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Redefining sad music: Music's structure suggests at least two sad states

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ABSTRACT

Many researchers have noted inconsistencies between descriptions and effects of nominally *sad* music. The current study addresses whether traditional music-related *sadness* can be broken down into more than one category. *Melancholic* and *grieving* musical passages were collected in three stages. Participants with superior aural skills rated 18 structural parameters of these musical passages on 7-point unipolar scales. The results are consistent with the idea that musical parameters differ in melancholic and grieving states and that what has been previously defined as *sad* music may, in fact, be conflating more than one emotional state.

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Introduction



For many years, emotion theory was based on the work of so-called basic emotion theorists, who posited that there were approximately six specific neural states that signified when a person was in a certain emotional state, such as sadness (Ekman, 1977). Although current psychological theory is dominated by several disparate perspectives on emotion generation and perception, these viewpoints tend to agree that there are many more emotions than those accounted for by the pioneering researchers (see Warrenburg, 2020a, for a review). In contrast to this psychological research, music research still focuses on only a few emotions that can be evoked or expressed through music (Juslin, 2013a; Warrenburg, 2020b).


Warrenburg (2020b) conducted a review of 306 research articles dating from 1928 through 2018. In this review, the author examined the types of emotions that have been related to more than 20,000 musical passages and found that there have been more than 100 emotions explicitly related to musical stimuli. Despite the apparent variety of emotions related to music, however, she found that over half of music-related emotion studies consisted of only three emotions: *sadness*, *happiness*, and *anger*. Furthermore, she found that only nine emotional terms were used to describe more than one percent of the musical stimuli: *sad*, *happy*, *anger*, *relaxed*, *chills/pleasure*, *fear*, *chills*, *peace*, and *groove*. The question that naturally arises

from these findings is, 'Can these nine emotion terms accurately describe all the affective states represented or elicited by music?'

The present paper describes the first study out of a series of six studies designed to provide some insight into the above question. All six studies focus on only one emotion: *sadness*. The study presented here explores how participants define music-related *melancholy* and *grief*, as well as tests whether these passages contain different musical features. The other five studies, not reported here, are concerned with the how participants perceive and experience emotion when listening to these musical passages, as well as how listeners' behaviour may differ after listening to melancholic and grieving musics.

Warrenburg's (2020b) paper on musical stimuli shows that the way researchers define *sadness* varies widely. Listeners and researchers appear to offer a wide range of descriptions when characterising nominally 'sad' music. These terms include *crying despair*, *depressed-sad*, *depression*, *despair*, *gloomy-tired*, *grief*, *quiet sorrow*, *sad*, *sad-depressed*, *sadness*, *sadness-grief-crying*, and *sorrow* (e.g. Juslin & Laukka, 2003). Using operationalizations made by psychologists, not all of these terms even correspond to emotions. Researchers distinguish three categories of affective responses: *emotions*, *moods*, and *personality traits* (Scherer & Zentner, 2001). Emotions are described as brief affective episodes that occur in response to a sig-

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nificant internal or external event; moods are described as longer affective states characterised by a change in subjective feelings of low intensity; and temperaments are described as a combination of dispositional and behavioural tendencies. According to this classic taxonomy, *sad* and *desperate* would be deemed emotions, *gloomy*, *listless*, and *depressed* would be moods, and *morose* would be deemed a temperament or personality trait. Without specifying which of these three affective classes (emotions, moods, personality traits) are being examined in a particular experiment, it becomes impossible to compare results across studies.

One indication that researchers have (unknowingly) compared results across these three affective classes is that meta-analyses on musical sadness provide seemingly null results. For example, despite the fact that many studies have shown that participants can perceive and experience musical sadness, a review found that there is no association of nominally sad music with positive or negative valence (Eerola & Vuoskoski, 2011). It could be that the large variance in response to sad music could be a consequence of the failure to distinguish multiple states of sadness.

Psychological research has long suggested that the term *sadness* is unnecessarily vague (Darwin, 1872). Current research related to human crying also suggests the existence of these two different, yet complementary, states (Vingerhoets & Cornelius, 2012). These emotions appear to have separate motivations and physiological characteristics (Andrews & Thomson, 2009; Frick, 1985; Kottler, 1996; Mazo, 1994; Nesse, 1991; Rosenblatt et al., 1976; Urban, 1988; Vingerhoets & Cornelius, 2012). Generally, *melancholy* is considered to be a negatively-valenced emotion associated with low physiological arousal, while *grief* is thought to be a negatively-valenced emotion associated with high physiological arousal.

Psychological research suggests that *melancholy* may arise when an individual experiences a failure to meet expectations, among other reasons (Ekman, 1992). Corresponding physiological symptoms are thought to include feelings of anergia, decreased heart rate, slow and shallow respiration, and reduced levels of epinephrine, norepinephrine, acetylcholine, and serotonin (Andrews & Thomson, 2009; Nesse, 1991). Sad or melancholic individuals also tend to have a slumped posture, relaxed facial expressions, feelings of lethargy, and reduced attentiveness. Melancholy tends to lead to reduced activity, slow movements, weak voice, diminished interest, social withdrawal, and increased rumination (Andrews & Thomson, 2009; Nesse, 1991).

Persons in a state of *grief* are also thought to experience negative valence, but their body is in a state of high arousal, with corresponding physiological symptoms like

crying, erratic breathing, and wailing (Rosenblatt et al., 1976; Vingerhoets & Cornelius, 2012). While in a state of grief, a person's heart rate and blood pressure may increase and breathing may become more erratic (Frick, 1985; Mazo, 1994; Urban, 1988). A person also experiences a rise in epinephrine, cortisol, and prolactin, as well as a constricted pharynx and a creaky voice (Frick, 1985; Mazo, 1994; Urban, 1988). Facial features associated with weeping have been called faces of 'agony' (Ekman, 2003). According to Huron (in preparation), 'grief vies with physical pain for the most negatively-valenced affective state'. Experiences of loss – whether due a significant death, loss of safety, loss of autonomy, or loss of identity – are thought to drive experiences of grief (Epstein, 2019).

A pertinent question is whether the hypothesised differences between melancholy and grief are also present in music. David Huron (2015, 2016) has speculated that the difference between *melancholy* and *grief* may also be present in music. The current paper has two central goals: (1) test whether listeners identify different musical examples in response to prompts of *melancholy* and *grief* and (2) whether the musical passages selected by participants exhibit the structural differences between *melancholy* and *grief*, as first hypothesised by Huron (2015, 2016).

