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Musical parameters in the playlist of a Dutch Crematorium

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ABSTRACT   *In cremation rituals in the Netherlands, music plays an important role. However,
what exactly this role is remains unclear. In the literature on cremation rituals, music has received
little attention up to now. A computational analysis of music played during cremations and a subse-
quent comparison of the results of this analysis with results of the analysis of two other playlists con-
taining popular music shows that the crematorium playlist differs significantly from the other two
playlists. The music played at cremations does indeed have specific properties, properties that corre-
spond to notions typically expected at cremations, making it suitable for the occasion. Theories of
the relation between musical properties and emotions indicate that the music played as part of cre-
mation rituals can be qualified as serene, solemn and tender. Here, we provide computational evi-
dence that this is indeed the case.*

KEYWORDS: crematorium; music; playlist; emotion; computational analysis

Introduction

In 1986, the Tilburg Crematorium, located in the south of the Netherlands,
was officially opened. In the more than 25 years of its existence, the Tilburg
Crematorium has developed into an important centre of mourning and memo-
rial rituals.[1] A crematorium is a place where ritual 'takes and makes place'
(Knott, 2005, p. 43). Without lit candles, a final farewell at the coffin and
songs to be listened to, the crematorium as a building would be different. The
rituals that take place there concern saying farewell and in most cases are an
expression of mourning and grief. They tend to have a great emotional impact.

Music is one of the main building blocks of the cremation ritual and it has
several functions or effects, which can be summarised in the keywords 'mem-
ory', 'emotion' and 'consolation' (Hoondert, 2014). A piece of music or an
artist might be associated with an event from a person's life or with personal
traits of a (dead) person and evoke memories of the original experience or the

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relationship (Janata, Tomic, & Rakowski, 2007; Jäncke, 2008; O'Callaghan, McDermott, Hudson, & Zalcberg, 2013). Besides, music can function as 'an externalisation of an intolerably overwhelming, incomprehensible, or crushing internal state' (Stein, 2004, p. 808) and as such help mourning people both to express their grief and to cope with grief and loss (Honing, 2012, pp. 26–28). Because of the importance of music as part of the cremation ritual, in the construction of the Tilburg Crematorium attention was paid not only to the design of the auditorium, but also to facilities contributing to the availability and quality of music and sound. A modern sound system was integrated into the construction. Right from the beginning, it was possible to choose songs from the playlist ('Muziekboek', music book) provided by the crematorium to be played during the ceremonial, or to supply tracks from one's own CDs if these were not on the playlist. One could also choose to sing and play live music (De Leeuw, 2009, pp. 64, 81). The playlist of the crematorium, which meanwhile has developed into an online tool for surviving relatives to select music from, currently contains 3703 unique performances (some songs occurring multiple times in different performances). The Tilburg Crematorium playlist provides music from a wide range of genres, and includes classical music, pop songs and religious songs. In this context, it is important to keep in mind that in cremation rituals in the Netherlands, people are used to *listening* to music, rather than being themselves involved in producing it. It is not customary to sing along, accompanied either by live playing musicians or by instrumental tracks provided by the playlist (singing along with tracks played over the crematorium's sound system would be extremely unorthodox and most likely be considered a breach of decorum, or at least 'strange'). It is also good to know that the Tilburg Crematorium, as most crematoriums in the Netherlands, is religion-wise a neutral building, it has no specific affiliation to any religious or ideological organisation. From the musical perspective, this means that there are essentially no limitations in choosing music: anything goes.

In this article, we will focus on the emotional impact of music. We will treat music *as sound* and not pay attention to the social contexts to which music belongs, or to the content of the lyrics in the case of vocal music. We are aware of the fact that the lyrics and the memories evoked by the music are of great importance to the listeners, but we will focus on music *as sound*, convinced as we are that music *as sound* has its own impact on the listeners (Heijerman & van der Schoot, 2005). This leads to our research questions, which consists of two parts: (1) What are the musical characteristics of the Tilburg Crematorium playlist, and (2) what do these characteristics say about the emotional impact of the music on the listeners?

In the next section, we will summarise previous research on music and emotion. Next, we will explain the methods we used and present the results of our research. We will end with a 'coda' as a reflection on our research results in relation to the cremation ritual and the mourning process.

Music and emotion

'How music works' has been a subject of discussion for ages. Greek philosophers like Pythagoras (circa 572–500 BC) and Plato (circa 427–347 BC) already spoke about the expressive qualities of music. The earliest reported empirical research on musical expression was done by Benjamin Ives Gilman (1892). One of the things he asked the participants in his investigation was to describe the general mood of a piece of music. During the twentieth and twenty-first centuries, various researchers carried on the research on the relation between musical parameters and emotion. Research focused on 'which emotions can be reliably expressed in music' and 'which factors in musical structure contribute to the perceived emotional expression' (Gabrielsson & Lindström, 2010, p. 367).

