts of the experiment so that participants did not feel under pressure, and the time taken for participants to complete the experiment ranged from

between 30 minutes to 50 minutes. Conditions during the experiment were kept as quiet as possible, however some unavoidable background noise was present at times.

### 3. RESULTS

The results of this experiment were consistent with the hypothesis that happy articles made subjects feel that happy music was happier, and sad articles made subjects feel that sad music was sadder, compared to non-congruent combinations. When the emotions of articles and music excerpts did not match, although participants felt happy music as being happy after reading a sad article, and sad music as being sad after a happy article, their moods were rated as being closer to neutral (number 5 on the 10-point scale).

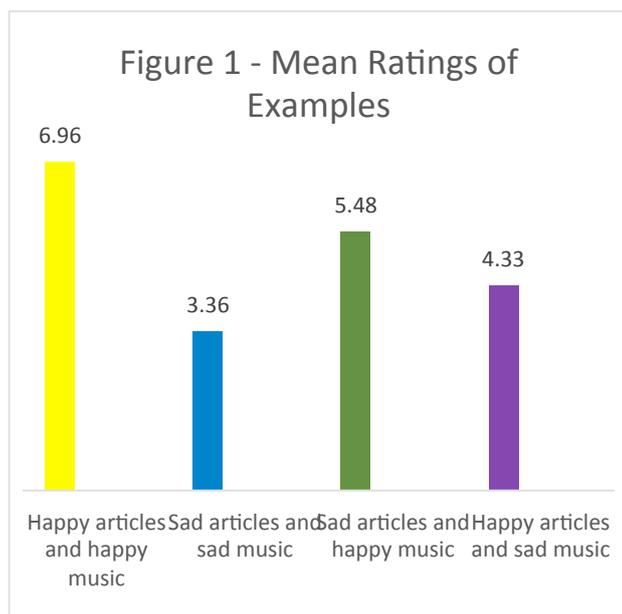


Figure 1. Mean happy-sad ratings of examples

On average, males rated happy articles and happy music examples as 7.3 on the scale of 1-10, whereas females rated these examples as 6.89. This was unexpected, as studies mentioned previously, for example Bianchin and Angrilli (2012), and McRae et. al. (2008), who stated that females experience stronger emotional responses than males. However these results do not support this claim, even though it is only a minor difference of 0.41. For sad articles and sad music this was different, and it supported the claim of females experiencing stronger emotional responses. Males on average rated examples as 3.6, and females rated them as 3.23. For the purpose of this experiment, and because the mean result was 33.71 out of 49, any participant that achieved 33 or over on the Gold-MSI was labelled as a musician. This means that 17 out of 24 participants, or 70.83%, were musicians. Between musicians and non-musicians, there was a clear difference between familiarity of the musical excerpts used. Musicians rated 59.1% of excerpts as very familiar or quite familiar, whereas this figure fell to 25.7% amongst non-musicians.

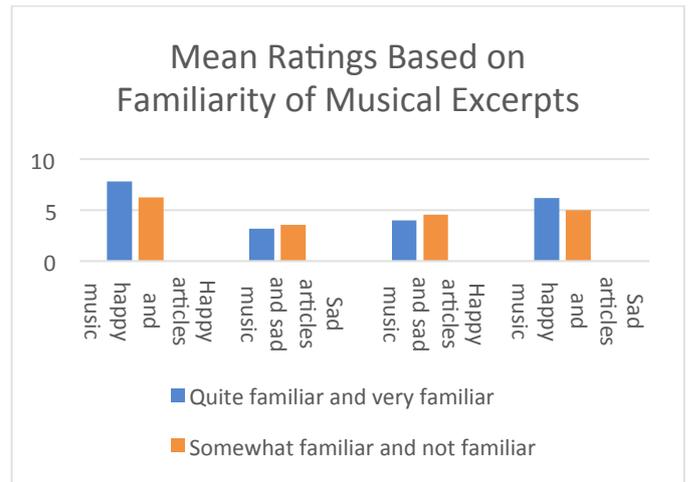


Figure 2. Mean happy-sad ratings by familiarity

For happy article and happy music examples, familiarity affected how happy the examples were rated as. For those who thought the music was quite familiar and very familiar, the mean rating of these examples was 7.8. For those who rated the music as not familiar and somewhat familiar, the mean rating of these examples was 6.23. For sad article and sad music examples, however, this difference was much less noticeable. For excerpts rated as quite familiar and very familiar, the mean score they were rated on the scale was 3.2, and for somewhat familiar and not familiar music, their mean score was 3.55. This could be because those who were familiar with the music will know the music better, and may have associations or memories with it which made them feel happier or sadder than those who did not know the music. For happy article and sad music combinations, quite familiar and very familiar music scored a mean of 3.98, whilst somewhat familiar and not familiar music scored a mean of 4.57. Finally, for sad article and happy music combinations, quite familiar and very familiar music scored a mean of 6.17, whilst somewhat familiar and not familiar music scored a mean of 4.97. It was expected that, when the music was more familiar to the listener, the results would be more “accurate” to what was expected to be seen in the results. For example, happy articles and happy music being rated as happier in those who found the music familiar rather than unfamiliar, and sad articles and sad music being rated as sadder. This was true for all combinations.