Part 1: Participant identification of melancholic and grieving musical passages

The aim of Part 1 is to describe the collection of melancholic and grieving musical passages, using two different approaches. The first approach asks trained and untrained student participants to provide examples of sad/melancholic music and crying/grieving music. The second approach utilises expert opinions to identify melancholic and grieving music. The result of these two approaches is a collection of melancholy and grief musical passages that will be used in Part 2 of the current paper and was used in five additional studies (Warrenburg, 2019).

Method 1: Untrained participant-selected passages

The first method aims to collect melancholic and grieving musical passages from participants who are unaware of the theoretical differences between *melancholy* and *grief*. This collection method was utilised to help minimise experimenter bias as well as reduce potential bias from previous studies. In general, the re-use of stimuli in multiple experiments reduces the validity of the research

insofar as a small repeated stimulus set reduces the representativeness of the stimuli for the phenomenon of interest (Warrenburg, 2020b). By gathering data from multiple musicians, it was hoped that a wide range of musical samples would be collected and that these samples would contain minimal bias.

Participants were asked to provide a list of musical works corresponding to two emotions: *sadness* (melancholy) and *crying* (grief). No details were given about how to define these emotions. Participants were allowed to choose works that elicited emotional responses or displayed emotional content. The instructions were intentionally left vague, in order to allow the participants to define the emotional spaces for themselves. Namely, participants could use multiple ways of defining ‘sadness/melancholy’ and ‘crying/grief’ music. They could use, for example, autobiographical memories, learned associations, familiarity with movie soundtracks, music theory concepts, etc. By collecting a broad swatch of stimuli, the hope was to gather data that covers a wide theoretical space of ‘musical melancholy’ and ‘musical grief’.

Participants were given the following instructions for this study:

We are interested in people’s musical preferences. For example, we are interested in what music people associate with the following feelings: anger, fear, happiness, sadness, crying, dancing, boredom, awe, fear, tenderness. To help us out with this, you have been selected to explore three of these terms: [e.g. happiness, sadness, crying]. Take some time to choose musical works that you think represent these emotions (e.g. this music sounds sad or happy) or makes you feel those emotions (e.g. this music makes me cry or makes me happy). You should come up with 10 minutes of music for each condition. You should write the musical works below in the appropriate box.

Participants

Participants ($n = 56$) were second-year aural training students in the School of Music at The Ohio State University. There were 22 females and 33 males (1 sex unreported). The average age was 19.6 (range from 18 to 25). The average years of private lessons was 7.5 years (range from 2 years to 16 years).

Results

The complete list of crying (grief) and sad (melancholic) songs identified by participants is listed in Supplementary Material A. Participants produced a list of 97 grief/crying songs and 115 sad/melancholic songs. Eight songs or works were present in both lists: Barber’s *Adagio for Strings*, Ticheli’s *An American Elegy*, Sufjan Stevens’ *Death with Dignity*, Kansas’s *Dust in the Wind*, Coldplay’s *Fix You*, Tchaikovsky’s *Symphony No. 6, Mvt IV*, Band of

Horses’ *The Funeral*, and Bruno Mars’ *When I Was Your Man*.

Method 2: Participant-selected passages trained with facial expressions

The second method asked participants to gather a list of musical works corresponding to a *priori* defined operationalizations of musical emotions. Namely, the aim was to define the emotional space for the participants according to psychological research on *melancholy* and *grief* (Andrews & Thomson, 2009; Frick, 1985; Mazo, 1994; Nesse, 1991; Rosenblatt et al., 1976; Urban, 1988; Vingerhoets & Cornelius, 2012). While it was important for participants to understand how *melancholy* and *grief* differ, it was important that the participants did not know how these emotions should theoretically correspond to sounds. In order to circumvent possible demand characteristics, the difference between melancholy and grief was explained through pictures of facial expressions.

Facial expressions are thought to convey information about the emotional state of an individual, but do not necessarily provide any information about vocal or non-verbal sounds. In the psychological literature, *grief* has been related to crying, wailing, and faces of agony; when expressing grief, people often have open mouths (Ekman, 2003; Vingerhoets & Cornelius, 2012). *Melancholy*, on the other hand, may not contain distinctive facial expressions and may sometimes be confused with expressions of relaxation or sleepiness; when expressing melancholy, people tend to have relaxed facial features, including a closed mouth (Andrews & Thomson, 2009; Nesse, 1991).

Participants were asked to focus explicitly on perceived (rather than experienced) musical emotion. In addition to several other mechanisms, much of the emotion induced by music appears to relate to autobiographical memory and arbitrarily-learned associations (Juslin, 2013b). Consequently, having participants focus on perceived emotion, rather than experienced emotion, may reduce some of the variability in the data.

Participants were given the following instructions:

We are interested in people’s musical preferences. For example, we are interested in what music people associate with the following feelings: anger, fear, happiness, sadness, crying, dancing, boredom, awe, fear, tenderness. To help us out with this, you have been selected to explore four of these terms: [e.g. peaceful/contented, joyous/jubilant, melancholy/sad, grief/crying]. These emotions are represented in the pictures in front of you.

Take some time to identify musical works that you think represent these emotions (e.g. “this music sounds peaceful,” NOT “this music makes me feel at peace.”). When thinking about suitable music, you should aim to select

passages that match the emotions portrayed in the pictures as closely as possible.

You should come up with 3 or 4 examples of music for each emotion. You should identify the musical works (or passages) in the appropriate box.

The picture stimuli were taken from the NimStim Set of Facial Expressions (Tottenham et al., 2009). This set of pictures contains 16 facial expressions, each performed by 43 professional actors, for a total of 672 facial expressions. The facial expressions are naturally-posed photographs of actors. The actors were African-, Asian-, European-, and Latin-American. The emotions portrayed are *happy*, *sad*, *angry*, *fearful*, *surprised*, *disgusted*, *neutral*, and *calm*. All emotions were taken in two conditions (open-mouth and closed-mouth), with the exception of *surprise*. Three *happiness* poses were selected, corresponding to closed-mouth, open-mouth, and open-mouth/exuberant. In the study by Tottenham and colleagues, the set was given to 81 untrained participants, who judged the facial expressions of the photos. The set has been shown to have high validity, reliability, and intra-rater agreement.

The photos used in the current study were chosen to represent the emotions of interest. The 'melancholy/sad' pictures were four pictures of 'sad: closed-mouth' from the NimStim set. The 'grief/crying' pictures were four pictures of 'sad: open-mouth' from the NimStim set. Each of the categories included expressions from the same four actors (actors 3, 11, 24, and 40) in the NimStim set. There were two females and two males. One actor was Latina-American, one actor was European-American, and two actors were African-American.