To answer these questions, various methods have been used. We will describe three of these, including the most important results emerging from the studies employing them, each revealing different insights into the field of musical parameters and emotion. Having presented these studies, we will briefly look at a summary by Gabrielsson and Lindström, who carried out a meta-analysis of over 30 studies in the field of musical parameters and emotion.

The earliest investigation involving systematic manipulation of various musical parameters was conducted by Hevner (1937). Hevner can be regarded as the founding mother of research on music and emotion. She created an 'adjective circle' in which she categorised a long list of adjectives related to emotions into eight subgroups. The adjectives grouped together in each of the subgroups were supposed to be semantically close. In the experiment, participants, after listening to a short piece of music, were asked to characterise the emotion this short piece of music evoked or expressed by selecting one of the eight subgroups. After one of the musical parameters had been manipulated, listeners were asked to listen again to the same, but now slightly changed piece of music, and to once again select an adjective. The differences between the responses to first and second exposures indicated the effect of the manipulated parameter. The results of this study showed that tempo was the most important musical parameter in carrying the expressiveness in music, followed by pitch and mode. Harmony and rhythm turned out to be less important and the ascending or descending quality of the melody seemed of no importance at all (Hevner, 1937, pp. 625–626).

Scherer and Oshinsky (1977) made use of tone sequences (the repetition of a musical figure or motif) in which they systematically manipulated acoustic characteristics. Subjects used three 10-point semantic differential scales (pleasantness–unpleasantness; activity–passivity; potency–weakness) and a dichotomous 0–1 (yes/no) scale to indicate whether or not a sequence could be an expression of a given emotion. Results of this study showed that the major mode (with a major third, cf. do-re-mi) was experienced as pleasant and happy, whereas the minor mode (with a minor third, cf. la-si-do) was associated with disgust and anger. Rhythmic sequences evoked responses such as active, fearful and

surprised, while non-rhythmic sequences were indicated as boring (Scherer & Oshinsky, 1977, p. 341).

In 2011, Bresin and Friberg published the results of their study on music and emotion. They selected four emotions (happiness, sadness, fear and peacefulness) and seven musical variables (tempo, sound level, articulation, phrasing, register, instrument, and attack speed) and asked 20 expert musicians to use gesture controllers for adjusting the values of the musical variables for communicating the different emotions. Their study confirmed results found in earlier studies. Bresin and Friberg also found strong agreements between participants on mean values. These values were independent from the particular score and its emotion (Bresin & Friberg, 2011).

The results of various studies on musical parameters and emotion have been summarised by Gabrielsson and Lindström (2010), both of whom are members of the music psychology research group of the Uppsala University of Sweden. They split musical factors into different levels and linked them – using results from various studies – to corresponding emotional expressions. These corresponding emotional expressions were provided with (an abbreviation of) a reference to the research behind it. For example, in a publication from 1937 Kate Hevner showed that a fast tempo corresponds to 'exciting'. In the table by Gabrielsson and Lindström, 'exciting' was thus provided with the abbreviation He37, referring to Hevner (1937). The emotional expressions were further 'grouped into (A) early studies using choice among descriptive terms, (B) studies based on multivariate analyses, and (C) later experimental studies' (Gabrielsson & Lindström, 2010, p. 387). An example, strongly reduced, is given in Table 1. Because Gabrielsson & Lindström collates data from dozens of researches, their overview now consists of a solid amount of parameters on every emotion, and provide a rich source of (specific) references. For us, this work served as a summary of earlier research and a register to look for emotion words 'corresponding' to the musical parameters we identified in our data-sets.

The information in this table immediately raises the following question: does the summary of the research by Gabrielsson and Lindström actually 'prove' that listening to music with (for example) a fast tempo will make us feel excited, happy or active? The answer is 'no', for two reasons. Firstly, we need to say that, although the results of various studies might seem to indicate a

Table 1. Example of the summary by Gabrielsson & Lindström based on Gabrielsson and Lindström (2010).

Factor	Levels	Emotional expression
Tempo	Fast	(A) Exciting (He37, Wa42), …
		(B) Happiness, … (Kl68, …)
		(C) Activity, … (Sc77)
	Slow	(A) Serene (He37, Wa42), …
		(B) Sadness (Kl68, …), …
		(C) Sadness, boredom, disgust (Sc77), …

direct relation between a particular musical parameter and a particular emotion, such a one-to-one correspondence relationship does not exist. There is always an interaction between various musical parameters. Although they can be identified independently from each other, the composer combines them in order to create (to com-pose!) a piece of music. Musical parameters interact and combine together to express or evoke a particular emotion. A simple example can make this clear:

> Happiness is expressed by means of fast tempo, moderate variations in timing, moderate to loud sound level, tendency to (relatively) sharpen contrasts between 'long' and 'short' notes (as in dotted patterns), mostly airy articulation, rapid tone onsets, bright timbre, fast and light vibrato (electric guitar). (Gabrielsson & Juslin, 1996, p. 86)