### 4. DISCUSSION

The results of this study supported the experiment’s hypothesis. As expected, there was a strong priming effect: happy music was perceived as happier following a happy article, with a corresponding effect in the negative condition.. Overall, this is consistent with previous research by, for instance, Logeswaren and Bhattacharya (2009). Some possible shortcomings of the study include the repetitive nature of the examples, and some news articles took longer to read than others, meaning that there is a chance that some participants became bored or lost focus. In future studies, similar lengths could be used in order to prevent participants losing focus. The experiment did not take into account how participants were already feeling, how tired participants were, or any other additional comments from them about how they

felt which they believed to be significant, and therefore any happiness or sadness which could have influenced how they rated their feelings for each example. Background noise was present occasionally, but could not be avoided, and this could have affected the participants' focus, as well as how well they were able to hear the musical excerpts. Well-known excerpts of music were used, which could have affected the results because, like in previous studies, participants could have already heard and known some of the music well and therefore have associations and memories relating to the music which could have influenced results. A solution to this could be to write examples purposefully for the study. The familiarity rating after each excerpt was put in place to help explain any results which looked abnormal. However a rating of how much participants liked each excerpt could have also been useful because if participants particularly liked or disliked a musical excerpt, this could have influenced results. Some participants mentioned that they did not know how to feel when incongruent music and news article combinations were presented, or that they felt confused, or that they were experiencing other emotions such as anger. The experiment did not account for these emotions, as too many emotions to be rated could become confusing and time consuming. A future study could account for more emotions and give participants breaks to avoid losing focus. All music used in the study was classical, which could be another influencing factor as some participants were not classically trained and may not enjoy classical music. A potential future study could use music composed specifically for the experiment, add a rating for how much participants like each excerpt, and cover a broader range of emotions, as well as musical genres to better represent all genres rather than just the classical genre.

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## APPENDIX

“Woman Realises the Old Dog She Just Adopted Was Same One She Had as a Child” (Happy) <https://www.goodnewsnetwork.org/woman-finds-old-dog-is-same-from-childhood/>

“Couple Who Lost Everything In A Wildfire Win \$1 Million Lottery” (Happy) <https://www.sunnyskyz.com/good-news/2646/Couple-Who-Lost-Everything-In-A-Wildfire-Wins-1-Million-Lottery>

“SAW MUM DIE. Boy, four, forced to watch mum die in horror crash from back seat and only survived when HGV driver swerved at last second” (Sad) <https://www.thesun.co.uk/news/5421259/boy-watched-mum-die-car-crash-hgv-swerved-survive/>

“Four-month-old puppy hanged, beaten and shot in “worst case of animal abuse officials have seen”” (Sad) <https://www.independent.co.uk/news/world/americas/dog-hung-sacramento-puppy-beaten-shot-killed-reward-jase-huggins-a8182221.html>

“Dog rescued from ledge 50ft above Swansea quarry” (Happy) <http://www.bbc.co.uk/news/uk-wales-south-west-wales-43124667>

“Child dies after his mother accidentally runs over him, sheriff says” (Sad) <http://www.sunherald.com/news/local/counties/jackson-county/article200894994.html>

“My puppy cured the loneliness of living with an illness” (Happy) <https://inews.co.uk/inews-lifestyle/people/puppy-cured-loneliness-living-illness/>

“Mother pleads guilty to murder of seven-week-old son” (Sad) <http://www.bbc.co.uk/news/uk-wales-north-east-wales-43127143>

“Australian girl, 5, is miraculously HEALED of cancer thanks to revolutionary treatment in Mexico after doctors gave her just weeks to live when she was diagnosed with an “incurable” brain tumor” (Happy) <http://www.dailymail.co.uk/news/article-5378115/Perth-girl-miracle-cure-brain-cancer-tumour-Mexico.html>

“American Airlines Employee Saves 2 Teenage Girls From Human Trafficking Plot” (Happy) <https://www.sunnyskyz.com/good-news/2649/American-Airlines-Employee-Saves-2-Teenage-Girls-From-Human-Trafficking-Plot>