The participants were given four pieces of paper, corresponding to the two emotion categories of interest in this study, and two additional pieces of paper, corresponding to the emotions of peaceful/contented, and joyous/jubilant (which were collected for a separate project). Each piece of paper reproduced images of the facial expressions, along with the title of the emotion represented in the pictures (e.g. 'Melancholy/Sad'). The participants were also given a sheet of paper containing the printed instructions.

Participants

Twenty-six participants who had not participated in the first study completed this task. All of the participants were second-year undergraduate music students at The Ohio State University who participated for course credit. The age of the participants ranged from 19 to 25 years ($M = 19.73$, $SD = 1.43$). Participants had a range of musical training from 1 to 15 years in either instrumental or vocal practice ($M = 6.27$, $SD = 3.74$).

Results

The participant-identified works included 20 grief/crying works, 46 melancholy/sad works, 46 peaceful/contented works, and 59 joyous/jubilant works (listed in Supplementary Material A). Of these 184 works, 91% of the stimuli might be labelled as popular music or film soundtracks, and only 9% of the stimuli might be considered to be Western Art Music. Most of the selections contained lyrics. Only three songs appeared in multiple lists. *Happy* (Pharell Williams), *Love Story* (Taylor Swift), and *Starships* (Nicki Minaj) appeared in both the joyous/jubilant and peaceful/contented lists.

Method 3: Expert-selected passages

The final method utilised experts who were familiar with the theoretical, behavioural, facial, postural, and vocal characteristics of melancholy and grief. In addition, the experts were familiar with ideas of how the musical structure might differ between melancholic and grieving music (see Part 2 for details about these features). The idea that grief-related and melancholy-related passages might differ in musical structure comes from the comparison of musical passages with speech prosody (Juslin & Laukka, 2003). *Melancholic* speech, for example, tends to be spoken in a quieter-than-normal voice, a slower speaking rate, lower-than-normal overall pitch, a monotone voice, in a mumbling fashion, and with dark timbre (Kraepelin, 1921). Melancholic-music tends to mirror these prosodic characteristics: melancholic music is quieter, slower, lower in pitch, has smaller pitch movements, is legato, and uses darker timbres (Huron, 2008; Huron et al., 2014; Post & Huron, 2009; Schutz et al., 2008; Turner & Huron, 2008; Yim et al., unpublished manuscript).

Grief sounds, on the other hand, include features such as vocalised punctuated exhaling, energetic sustained tones (wails), ingressive vocalisation, use of falsetto phonation, breaking voice, pharyngealization, creaky voice, and sniffing (Huron, 2015; Urban, 1988). Grief music, then, is conjectured to exhibit similar features: it may contain punctuated or forceful onsets, sustained tones, descending pitch motions, ingressive phonation, wide leaps, loud dynamics, and utilise abrupt pitch transitions ('breaking') (Huron, 2015; Paul & Huron, 2010).

Based on this research, it could be expected that the specialists surveyed in this study had a narrow conceptualisation of what music should be considered to be melancholic or grieving. A wide range of songs – the lists curated from Methods 1 and 2 – were used in order to find exemplars of melancholic and grieving musical passages. From these lists of participant-identified

works, works without understandable lyrics were selected in order to avoid possible confounds arising from the semantic content.

In addition to the two participant-generated sources of stimuli cited above, a final source of stimuli was the database of Previously-Used Musical Stimuli (PUMS) (Warrenburg, 2020b), which contains more than 22,000 emotional music passages. Passages that had been explicitly categorised as *sad* (or related terms, such as *depressed* and *sorrowful*) by other researchers were selected from an early version of the PUMS database. These *sad*-related passages led to an additional list of 884 candidate melancholic and grieving works. Due to insufficient information identifying specific passages or sections of interest, this list was further reduced to 650 works, as some works were not given identifiable information (such as the title, composer, and performer) and could not be found.

Using these three sources – the two participant-generated lists in Methods 1 and 2 and the PUMS database – a total of 928 musical works that were related to musical *sadness* were selected (650 from the PUMS database, and 278 participant-selected works from the methods presented above). This list primarily consists of full musical works. From these full works, two types of stimuli were generated:

- (1) Passages of approximately 15 s. These passages are sufficiently short to effectively represent one musical emotion, termed ‘affectively homogenous’. They are also an appropriate length for listeners to accurately categorise the conveyed musical-emotion of the passages (Eerola & Vuoskoski, 2013).
- (2) Passages of approximately 1 min. These passages are long enough to be able to effectively induce emotions in listeners (Eerola & Vuoskoski, 2013).

In order to generate the 15-second and 1-minute samples of music, the author listened to each candidate passage of music. When the information was available from participants or in the PUMS database, the author listened to the indicated *start* and *stop* points of the passage, such as corresponding measure numbers or duration markings for a particular recording. When this information was not available, the author listened to the entire movement of a multi-movement piece or the entire work for single-movement musical selections. The 15-second passages were not selected at random or from the beginning of the work. Rather, these short samples corresponded to peak emotional moments and passages of affective homogeneity. The 1-minute samples all contain the corresponding 15-second samples, but also include an additional 45 s that were selected to begin and end

on sections that make musicological sense (using information like cadences and phrases to make this determination). If the emotion of the music surrounding the 15-second samples changed very quickly, no corresponding 1-minute passage was created. Multiple passages from a single piece of music were allowed. For example, Barber’s *Adagio for Strings* resulted in several passages. Using this process, 62 passages of music-related melancholy or grief were selected from the 928 candidate musical selections (see Supplementary Material A for more details).

In order to attempt to minimise bias from the author’s selection of musical passages, two additional experts independently listened to each of these 62 passages in a randomised order. These experts were also familiar psychological and musical theories about *melancholy* and *grief*. These two judges were asked to classify each passage as either *grief-expressive* or *melancholy-expressive*. The labelled emotion (melancholy or grief) of these passages and the correspondence among the judges is presented in Supplementary Material A. Intra-rater reliability was calculated by comparing within-subject responses to the short and long musical passages. Out of 87 comparisons, 75 ratings were consistent across the short and long passages, leading to an intra-rater reliability of 86.2%. Out of the 62 musical passages selected, the raters agreed on 38 out of the 62 samples, or 61.2% of the passages.