Secondly, the dynamics of our private lives also influence the way we perceive music. Listening to music with musical parameters pointing to happiness will not necessarily make us feel happy if we have just broken up with our fiancé, missed the train or have to say farewell to our beloved deceased. Hunter, Schellenberg, and Griffith (2011) performed research on the relation between mood (sad, neutral or happy, induced by pictures), music (preselected 'happy' or 'sad' music) and the (emotional) perception. Their research made clear that after a happy or neutral mood induction, happy music was preferred to sad music. It also showed that when all musical parameters (in their research called 'cues') clearly suggest happiness or sadness, the pictures shown didn't influence the perception of music. Though, when musical cues were in conflict and did not clearly point to happiness or sadness, the pictures *did* influence the perception. When musical cues weren't clear, a sad mood induction increased the perception of sadness in music, and a happy mood induced more happiness in music (Hunter et al., 2011, p. 1071).

Although we are fully aware of these influences, in this study we will stay focused on the musical parameters offered by music itself. A strong argument to support this choice is found in the way we theorise on the way music and emotion are related. Until now, we have assumed that there is indeed a relation between musical parameters and emotion. This raises a lot of important but also confusing theoretical questions. Is there any emotion *in* music, does music *express* emotions or do listeners merely *ascribe* emotions to music? Jenefer Robinson, professor of philosophy at the University of Cincinnati, makes a distinction between emotion and mood. 'Emotion begins in bodily changes which in turn induce a mood and make us readier to get into some emotional state. Which emotional state we get into, is the result of interpreting our bodily state by reference to the context in which we find ourselves' (Robinson, 2005, p. 403). The way we label our emotional experience strongly depends on social and cultural factors. So when we listen to music, the music creates a bodily change, on the basis of which we ascribe – under the influence of social and cultural factors – emotions to ourselves. In the words of Robinson: 'Music

evokes moods by means of effecting autonomic changes, motor activity, and action tendencies, so as to put listeners into a mood state, a state in which they more readily ascribe emotions to themselves'.(Robinson, 2005, p. 405) Because participants in a cremation ritual are more or less all in the same situation of saying farewell to a beloved deceased, we may assume a comparable ascription of emotion, evoked by music.

Method

In the preceding section, we have described studies employing various methods and yielding a range of results. In our research, in contrast to previous investigations, we neither asked participants to select an emotion word that they feel best fits a specific piece of music, nor did we carry out experimental research by manipulating musical parameters. What we did do was perform an empirical analysis based on data which came, indirectly, from the ritual setting in the Tilburg Crematorium and subsequently compare the results with the analyses of other playlists.

Material

In our research, we used three playlists: one containing songs from the Tilburg Crematorium and two playlists containing contemporary music: the Dutch *Top 2000* and *Top 40*. We chose to compare these three playlists to enable ourselves to find out more about the characteristics of the 'main' musical parameters of the Tilburg Crematorium playlist. Are they different than the *Top 2000* and the *Top 40,* and what does this tell us about the way people listen to music in the Tilburg Crematorium? We will describe each of the playlists in some detail.

The Tilburg Crematorium playlist contains music played and listened to during cremation rituals ever since the opening of the Tilburg Crematorium in 1986. In the first few years of its existence, the crematorium offered a predefined list to the next of kin. This list contained 25 'programmes' of three pieces of music each. People were invited to choose one of these programmes to listen to during the cremation ritual. Over the years, the list began to grow and develop – musical pieces were added to the total selection of music and people became more and more free to choose individual tracks from the entire list. People are also free to choose and play music that is not on the Tilburg Crematorium playlist. An employee of the crematorium estimates whether or not a non-playlist-track might be played during one of the next cremations. If the employee thinks it's likely for the non-playlist-track to be played again during another cremation ritual, the track is added to the playlist. On this way, the playlist grows and each track has been played during at least one cremation in the Tilburg Crematorium.[2]

At the beginning of the twenty-first century, the playlist became available as an online tool, the so-called 'Muziekboek' (music book).[3] In April 2013, this

list contained as many as 3703 performances. The music on the list is quite varied. It includes both instrumental and vocal music, as well as both classical and popular music. Based on cremation services in the period from August 2011 to February 2013, we ranked the frequency of the songs played. Table 2 provides an illustration of the content of the list by showing the 10 most frequently selected songs in this period. Some songs occur in the list more than once, in a number of different performances. While the number of different songs in the list is 2129, the total number of performances is far greater.[4] In our investigation, we will consider all performances, all 3703 entries therefore, as the differences in performance of the same song may have an impact on how the song is perceived.