“Boy Who Lost His Life While Saving Friend Called Hero” (Sad) <http://www.newser.com/story/255103/11-year-old-dies-rescuing-friend-from-frozen-pond.html>

“13-Year-Old Girl Dies on Popular Hiking Trail” (Sad) <http://www.newser.com/story/255082/13-year-old-girl-dies-on-popular-hiking-trail.html>

- “Woman’s Near-Fatal Car Accident Led Her to Marrying the Love of Her Life” (Happy) <https://www.goodnewsnetwork.org/near-fatal-car-accident-led-to-marriage/>
- “”Sad” Dog Looking For Kids to Read to Him is Now All Booked Up” (Happy) <https://www.goodnewsnetwork.org/sad-dog-looking-kids-read-now-booked/>
- “Mom shares her son’s heart-breaking last days” (Sad) <https://edition.cnn.com/2017/04/13/health/child-cancer-post-trnd/index.html>
- “Mother dies after caesarean” (Sad) <http://www.thedailystar.net/country/mother-dies-after-caesarean-1537156>
- “Norwalk 6-Year-Old Dies Of Suspected Flu Complications” (Sad) <http://www.courant.com/breaking-news/hc-news-norwalk-girl-flu-death-20180219-story.html>
- “Cow Escapes Slaughterhouse By Smashing Through A Metal Fence And Swimming To An Island” (Happy) <https://www.sunnyskyz.com/good-news/2648/Cow-Escapes-Slaughterhouse-By-Smashing-Through-A-Metal-Fence-And-Swimming-To-An-Island>
- “Dog Spots Stranger in Airport And Instantly Knows He Needs Comforting” (Happy) <https://www.sunnyskyz.com/good-news/2647/Dog-Spots-Stranger-In-Airport-And-Instantly-Knows-He-Needs-Comforting>
- “Husband devastated as his baby daughter dies at birth and his wife, 34, passes away just eight days later after suffering epileptic fit and bleed on the brain” (Sad) <http://www.dailymail.co.uk/news/article-5394651/Mans-baby-dies-wife-passes-away-eight-days-later.html>
- Polonaise de Concert in D, Op. 4, Henryk Wieniawski (Happy) – 0-0:38
- 5 Military Marches, Op.39, “Pomp and Circumstance”, No. 1 in D major, Edward Elgar (Happy) – 0-0:25
- Standchen, Franz Liszt (Sad) – 0-0:35
- Symphony No. 9 in C Major, D.944 – “The Great”: 4. Allegro vivace, Franz Schubert (Happy) – 0-0:32
- Etude in C sharp Minor, Op. 2, No. 1, Alexander Scriabin (Sad) – 0-0:32
- Comptine d’un autre été, l’après-midi, Yann Tiersen (Sad) – 0-0:40
- Piano Trio No.1 in D Minor, Op. 32: III. Elegie: Adagio, Anton Arensky (Sad) – 0-0:34
- Polonaise in A Major, Op. 21, Henryk Wieniawski (Happy) – 0-0:50
- Violin Concerto in E Minor Op. 64: III. Allegretto non troppo – Allegro molto vivace, Felix Mendelssohn (Happy) – 0-1:11
- Sonata No. 14 “Moonlight” in C Sharp Minor, Op. 27 No. 2L 1. Adagio sostenuto, Ludwig van Beethoven (Sad) – 0-0:45
- Adagio in G Minor, Tomaso Albinoni (Sad) – 0-0:40
- Symphony No. 3 in E flat, Op. 55 “Eroica”: III. Scherzo: Allegro vivace, Ludwig van Beethoven (Happy) – 0-0:38
- Liebesträume, No. 3: Nocturne in A flat major, Franz Liszt (Happy) – 0-0:31
- Elégie Op. 24, Gabriel Fauré (Sad) – 1:07
- Violin Concerto No. 1 in G Minor Op. 26: III Finale – Allegro energico, Max Bruch (Happy) – 0-0:47
- Nocturne No. 20 in C sharp minor, Frédéric Chopin (Sad) – 0-0:54
- Symphony No. 5 in D Minor, Op. 47: III. Largo, Dmitri Shostakovich (Sad) – 0-0:53
- Concerto for Violin, Strings and Continuo in E Major, No. 1, Op. 8, RV 269, “Spring”: 1. Allegro, Antonio Vivaldi (Happy) – 0-0:29
- Theme From Schindler’s List, John Williams (Sad) – 0-1:06
- Symphony No. 70 in D Major, Hob. 1:70: III. Menuet: Allegretto, Franz Joseph Haydn (Happy) – 0-0:32