Discussion of Part 1

In the psychological field, it is recognised that what some people call *sadness* can be better explained using (at least) two separate terms: *melancholy* and *grief* (Darwin, 1872). The idea that nominally *sad* music may, in fact, be better explained by using these two terms has broad implications for the field of music psychology as a whole. Of the 117 emotions listed in the PUMS database, 22% (2107) of the stimuli were designated as *sad* (Warrenburg, 2020b). *Sadness* was also the most commonly-reported emotion, appearing more often than *happiness*, *anger*, *fear*, and *tenderness*.

Part 1 of this asked participants of various levels of expertise to identify two (potential) types of sad music: *melancholy* and *grief*. There were few works that were identified as both melancholic and grieving, suggesting that there may be differences between these types of music. The next logical step in the examination of *melancholic* and *grieving* music is to inspect the musical characteristics of these *melancholic* and *grieving* passages. Part 2 presents a study that uses highly-trained listeners to identify different features in *melancholic* and *grieving* stimuli.

Part 2: Participant ratings of features in melancholic and grieving musical passages

Melancholic and *grieving* music may contain similar features to their vocal homologues (consistent with Juslin & Laukka's, 2003 meta-analysis of emotional speech and music). Almost a century ago, Emil Kraepelin described characteristics of *melancholic* (what he called *sad*) speech: melancholic speech consists of a quieter-than-normal voice, slow speaking rate, lower-than-normal overall pitch, monotone voice, mumbling fashion, and dark timbre (Kraepelin, 1921). In the past decade, Huron and colleagues have found that nominally *sad* music – what we have been referring to as *melancholic* music – is consistent with many of these features of sad speech (see Table 1 for a summary of these features). *Melancholic* music tends to have quiet dynamics (Turner & Huron, 2008), slow tempo (Post & Huron, 2009), comparatively low pitch (Huron, 2008), small pitch movements (Huron, 2008), legato articulation and increased use of the sostenuto pedal (Yim, Huron, & Chordia, in preparation), and dark timbres (Schutz et al., 2008).

In many of these studies, *sad* music was operationalised simply as music in the minor mode. This definition may be problematic because music in other modes (e.g. major, Dorian) can sometimes be considered *sad* and it is clear that not all minor-mode passages are *sad*. Additionally, in these studies, Huron and colleagues did not differentiate between *melancholic* and *grieving* music.

In the years since these *sad* music studies were completed, Huron has written theoretical papers about features of *grieving* music (Huron, 2015, 2016). Drawing on work from the fields of psychology and ethology, Huron summarises research about vocal characteristics of *grief*: grieving persons often have a constricted pharynx and creaky voice (Frick, 1985; Mazo, 1994; Urban, 1988). Consistent with the idea that emotional music

may mirror emotional speech, Huron hypothesises that grieving music may contain features like sustained tones, gliding pitch motions, wide pitch intervals or leaps, harsh or nasal timbres, and repeated staccato or détaché articulations (see Table 1 for a summary of these hypothesised features).

Huron's work on potential features of grieving music, as well as any differences between melancholic and grieving, remain hypothetical – they have not been tested empirically. The aim of Part 2 of the current paper is to test whether the passages of music deemed melancholic or grieving by participants contain structures consistent with Huron's theories.

Methods

In attempting to assess the importance of different proposed parameters, at least three different measurement methods might be distinguished: (1) score-based analysis, (2) audio-signal based analysis, and (3) listener subjective estimates. For the case of loudness, a number of studies have made use of dynamic markings in musical scores. For example, the average loudness can be calculated by noting the dynamic marking for a particular passage. This can be quantised by utilising an ordinal scale of common dynamic markings, with *ppp* being ranked as '1', *pp* as '2', through *fff* as '8'. A second approach might take advantage of audio-signal processing tools, such as the MIR Toolbox in MATLAB (Lartillot & Toivainen, 2007). For example, the average RMS levels can be taken as an estimate of loudness. A third way we could measure each musical parameter might make use of subjective judgments of these features by listeners. For example, listeners would rate the loudness on a 1–7 unipolar scale.

There are advantages and disadvantages to each of these three methods. Although score-based methods have proved useful in previous corpus studies, this

Table 1. Hypothesised grief and melancholy acoustic and musical features according to David Huron (2015).

Melancholic Speech Features	Melancholic Musical Features	Grieving Speech Features	Grieving Musical Features
Quiet voice	Quiet dynamics	Energetic voice	Loud dynamics
Slow speaking rate	Slow tempo	Energetic or sustained tones (wails)	Sustained tones; Gliding pitch motions/portamento; Energetic/fast tempo
Lower overall pitch	Low tessitura; Minor mode	Falsetto phonation	High tessitura
More monotone prosody	Small pitch range; Small melodic intervals	Breaking voice	Large pitch range; Wide pitch intervals or leaps
Mumbled articulation	Legato articulation; Greater use of sostenuto pedal	Vocalised punctuated exhaling	Repeated staccato/détaché
Dark timbre	Dark timbre instruments; Stopped strings; Use of mutes	Pharyngealization	Harsh or nasal timbres
Breathy voice	–	Sniffing	–
	–	Ingressive vocalisation	–

approach is impractical in this case since notated scores were not available for all of the ten extracts used. Although the audio signal processing tools are sophisticated, they are unable to address several factors thought to be important for grief and melancholy. For example, there currently exists no audio-based tool to determine whether an instrument is played with mutes. Although subjective, listener ratings may have greater validity in identifying factors related to emotion. For example, if a work starts quietly, but builds in dynamic until the end of a passage, perhaps participants would weigh the ending of the work as more important to the emotional character than the beginning. Therefore, rather than rating the average dynamic, he or she may say the passage is generally 'loud'. Additionally, participants can choose to weight the melody and accompaniment differently. Two disadvantages of this approach are that participants may be biased and typically only one recording of a passage is used to gather the ratings. This method was chosen for the current study, even with its limitations.

Stimuli

Recall that the principle goal of Part 2 was to examine the importance of several musical parameters in determining whether a passage represents *melancholy* or *grief*. The methodology made use of the participant lists of *melancholic* and *grieving* musics collected in Part 1. The 15-second passages were used instead of the one-minute passages because it was thought that the shorter passages might be more affectively homogenous. In other words, the short passages are more likely to only represent a single emotion (*melancholy* or *grief*). The longer passages may be more likely to represent or portray multiple emotions, and therefore might confuse the participants or add unwanted or unexplained variance. The use of shorter passages also makes it more likely that participants will choose to listen to the passages more than once, which will help to maintain a more accurate memory of each stimulus.