The *Top 2000* is a playlist containing 2000 songs and is renewed every year. The list is compiled by people voting for their favourite songs. They can select songs from the *Top 2000* lists from the past and songs played regularly on NPO Radio 2, a national Dutch radio station, but they can also suggest new songs. If we count the individual songs that occurred in at least one of the *Top 2000* playlists from the start in 1999 to 2013, this results in 2583 unique songs.[5] The *Top 2000* is broadcast non-stop on NPO Radio 2 from the second day of Christmas (Boxing Day) at 12:00 noon to the end of the year at 12 o'clock on New Year's Eve. Just before midnight, the number one on the playlist is played, which for the past few years has tended to be *Bohemian Rhapsody* by *Queen* (Radio 2, n.d.). According to Wildschut and Seehusen, the choice of songs is based mainly on nostalgia: the *Top 2000* has developed into a nostalgic tradition. As such, the *Top 2000* takes listeners back to moments of happiness and makes them feel reunited with loved ones (Wildschut & Seehusen, 2011, p. 31).

The *Top 40* is a weekly compiled playlist containing the 40 most popular singles of that week in the Netherlands. The list is composed by the Dutch *Top 40* Foundation and is based on airplay on six Dutch radio stations, singles sales, consumer research and, as of 2003, digital download counts. The *Top 40* is

Table 2. Most frequently selected songs in the Tilburg Crematorium playlist.

Artist	Title
Andrea Bocelli and Sarah Brightman	Time to say goodbye
Sweet people	Et les oiseaux chantaient
Marco Borsato	Afscheid nemen bestaat niet ('There is no such thing as goodbye')
André Rieu	Memories
Frans Bauer	Een trein naar niemandsland ('A train to no man's land')
Andrea Bocelli	Ave Maria
Guus Meeuwis	De weg ('The road')
Paul de Leeuw	De steen ('The stone')
Frank Sinatra	My way
Rob de Nijs	Zo zal het zijn ('That's the way it will be')

broadcast weekly on Friday afternoons between 2:00 and 6:00 pm on Radio 538 (Top 40, n.d.). We included songs found in the *Top 40* since the start in 1965 up to March 2014. Combining the *Top 40* lists results in a total of 13,273 unique songs.[6] This yields a large database covering nearly 50 years of popular music, with popularity being indicated by rating surveys and sales figures.

All three playlists contain songs that are popular according to some measure. The *Top 2000, Top 40* and Tilburg Crematorium playlists are based on explicit voting as favourite songs, sales and suitability for cremations, respectively. We believe that the first two lists contain a good, coherent, sample of contemporary music. Besides, both the *Top 2000* and the *Top* 40 are quite dominant playlists in Dutch culture. Furthermore, the contexts and functions of the playlists are different, which allows us to compare the musical properties of the songs on the playlists and relate them to the purpose of the music.

Musical analysis

In analysing the playlists, we made use of computational methods. The musical parameters of the Tilburg Crematorium playlist were compared with those of the songs found in the *Top 40* and the *Top 2000*, both of them popular Dutch charts. To make such a comparison possible, the musical parameters needed to be extracted first. Since we were only considering music *as sound*, no distinction needed to be made between songs with or without lyrics. This allowed us to combine information from all songs from the playlists for comparison.

It is obviously impossible to extract musical parameters from the mere name of the artists and the title of the songs. What is needed is the actual performance itself. However, we do not currently have access to recordings of the actual performances. This makes it impossible for us to perform our own computational musical analyses of the songs. Fortunately, there is a web service provided by the Echo Nest that makes all kinds of musical information available to the public. The Echo Nest refers to itself as a 'music intelligence company'. They have created a platform that includes a web service that allows access to a wide spectrum of detailed musical data. When given the name of the performing artist and the title of a song, the web service will present information on several musical properties of the song in question. This information comes from analyses performed by the Echo Nest itself on actual performances of songs.

The information provided by the Echo Nest can be grouped into several classes. First, song and artist identification information is provided. This includes the name of the artist and the title of the song as well as unique identifiers for use within the Echo Nest web service. Second, artist information is given. This includes information on how familiar the artist is (to the general public), the 'hotttnesss' [*sic*] of the artist (describing how popular the artist is) and information on the location of the artist. Third, song-specific information is provided in the form of song hotttnesss (describing the popularity of the

song). Fourth, information is given based on the audio analysis of the song. This group contains the information we are most interested in. The audio analysis provides information on a number of song-specific properties: time signature (also called metre, which defines the number of beats or pulses per bar and their durational value) and key (which indicates the tonic note and/or chord which gives a subjective sense of arrival or rest). In addition, performance-related information is given: duration of the performance, overall loudness and parameters measuring likelihoods as to whether the performance in question is a live, instrumental or acoustic performance. Also, a measure of the danceability of the song is given. Finally, four aspects that are most relevant for the research presented here are provided: valence, energy, tempo and mode. We will discuss each of these in some more detail.

The valence and energy aspects of a song have a link with the emotion and musical parameters research we presented in the previous section. Both rely on a combination of musical properties that can be measured objectively. Unfortunately, it is unclear exactly how the Echo Nest combines these properties into these complex characteristics.