There were 8 *grieving* and 25 *melancholic* 15-second passages rated by the author and two additional experts. Because both the 15-second and 1-minute samples were planned to be used in future experiments (Warrenburg, 2019), it was decided *a priori* to only include musical passages where both the short and long samples unanimously conveyed the intended emotion (melancholy or grief). Of the 8 *grieving* excerpts, all three raters agreed that 5 excerpts conveyed grief. All 5 corresponding 1-minute passages were also unanimously rated as conveying grief. Of the 25 short *melancholic* excerpts, the three raters agreed that 16 passages conveyed melancholy. Of these 16 short *melancholic* excerpts, four did not have corresponding 1-minute passages. Of the 12

Table 2. List of stimuli for the study.

ID	Composer	Title	Passage	Type
1	Arnold and Price	Sherlock Series 2, Track 18	1:11–1:26	Grief
2	Barber	Adagio for Strings	6:20–6:35	Grief
3	Marionelli	Jane Eyre, Track 1	02:08–02:23	Grief
4	Tchaikovsky	Symphony 6 Mvt 4	05:54–06:11	Grief
5	Williams	Schindler's List, Track 1	02:37–02:47	Grief
6	Albinoni	Adagio in G Minor	0:24–00:36	Melancholy
7	Barber	Adagio for Strings	4:06–4:22	Melancholy
8	Faure	Après un rêve	0:00–0:13	Melancholy
9	Junkie XL	Redemption	00:01–00:19	Melancholy
10	Mozart	Fantasia in D Minor	00:50–1:07	Melancholy

remaining short *melancholic* passages, the raters agreed that the corresponding 1-minute passages also conveyed melancholy in 8 cases. Of these 8 *melancholic* passages, 5 were randomly selected to be included in the experiment so that there were the same number of *grieving* samples and *melancholic* samples. The resulting 5 *grieving* and 5 *melancholic* 15-second passages are summarised in Table 2 below. The final 10 passages were presented in a random order to all participants.

Study design

The purpose of the study was to examine the relative importance of the eleven hypothesised features of musical melancholy and nine hypothesised features of musical grief (summarised in Table 1) in music labelled by participants as *melancholic* and *grieving*. Participants – all of whom were highly skilled in aural skills – were asked to listen to the ten musical passages and rate each excerpt on the twenty features. Each feature was presented on a 7-point unipolar scale. Unipolar scales (e.g. loud dynamics, from 1: *not at all loud* to 7: *very loud*) were used instead of bipolar scales because the seemingly-related features (such as quietness and loudness) were thought to be statistically independent (see Larsen & McGraw, 2011 for a similar discussion). Namely, it is possible for a passage to have both quiet and loud elements.

Listeners were asked to rate each musical passage on the proposed characteristics of *melancholic* music and the proposed characteristics of *grieving* music. The twenty features included quiet dynamics, loud dynamics, slow tempo, fast tempo, low register, high register, narrow pitch range, wide pitch range, use of small melodic intervals, use of wide melodic intervals, legato articulation, staccato articulation, use of long (or sustained) tones, gliding pitch motions, use of minor mode, dark sound (or timbre), harsh or nasal sound (or timbre), use of sustain pedal (if piano was present), use of stopped strings (if string instruments were present), use of mutes (if brass or string instruments were present).

Unlike speech, music commonly makes use of multiple simultaneous sound sources. This can lead to

divergent textures, such as a contrast between a melody and an accompaniment. It is possible for a melody to feature the use of small intervals and a narrow pitch range, while the accompaniment features arpeggiated figures involving large intervals and a wide pitch range. Similarly, a melody may involve a rather slow pace, whereas the accompaniment features a rapid sequence of pitches, suggesting a faster pace. The combination of multiple features raises the question of which component of the texture listeners should rate. Rather than instruct listeners to focus on just one component in a musical texture (such as the melody or the accompaniment), listeners were instructed to respond according to the overall emotional character conveyed by the passage. This allows listeners to focus on one element or another, depending on the particular passage and feature of interest. Namely, listeners were asked to focus on one element or another, depending on the particular passage and feature of interest. Listeners were also encouraged to report any additional observations that were salient to them regarding the emotional character of the passage (reported in Supplementary Material B).

Pilot study

A pilot study of 10 musicians (7 graduate students in music theory, 1 professor of music theory, 1 undergraduate in music, and 1 graduate student in psychology) was conducted in order to assess the difficulty of this task. In the pilot study, listeners were asked to rate how confident they were in their ability to understand and aurally notice each of the twenty features (e.g. legato articulation, use of stopped tones) in several excerpts of music. The confidence ratings showed that listeners varied in their confidence to hear each feature. The means and standard deviations of the confidence ratings are shown in Table 3. Because of the low confidence scores on 'use of stopped strings' (average of 1.8 out of 7) and 'use of mutes', (average of 2.9), these features were eliminated from the main study. The other eighteen features were included in the main study.

Main study

After the pilot study was completed, a separate study was needed to assess the importance of the remaining eighteen features in determining whether a musical excerpt was *melancholic* or *grieving*. The aim of the study was to examine the importance of each of the twenty identified musical parameters in determining whether a passage represents melancholy or grief. The chosen passages of melancholic and grieving music are summarised in Table 2. The participants received the following instructions before the task:

Table 3. Confidence ratings on the 20 dimensions for the pilot study.

Dimension	Mean Confidence	SD
Quiet dynamics	6.6	.66
Loud dynamics	6.6	.66
Slow tempo	6.7	.46
Fast tempo	6.7	.46
Low register	6.1	.94
High register	6.1	.94
Narrow pitch range	4.6	1.91
Wide pitch range	4.6	1.91
Use of small melodic intervals	5.5	1.02
Use of large melodic intervals (or leaps)	5.5	1.20
Legato articulation	6.1	1.04
Staccato (or détaché) articulation	6.2	1.17
Use of sustained tones	5.9	1.22
Gliding pitch motions (or portamento)	4.3	1.62
Minor mode	4.1	1.37
Use of the sustain pedal	3.25	1.48
Dark sound (or timbre)	4.1	1.64
Harsh/nasal sound (or timbre)	4.0	1.48
Use of stopped strings	1.8	.87
Use of mutes	2.9	1.79

In this task, you will listen to 10 musical excerpts, each about 15 seconds in length. You are free to listen to each excerpt as many times as you wish. You will be asked to rate each excerpt according to 18 features. Your response should reflect the overall emotional character conveyed by the passage. In rating these features, we encourage you to make your best guess if you are not sure of an answer, but you are allowed to leave the question blank if you choose.

In addition, we ask that you identify any additional noticeable musical features that you think contributes to the emotional character of the music (such as rhythm, harmony, instrumentation, orchestration, structure, etc.).

Twenty independent judges, unfamiliar with the results of the pilot study, were recruited for this task. Because of the importance of being able to discriminate features of the musical passages (e.g. use of small melodic intervals, use of minor mode), it was decided *a priori* to only include participants who were highly proficient in aural skills. Accordingly, each of the participants was hand-selected by music theory or aural skills instructors because of his or her demonstrated superior aural-skills ability. The participants were all from the School of Music at The Ohio State University.

In order to minimise possible confirmation bias, the judges were not told about the hypothesised differences between melancholy and grief. Since the participants were from The Ohio State University, it is appropriate to determine whether they were familiar with Huron's theories about melancholic and grieving music. At the end of the survey, participants were asked, 'Are you familiar with David Huron's theory of the difference between sad (or melancholy) music and grief-like music?' in order to control for possible confounding effects. A few of

the judges were familiar with the theoretical distinction between melancholy and grief but were unaware of the classification of the specific passages used in the study. A regression analysis showed that the results of the study were unaffected by whether or not participants were familiar with the theoretical distinction between melancholy and grief. In other words, those familiar and unfamiliar with the theory made similar judgments about the features of interest in the study.

Due to a technical error, demographics were collected for only 12 out of the 20 participants. Half of the 12 participants were female (50%) and the average age was 26.5. Participants reported, on average, 11 years of private instrument/voice instruction and reported an average of 3.46 years of aural skills or theory training.

Results

Exploratory data analysis

If the proposed *grieving* and *melancholic* features help to discriminate the two types of passages, one might expect that the ratings for the eighteen features should differ across nominally-melancholic and nominally-grieving

passages. Figure 1 shows kernel density estimate (KDE) plots of ratings of melancholic and grieving passages for the 18 examined features in the main study of Part 2. The X-axis represents the intensity of the features, ranging from 1 (the feature does ‘not at all’ describe the passage) to 7 (the feature ‘very’ much describes the musical passage). The Y-axis represents the gaussian kernel density estimate of the probability density function. The plots show that there are some differences between melancholic and grieving musics. Although there are different effect sizes among the features, the graphs are consistent with the idea that grieving music may be *louder*, *higher* (in register), *wider* (in pitch range – distance from the lowest note to the highest note) and *harsher* (in timbre) than melancholic music. Again taking into account various effect sizes, melancholic music may be *quieter*, *lower* (in register), *narrower* (in pitch range), *smaller* (in average interval size), *darker* (in timbre), and contain more *pedal* use than grieving music. These features were tested empirically in a logistic regression, described in the next section.

Supplementary Material B shows additional KDE plots comparing (1) the five melancholic stimuli on a subset of

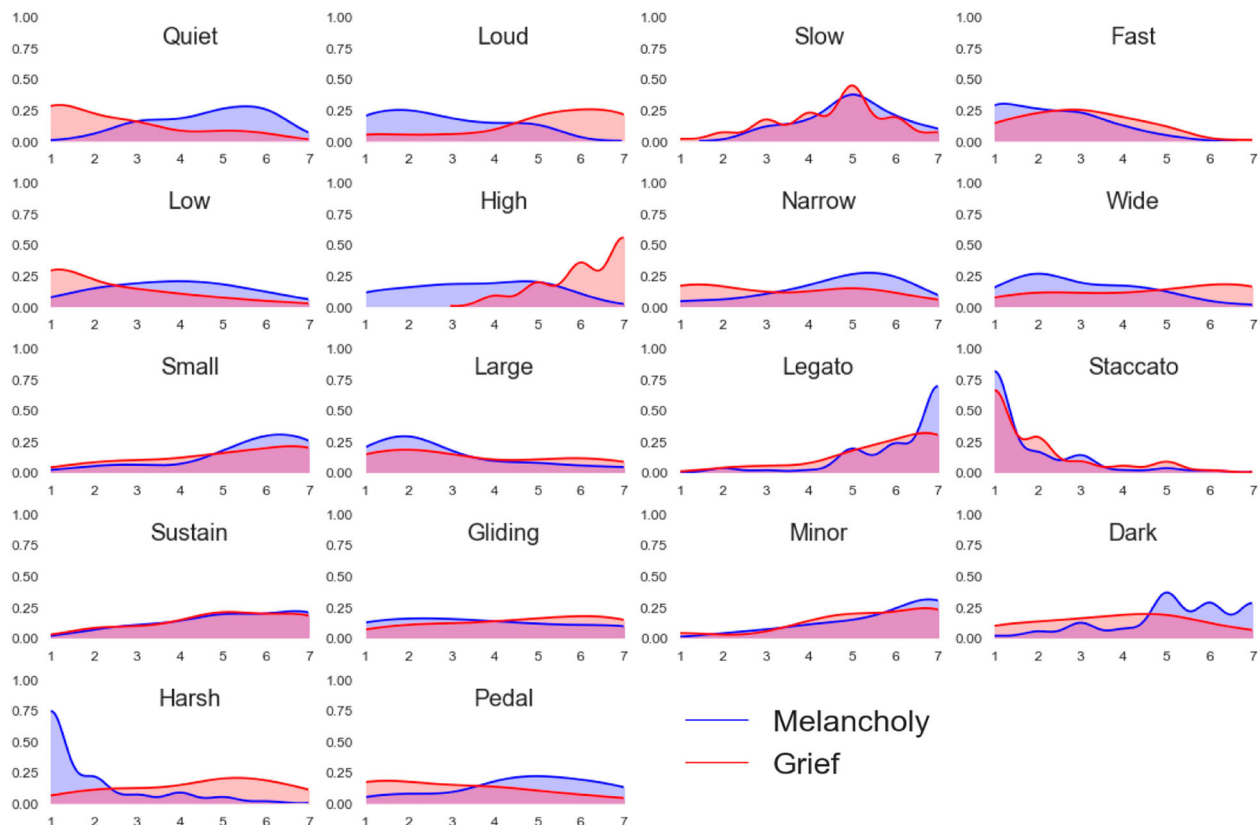


Figure 1. Kernel density estimate (KDE) plots of ratings of melancholic and grieving passages for the 18 examined features in the main study described in Part 2. The X-axis represents the intensity of the features, ranging from 1 (the feature does ‘not at all’ describe the passage) to 7 (the feature ‘very’ much describes the musical passage). The Y-axis represents the gaussian kernel density estimate of the probability density function.

features, (2) the five grieving stimuli on the same subset of features, and (3) the confidence and familiarity ratings for all features.