According to the information on the Echo Nest website, *valence* (which is represented as a value between 0 and 100) is

> the musical positiveness conveyed by a track. Tracks with high valence sound more positive (e.g. happy, cheerful, euphoric), while tracks with low valence sound more negative (e.g. sad, depressed, angry). This attribute in combination with energy is a strong indicator of acoustic mood, the general emotional qualities that may characterise the track's acoustics. Note that in the case of vocal music, lyrics may differ semantically from the perceived acoustic mood. (Echo Nest, n.d.)

Energy, according to the Echo Nest website, 'represents a perceptual measure of intensity and powerful activity released throughout the track. This property is represented as a value between 0 and 100. Typical energetic tracks feel fast, loud, and noisy. For example, death metal has high energy, while a Bach prelude scores low on the scale. Perceptual features contributing to this attribute include dynamic range, perceived loudness, timbre, onset rate, and general entropy'. (Echo Nest) Unfortunately, Echo Nest does not provide details or parameters describing dynamic range, timbre and other items related to energy.

In addition to these two complex characteristics, two musical parameters given by the Echo Nest can be related to the existing literature: tempo and mode. *Tempo* indicates the speed of a song and is described in number of beats per minute (BPM). The *mode* of a song can be either major or minor. The terms 'major' and 'minor' are related to the third note of the tone scale used. If the third of a scale is a major one, the mode is major. If the third of a music scale is a minor one, the mode is minor.

Even though Echo Nest provides us with a wealth of musical meta-data, it unfortunately does not provide us with the details of all the musical parameters and characteristics that we read about in the literature. Therefore, we will focus

on tempo and mode as the 'simple' parameters and valence and energy as 'complex' characteristics.

Overview of playlists

Before we can compare the musical properties of the songs on the different playlists, we first need to extract this information from the Echo Nest web service. Unfortunately, not all songs are recognised (or have been analysed) by the Echo Nest. Effectively, this limits the songs of the playlists somewhat. An overview of the number of songs in the playlists can be found in Table 3. This table also shows the number of songs recognised by the Echo Nest (as well as the percentage this represents of the total number of songs in the playlist). Furthermore, the table shows mean and standard deviations of tempo, valence and energy and the percentage of major songs in the playlist (all other songs are in minor mode).

If we take a look at the percentage of songs in the playlists analysed by the Echo Nest, we see that this includes all the songs that are found on the *Top 2000* playlist. These are all well-known songs. Where the songs of the *Top 40* playlist are concerned, we see that approximately one in four songs is not recognised. Fitting a locally weighted polynomial regression (a statistical technique) to the percentages of missing songs over the years, we see that it is in the early years of the *Top 40* that we find most of the songs not known to the Echo Nest. After this, the percentage of non-recognised songs decreases over time, with lowest values in the 80s and 90s. In more recent years, however, the percentage of songs not recognised by the Echo Nest increases again. We believe that songs from the 60s, even though popular at the time in the Netherlands, on average tend to be less popular in general and because of that have not been analysed yet by the Echo Nest. Additionally, many songs not analysed have Dutch lyrics. Songs from the 80s and 90s are still relatively popular and played regularly on the radio, for instance. Very recent songs may still need to be analysed. The Tilburg Crematorium playlist contains even more songs not recognised by the Echo Nest. There seem to be two main reasons for this.

Table 3. Overview of properties of the three playlists.

	Number of songs	Number of songs known by the Echo Nest	Mean tempo and standard deviation (in BPM)	Mode: % major mode	Mean valence and standard deviation (0–100)	Mean energy and standard deviation (0–100)
Tilburg Crematorium	3703	2099 (56.7%)	110.6 (30.7)	79.8	33.8 (23.3)	37.6 (21.0)
Top 40	13,273	9861 (74.3%)	120.0 (25.3)	69.8	61.3 (24.5)	66.2 (20.7)
Top 2000	2583	2583 (100.0%)	117.1 (26.8)	75.8	56.7 (24.9)	57.8 (21.9)

Firstly, the playlist contains many Dutch songs, which for that reason may simply not be included in the Echo Nest database. Secondly, the playlist contains many classical songs, many of which the Echo Nest is not familiar with or does not deal with either.

Note that even though not all songs have been analysed by Echo Nest, we believe that the large amounts of remaining songs still result in such data-sets to allow for reliable statistical analyses. In particular, the number of songs from the Tilburg Crematorium playlist seems to be relatively low. However, 2099 songs still provides a good sample of songs played during cremations. One may argue that the availability of Echo Nest data may bias the results on this playlist, which may be true and should be seen as a limitation of using a service such as Echo Nest, however, all of these songs have indeed been played during cremations and as such do describe a sample of appropriate songs for these occasions.