Logistic regression

Although Figure 1 provides some context about how melancholic and grieving musical passages may differ on a number of features, it is important to test these features empirically. Logistic regression provides a suitable method of analysis, where the predicted variable is the grief or melancholy designation and the predictor variables are the eighteen features of interest.

Preprocessing included the following steps. Observations that included a high number of missing values – like if the listener rated a work on only one of the 18 features – were dropped. One listener did not meet this criteria for any of the musical passages and was dropped from the analysis (resulting in a new n of 19). Of the 200 possible observations, 138 observations were left. Because not all musical works contained *pedal*, the column contained missing values for 57% of the observations: the *pedal* column was therefore dropped from the analysis. The remaining 17 features all had less than 3% missing values and so were retained for analysis. The missing values for these 17 columns were imputed with the median value for the missing feature of the specific musical passage. For example, one observation of William’s ‘Schindler’s List Theme’ had a missing value for *dark*. This missing value was replaced with the mean value for *dark* for the Williams piece specifically (rating of 4.0). In comparison, the Tchaikovsky work had a *darkness* median of 4.5 and the Junkie XL work had a *darkness* rating of 6.0.

As might be expected, there were high correlations among certain pairs of features, like *narrow/wide* ($r = -0.88$), *quiet/loud* ($r = -0.82$), *large/small* ($r = -0.80$), *fast/slow* ($r = -0.75$), *high/low* ($r = -0.64$), and *staccato/legato* ($r = -0.61$). One feature from a pair of features with an absolute correlation value of 0.8 or more was deleted to minimise effects of multicollinearity. *Narrow*, *quiet*, and *small* were therefore eliminated from the list of features. These three features – hypothetically predictive of *melancholy* – were eliminated instead of their hypothetical *grieving* pairs (*wide*, *loud*, *large*) because Huron and colleagues have already done previous work showing that melancholic music contains comparatively narrow pitch ranges, quiet dynamics, and small average interval sizes. Instead, it was deemed desirable to test how melancholic and grieving works compare on the hypothetical features of grief (comparatively wide pitch ranges, loud dynamics, and large average interval sizes), which have not been tested before.

The resulting model features therefore included the following features: *loud*, *slow*, *fast*, *low*, *high*, *wide*, *large*,

Table 4. Logistic regression results predicting the likelihood that a piece of music is grieving (rather than melancholic) from 18 musical features.

Feature	Coefficient	Standard Error	p-value	Significant (alpha = 0.05)
Loud	0.87	0.36	0.02	*
Slow	−1.04	0.63	0.10	
Fast	−0.97	0.62	0.12	
Low	−0.94	0.59	0.11	
High	1.11	0.47	0.02	*
Wide	1.20	0.54	0.03	*
Large	0.10	0.46	0.83	
Legato	−1.70	0.71	0.02	*
Staccato	−2.06	0.75	0.01	*
Sustain	0.16	0.39	0.69	
Gliding	0.93	0.46	0.04	*
Minor	0.26	0.34	0.45	
Dark	0.09	0.38	0.82	
Harsh	1.40	0.60	0.02	*

legato, *staccato*, *sustain*, *gliding*, *minor*, *dark*, and *harsh* (also shown in Table 4). The logistic regression was designed to predict the likelihood of a piece being grieving (coded as 1) rather than melancholic (coded as 0).

As can be seen from Table 4, music that is louder, higher-in-pitch, contains wide pitch intervals, gliding pitches, & harsh timbres, and contains less legato & staccato passages predicts music that has been previously categorised as grieving (all $ps < 0.05$). The amount of variance explained by the model was 81.3% (pseudo- R^2 value of 0.813).

The additional features that listeners used to ‘identify any additional noticeable musical features that you think contributes to the *emotional character* of the music’ are listed in Supplementary Material B.

Discussion of Part 2

In light of the logistic regression analysis, it appears that *quiet*, *low register*, *narrow pitch intervals*, *sustained tones*, *gliding pitches*, and *harsh timbres* are statistically significant predictors of whether a passage might be deemed expressive of melancholy or expressive of grief. Overall, the results are consistent with Huron’s theory that features of *melancholic* and grieving music mirror characteristic physiological hallmarks associated with *melancholic* and grieving speech.

One limitation of the study design is that the instructions ask the participants to write freely about any additional features that they believe could contribute to the emotional character of the music. It is possible, then, that the act of writing free responses could have influenced the participants’ responses with respect to the unipolar ratings of features. The results of the unipolar ratings could therefore conflate situations where the participants’ ratings correspond to the structural features in the music

and situations where the participants' responses correspond to the features that best describe participants' *beliefs* about which features contribute to emotional character. Although these potential effects may exist for individual participants, the use of aggregating participant responses may minimise this bias. Additionally, the study utilised a randomised design (the order of the stimuli were randomised between participants), which may mitigate some of these concerns about bias. It is still appropriate, however, to interpret the results cautiously.

General discussion

The objectives of the current studies were to (1) explore how listeners self-select *melancholic* and *grieving* musical passages and (2) test a small subset of these passages to determine whether they exhibit the features hypothesised by David Huron of *melancholic* and *grieving* musics. The results of the first objective indicated that people generally identify separate musical works for these two types of sad music. In other words, there was little overlap in the two lists of participant-selected works. The results of the second objective were consistent with Huron's idea that *melancholic* music may be quiet, low in register, and contain narrow pitch intervals and *grieving* music may be more likely to contain sustained tones, gliding pitches, and harsh timbres.

In this study, participants were not directly asked whether these passages were expressive of emotions, and if so, which emotions they represented. In other words, from the studies presented here, it is not possible to claim that these passages are perceived as portraying *grief* and *melancholy*, specifically. Recall that the present study represented the first in a series of six studies that examine the difference between *melancholic* and *grieving* musics. Two of the aforementioned studies test whether listeners perceive different emotions in the melancholic and grieving passages collected in Part 1 of the current study. The results are consistent with this idea – listeners perceive more melancholy in the melancholic passages and perceive more grief in the grieving passages (Warrenburg, 2019). This finding was replicated using a different methodological design. Two further studies explored how listeners feel when listening to these melancholic and grieving stimuli. The results are consistent with the hypothesis that listeners experience different emotions when listening to melancholic music (e.g. depression, reflection, nostalgia) and when listening to grieving music (e.g. crying, distress, turmoil, death, and loss) (Warrenburg, 2019). The final study tests whether there are different downstream pro-social behaviours associated with melancholic and grieving music listening. The

results were not consistent with this hypothesis (Warrenburg, 2019). Taken together, these findings provide initial support that there are at least two distinct types of *sad* music – *melancholy* and *grief*.

Huron is not the only scholar to suggest that there are multiple types of music-related sadness (Eerola & Peltola, 2016; Eerola et al., 2015, 2018; Laukka et al., 2013; Peltola & Eerola, 2016; Quinto et al., 2014; Taruffi & Koelsch, 2014; van den Tol, 2016). Musical *sadness* has also been broken down into categories such as *grief*, *melancholia*, and *sweet sorrow* (Peltola & Eerola, 2016), *grief-stricken sorrow*, *comforting sorrow*, and *sublime sorrow* (Eerola & Peltola, 2016), as well as other combinations (Eerola et al., 2015). These researchers have suggested that some of these *sad* emotions are negatively valenced, while others are positively valenced. Combined with the research presented in the current paper, it seems clear that breaking nominally *sad* music into different categories may help account for the wide variety of experiences people have when listening to music.

Limitations

An important limitation of the presented work is that the methods only test the difference between two types of *sad* music – *melancholy* and *grief*. As mentioned in the introduction, there have been many other descriptions of *sad* music, including terms like *crying despair*, *comforting sorrow*, and *sublime sorrow* (Juslin & Laukka, 2003; Laukka et al., 2013; Peltola & Eerola, 2016; Quinto et al., 2014). Additionally, there are a variety of emotions that listeners experience when listening to *sad* music (Eerola et al., 2018; Peltola & Eerola, 2016; Taruffi & Koelsch, 2014; van den Tol, 2016). Given this body of research, it is likely that there are more kinds of music-related *sadness* than just *melancholy* and *grief*. The aim of the current paper was simply to determine whether or not there is more than one type of *sad* music. An important next step, then, is to determine how many types of *sad* music might exist. It is possible that there are five or ten types of *sad* music. It is also possible that *sad* music may exist on continuum with an infinite number of categories (discussed below).

The other main limitation of the presented research regards the stimuli. Although candidate musical passages came from participant suggestions and other researchers (via the PUMS database), the author was involved in selecting the passages of music that became the stimuli. Attempts to minimise bias from the author's perspective were taken, including utilising two additional expert raters to aid in the final stimuli selection. In another series of studies (Warrenburg, 2019), participants validated these stimuli as expressing and inducing feelings of melancholy and grief.

Although there were many passages of melancholic and grieving musics collected in Part 1, only ten passages were utilised in Part 2. A further limitation of the study presented in Part 2 is that the current findings are limited to the stimuli used here or generalise to other musical passages. Because of the small number of samples, it is possible that the logistic regression was susceptible to random differences among these ten passages. For example, four of the five *melancholic* passages are excerpted from classical compositions and the last passage is taken from a film score. On the other hand, two of the five grief-like passages are excerpted from classical compositions, while the other three passages are taken from film music. Since composers of film music may be more strongly motivated to portray a specific emotion in their work, it is possible that the results suffer from bias from the imbalance of the number of film passages in each group (melancholic and grieving).

An additional limitation is that only exemplars of melancholic and grieving musics were used in Part 2. Future research could address this limitation by replicating the study with passages that may belong somewhere between the categories of melancholy and grief, by using longer passages of music that contain both melancholic and grieving features, or by engaging with newly generated or composed music which is deliberately written to lie between melancholic and grieving categories. The passages listed in Supplementary Material A would be a good place to start to address this limitation.

Future directions

Recall that, in Part 2, participants with superior aural skills were asked to explain which features they used to make discriminations between *melancholic* and *grieving* music. These students listed 87 features that were not accounted for by the features proposed by Huron (see Supplementary Material B for all of these features). Some of these responses included features like *harmonic complexity*, *orchestration* (sparse, dense, woodwind-focused, string-focused), *timbral contrasts*, *texture* (homophonic, polyphonic, monophonic), *instrumental density* or *extensity*, *use of close mikes* (intimacy of the sound), and *melodic structure* (ascending, descending, parabolic). By asking listeners to classify features of a wide range of nominally *sad* music and then performing an unsupervised machine learning analysis, it may be possible to identify features that contribute to a number of types of *sad* states. The results may, at least, be consistent with the idea that there are more types of music-related *sadness* than just *melancholy* and *grief*.

Lindsay Warrenburg has recently published an article about how different emotional theories – basic emotions

theory, appraisal theory, psychological construction, and social construction – may contribute to different methodological designs and conclusions (Warrenburg, 2020a). The separation of *sadness* into *melancholy* and *grief* could support any of these theories. Some music and emotion scholars, like David Huron and Patrik Juslin, may believe the distinction between *melancholy* and *grief* may correspond to two basic (discrete) emotions, each with distinctive neurological patterns and physiological responses. Other scholars, such as Henna-Riikka Peltola and Julian Céspedes Guevara could interpret the differences between *melancholy* and *grief* as evidence that emotions exist on a (dimensional) continuum. Without further testing, there is no single way to interpret the results presented in the current study.

Even if there are an infinite number of non-musical *sad* emotional states, it is not known how many types of *sadness* can be evoked or portrayed by music. It is possible that music represents and elicits only a few distinct kinds of *sadness*, corresponding to, say, *melancholy* and *grief*. However, it is equally possible that a collection of musical passages can be mapped onto an entire ‘sadness spectrum’. Future research needs to address this idea directly by investigating a wide variety of music previously labelled as *sad*.

Regardless of the psychological framework one chooses to adopt, it is clear that the emotion literature writ large has turned away from the idea that there are only a few emotional states. Rather, current scholars recognise the complexity of emotions, whether they are expressed in an art form like music or are evoked through personal situations. The time has come for the music cognition literature to follow suit and begin to demystify the emotions expressed and evoked in music. The first step to do this is to break down large categories of music into smaller categories that can be defined with differing musical structures and syntax. The hope of the current research is to inspire other music scholars to follow suit and begin adopting a wider vocabulary to describe music-related emotions. This type of research, for example, is currently being conducted by Caitlyn Trevor, who is investigating scary film music using Topic Theory, theories of ethology, behavioural studies, and neuroimaging methodologies (Trevor et al., 2020).

Through careful analysis of the musical structure, along with perceptual and cognitive experiments, the field of music and emotion may be redefined by recognising tens or even hundreds of emotions related to music. This paper presents an important first step, but only that first step; the future remains bright and open for those studying music and emotion to take a closer look at how our field is defined.

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