To illustrate the properties measured by the Echo Nest that will be used here, we provide a number of examples from the playlists used in this research. The fastest song (highest tempo) in the Tilburg Crematorium playlist is the song *Sympathy for the devil* by the Rolling Stones with 228 BPM, Blondie with *Heart of glass* (232 bpm) in the *Top 40* and *Pride* by U2 (217 bpm) in the *Top 2000* playlist. The slowest songs according to the Echo Nest are *Dulcissime* by Carl Orff (44 bpm) in the Tilburg Crematorium playlist, *Ballroom Blitz* by Sweet (35 bpm)[7] in the *Top 40*, and Alison Moyet with *That Ole Devil Called Love* (51 bpm).

Ranking songs from the Tilburg Crematorium playlist on how frequently they have been played (see Table 2), we find a major mode in Sweet People's *Et les oiseaux chantaient*, for example, and a minor mode in André Rieu's *Memories*. Echo Nest provides details about the mode of a song, indicating whether the song is major or minor. This research only shows (percentages) about minor or major, and doesn't provide details about whether a song is written in (for example) C-minor or F-major.

Taking a look at valence, we see that in the Tilburg Crematorium playlist the highest valence (happiest song) is found in *Banger hart* by Rob de Nijs (97.3), while the song with the lowest valence (3.0) is *Adagio for Strings* composed by Samuel Barber. For the *Top 40*, the highest (99.5) and lowest valences (24.7) are Snoopy with *No time for a tango* and Boyzone with *Key to my life*, respectively. For the *Top 2000* playlist, the songs with the highest (99.6) and lowest (3.7) valences are the Everly Brothers with *Claudette* and Clannad's *Theme from 'Harry's game'* respectively.

Furthermore, in the Tilburg Crematorium playlist, *Tutti Frutti* by Little Richard has the highest score on energy (98.5), while Robbie Williams with *Beyond the sea* has the lowest (0.0).[8] For the *Top 40*, the highest and lowest energy scores can be found in *Poco Loco* by Poco Loco Gang (99.9) and Judy Collins with *Amazing Grace* (0.0). Finally, in the *Top 2000* playlist, the songs with the highest and lowest energy are *Never Gonna Give You Up* by Rick Astley (99.6) and Marvin Gaye's *Sexual healing* (1.4), respectively.

Empirical results

The research described here focuses on two areas. Firstly, we are interested in the musical characteristics of the Tilburg Crematorium playlist. An overview of these properties can be found in Table 3. However, what do these numbers mean if we only look at the Tilburg Crematorium playlist results? These numbers have to be placed in a context for them to be meaningful. In order to do this, we will set the musical properties of the Tilburg Crematorium playlist against the same musical properties of other playlists, and compare them. This will answer a subquestion in this research: Does the Tilburg Crematorium playlist differ from the *Top 40* and *Top 2000* playlists? If there are differences, in which musical properties exactly do we find them?

Assuming that we would find differences between the musical properties of the playlists (which effectively shows that music played during cremations has specific musical aspects), we were especially interested in what these differences mean in the context of emotion. More particularly, we wanted to find out how differences in musical properties of songs in the playlists compare to results found in earlier research on musical parameters and emotion.

Tempo

Table 3 gives the mean tempo (and standard deviation) of the songs in the three playlists: the Tilburg Crematorium playlist, the *Top 40* and the *Top 2000* playlists. The question is: are these different averages really different, or are they merely an 'unfortunate' by-product of the selection of songs? In other words, is the set of songs that fit 'logically' in the different playlists really different? In order to test this, we need to perform statistical tests. These will tell us whether the distributions of tempi of the songs are really different.

Firstly, we investigated whether the distributions of tempi in the three playlists are statistically significantly different by performing an ANOVA test. This test shows that the differences between the playlists are indeed statistically significant ($F(2, 14,540) = 109.4$, $p < .001$). Investigating the differences using a Tukey test, we found that these averages between all three playlists are significantly different ($p < .001$) from each other. This means that overall the songs in the Tilburg Crematorium playlist have a significantly lower tempo than those in the *Top 40* and the *Top 2000,* and also that the *Top 40* has a higher tempo than the *Top 2000* playlist.

Mode

To investigate whether there are differences between the division of major and minor songs in the playlists, we cannot perform an ANOVA test as the values for mode are categorical. If the songs from three playlists would have been sampled from the same mode distribution, the proportions of major and minor songs would be the same in all three playlists. To measure whether this is the

case, we performed a three-sample test for equality of proportions. This shows that there are significant differences in the division of major and minor songs in the three playlists ($X^2 = 105.5$, $p < .001$). To see between which playlists differences occur, we performed binomial tests between all pairs of playlists and performed the Bonferonni-correction. The tests between the pairs of playlists show that the proportions of major and minor songs in all the playlists are statistically significantly different ($p < .001$). This means that all playlists contain statistically significantly more major than minor songs and that the proportions of major and minor songs between the playlists are also significantly different. The Tilburg Crematorium playlist contains 3.9 times more major than minor tracks, the *Top 40* contains 2.3 times more major than minor tracks and the *Top 2000* contained 3.1 times more major than minor tracks.

Valence

Considering the values for valence, an ANOVA test shows that again we find statistically significant differences ($F(2, 14{,}534) = 1106$, $p < .001$).[9] Investigating the differences using a Tukey test shows that the differences between all the playlists are statistically significant ($p < .001$). It means that the *Top 40* playlist has the highest valence, followed by the *Top 2000* playlist. The Tilburg Crematorium playlist has the lowest valence.

Energy

Finally, we compare the energy scores of the three playlists. Again, an ANOVA test shows that the playlists are statistically significantly different ($F(2, 14{,}540) = 1641$, $p < .001$). Performing a Tukey test shows that all playlists pairwise are statistically significantly different ($p < .001$). The *Top 40* playlist has the highest amount of energy. The *Top 2000* playlist has more energy than the Tilburg Crematorium playlist, but less than that of the *Top 40* playlist.

Discussion

Summarising, we found that the Tilburg Crematorium playlist has a relatively low tempo, a large proportion of major songs, low energy and low valence (compared to both *Top 40* and *Top 2000* playlists). The *Top 2000* playlist is in between the Tilburg Crematorium and *Top 40* playlists with respect to tempo, proportion of major songs, amount of energy and valence. These results indicate that we can order the playlists consistently.

Now that we have found that the Tilburg Crematorium playlist contains tracks with a relatively low tempo and predominantly in major mode, what does this tell us about the emotional impact of the music? According to the summary by Gabrielsson and Lindström (2010, pp. 383–387), a major mode is associated with emotion words like: happy, joy, graceful, serene, solemn, attraction and tenderness. A low tempo is associated with: serene, tranquil, dreamy,

longing, sentimental, dignified, serious, solemn, sad, lamentation, excited, boredom, disgust, tenderness and peace. The emotion words these musical parameters have in common are: serene, solemn and tenderness.[10] Although we only used two musical parameters, the low tempo and major mode point to serene, solemn and tender music being played in the Tilburg Crematorium. We deliberately use the verb 'point to', because we know that there are many more musical parameters that influence the emotional impact of the music. Next to that, as we mentioned before, the (individual) social context also influences the way music and emotion are connected.

The *Top 2000* playlist shows lower tempo, energy and valence, and a higher proportion of major songs when compared with the *Top 40* playlist. This may indicate that the *Top 2000* playlist is indeed based on feelings of nostalgia, while the popularity of the songs in the *Top 40* playlist is characterised (besides rating surveys and sales figures) by high valence, a high amount of energy and up-tempo music.

Three final remarks

We conclude with three final remarks, broadening the scope of this paper to the issue of coping with death in Dutch culture. The first remark concerns the culturally biased link between the minor mode and grief or grieving. The second remark relates our findings regarding the musical parameters and characteristics to the crematorium as a ritual place. The third and final remark relates our findings to the ways we cope with death in our culture.

There appears to be a general consensus among musicologists, musicians and listeners that music written in the minor mode is more likely to elicit feelings of sadness than music written in the major mode. Kastner and Crowder, for example, state that:

> One of the compelling expressive devices in tonal music is the use of modes to suggest emotion: For most Western listeners, the minor mode suggests a negative emotional tone while the major mode has a more positive connotation, other things being equal. (Kastner & Crowder, 1990, p. 190)

As we have found 3.9 times more major than minor mode tracks in the Tilburg Crematorium playlist, we may conclude that the relation between the minor mode and sadness is not self-evident. Or perhaps, we cannot say that a sad situation like the cremation ritual of its own accord calls for music in a minor key. This assumption can be strengthened by looking at the *Top 40*, which contains only 2.3 times more major than minor songs. Compared to the Tilburg Crematorium playlist, there are relatively more songs in minor mode in the *Top 40*. Although we are fully aware of the fact that both playlists contain more major than minor songs, these findings might seem to indicate an ambiguous role of mode in its relation to emotion. We could also say that equating all songs played in the crematorium with 'sadness' is unwarranted, even though

the occasion is a sad one. Songs may be selected because they characterised the deceased, marked a special relation with one of their loved ones, or somehow meant a lot to them – and these may all be cheerful, upbeat songs.

Where the Tilburg Crematorium playlist is concerned, we have found 'serene, solemn and tender' as the being most important emotion words. These same words can be adopted to newly built and refurbished and refurnished crematoria in the Netherlands after 2000 (Cramwinckel, 2011). The general critique levelled against crematoria of their being uninspiring and impersonal has been repeated over and over again (Klaassens & Groote, 2012, 2014). After 2000, architects and designers began to create new places for saying farewell to deceased loved ones, places displaying cherished characteristics such as colour, warmth, light, symbolism, open space, connections to nature. The Tilburg Crematorium is a good example of this development. In 2003, 2008 and 2009, the various rooms of the crematorium were redesigned to meet the needs of the bereaved for a more homelike and tender atmosphere (Cramwinckel, 2011, pp. 17–20; De Leeuw, 2009, pp. 135–136). It seems to us that the dominant emotion words of the Tilburg Crematorium playlist fit the general development of the crematorium design.

Our final remark concerns the relation between the dominant emotion words associated with the playlist and the general way of coping with death in Dutch culture. In 2006, our former colleague Piet van den Akker researched new death rituals in the Netherlands (van den Akker, 2006). One of his research questions was: What do next of kin want to express in case of bereavement? Van den Akker discerned three objectives (van den Akker, 2006, pp. 135–136). First, the bereaved want to do justice to the deceased and to show their respect. Secondly, the bereaved want to be recognised in their loss and to be rewarded with sympathy and consolation. Thirdly, the bereaved want to say farewell to the deceased in a way that is satisfactory to themselves and socially accepted. Although the personal and individual character of death rituals is stressed, they are nevertheless part of a cultural and social way of coping with death. In our opinion, the dominant emotion words associated with the Tilburg Crematorium playlist fit the first and third objectives of death rituals. In Dutch culture, we show respect to the deceased, even though relations have been broken and the remembrance of the deceased is filled with pain and anger. Besides, and even more importantly, in Dutch (and Western) culture we tend to say farewell to the deceased in a serene, solemn and tender way and not – in contrast to other cultures – with intensely expressed weeping or wailing (Huntington & Metcalf, 1979, pp. 23–43).

Coda

We consider the research we conducted as a pilot, introducing computational techniques into death studies. In our pilot, we compared three playlists from the perspective of emotion. The results, although preliminary, indicate good opportunities for continuing this kind of research. At least two domains of

further research come into view here. First, we would like to collect the playlists of the approximately 70 crematoria in the Netherlands and expand the research on cremation music and emotion with a much larger database. Collecting the playlists of the Dutch crematoria, which are spread all over the country, will make it possible to objectively compare those lists and to mark differences between several regions of the country. As a consequence of historical developments, the Netherlands became subdivided into a mainly Protestant part (North of the great rivers) and a mainly Roman Catholic part (South of the great rivers). This partition has practically dissolved since the sixties of the twentieth century, but remnants are still traceable (van Eijnatten & van Lieburg, 2005). By using computational techniques, we will be able to research the differences between playlists of crematoria in the south of the Netherlands and those in the north in relation to the religious history of the country.

Second, we want to compare the Dutch cremation playlists with those in other countries. In order to do so, we have to include historical, demographic, cultural and religious data to understand the characteristic properties of the playlists of the crematoria in a specific country. The aim of this kind of research is to gain insight into the characteristics of the Dutch situation with regard to cremation by comparing the playlists of the Dutch crematoria with results of research in other countries. By 'making the familiar strange' we want to outline the Dutch cremation soundscape (Kaufman Shelemay, 2001).

Disclosure statement

Notes

[1] In the period between 1986 and 2008, the number of cremations increased from 61 in 1986 to 1684 in 2008. See, De Leeuw (2009, p. 86).
[2] We have information on 2507 ceremonies (period 2011–2013). 54 Ceremonies do not include music at all, 955 contain tracks from the online playlist only, 668 include no tracks from the online playlist at all, 830 contain a mix of tracks from the online playlist and tracks from a CD supplied by the next of kin. Unfortunately, there is no information available on the tracks not included in the online playlist.
[3] http://www.crematoriumtilburg.nl/muziekboek.
[4] Thanks to Nadine de Jong, who researched the playlist of the Tilburg Crematorium as part of her MA Thesis research (*Musical characteristics of songs played at cremations*. MA Thesis Tilburg University 2014).
[5] Thanks to Jacqueline Jacobs, who researched the *Top 2000* playlists as part of her MA Thesis research (*Composing your running playlist. The differences of running and non-running playlists*. MA Thesis Tilburg University 2014).
[6] Thanks to Nadine de Jong, who researched the *Top 40* playlists as part of her MA Thesis research (see note 4).
[7] Unfortunately, this shows that the results provided by the Echo Nest are not always correct. For instance, *Ballroom Blitz* by Sweet has a higher tempo than 35 bpm. It is difficult to measure the exact quality of the results of the Echo Nest, but we believe that this effects only a small number of songs and that due to the large number of songs available, this still yields reliable results.

[8] In fact, this score is non-zero, but rounds to 0.0 with one decimal.
[9] For six songs, Echo Nest did not provide any valence value.
[10] Other characteristics of serene are high pitch, flowing/fluent rhythm, and simple harmony. Other characteristics of solemn are soft loudness and legato articulation. Other characteristics of tenderness are soft loudness, legato articulation and round amplitude envelopment (Gabrielsson & Lindström, 2010, pp. 384–387).

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