Multiple conceptual and experimental theories have tried to link metaphors and emotions, or at least included both entities in their framework. The BRECVMMA, one of the most influential models trying to explain the link between music and emotion, places visual imagery as one of the eight mechanisms to induce emotions (Juslin, 2013). Visual imagery is a conceptualization of the musical structures through a "metaphorical non-verbal mapping between the music and so-called image schemata grounded in bodily experience" (Juslin and Västfjäll (2008), p566). These inner images can represent an emotional character through a metaphorical mapping of the musical structure (Osborne, 1981), especially with certain acoustical features, such as pitch, dynamics, predictability in melodic, harmonic and rhythmic elements. By manipulating acoustic features, researchers have shown that most musical parameters significantly affect several dimensions of motion imagery. For example, a crescendo will be seen as going upwards. Visual imagery, however, is depending a lot on individual differences and is a very conscious process with a strong volitional influence (Juslin, 2013). A smaller proportion of the population report using such mechanism to elicit emotions (Juslin et al., 2011). More generally, individuals exhibit differences in how vivid they imagination is (Marks, 1973). Finally, visual imagery is also more difficult to manipulate that other processes (such as expectancy) (Juslin, Harmat, & Eerola, 2014).

Another theory comes from semiotics, the study of signs. Music can, in a sense, be represented as a kind of sign, a stimulus pattern that has meaning (theory created by Charles S. Pierce in the late 19th century, although not on music per se). If we admit that music is a kind of sign, we must differentiate between the three different types of signs explaining how meaning is attached to the pattern: the icon, the index, and the symbol. These three signs can be applied to music as what Koelsch refers to as extramusical meaning (Koelsch, 2011). The first type of sign attached to musical meaning is the icon. Iconic musical meaning emerges from the static likeness between musical patterns (and their interpretation) and sounds made of objects, as well as the qualities of objects and even abstract concepts. For example, a musical excerpt may sound ‘like a bird’, or a piece of music like Louis Moreau Gottschalk’s "The banjo" might give an iconic representation of the sound produced by a banjo without using the actual instrument (Zbikowski, 2010). While Charles S. Pierce regarded music mainly as an iconic sign, there are also many features of musical expression that can be indexical and even symbolic (Monelle, 1991). A musical index refers to a sound pattern that indicates the presence of a psychological state of an individual, such as the presence of an emotion or an intention. An example would be "this piece sounds happy". The last type of sign, the symbolic meaning is not studied in this paper, since it depicts a stable habitual convention-based relationship with its object and is associated in general with words, and in the case of music, with national anthems. The next theory concerns conceptual blending. The fathers of this theory, Fauconnier and Turner (2008), propose that a conjunction of conceptual blending and cognitive metaphor offers useful insights for analyzing musical emotions (Fauconnier & Turner, 2008). Conceptual blending is the creation of a novel, emergent structure, occurring in the blended space, from the mapping of two separate input mental spaces, containing each conceptual packet. This mapping is motivated by another generic space, hosting preconceptual and often spatial topologies common to the two inputs. Using conceptual blending, Spitzer (2018) managed to explain musical anger, in both Vivaldi and Haydn pieces, as a blending of one reference space containing the emotion scripts (e.g. how anger is supposed to unfold) with the presentation space containing the musical script, performance, and gesture (Spitzer, 2018). Both of them are based on the generic space containing the musical persona, the music’s virtual "body". The last theory, useful from our perspective to understand the complex relationships between metaphor, music, and emotion, is based on a hierarchical system of six contextual constraints to build meaning (Antovic, 2018). These proposed six levels are physiological reactions, image-schematic structures, connotational, conceptual, cultural context, and finally personal.
experiences. Metaphors based on the grounded image schemata appears at level two while level three ascribe emotional qualities to the music. In addition, emotional connotation can be grounded in the image-schematic level two, when, for instance, an ascending sequence of notes, tapping into the VERTICALITY schema, is interpreted as "majestic" (Cooke, 1959). As the fifth level, culture plays an important role in shaping the musical meaning. Western European music for example features repetitively themes such as the hunt, the military, and the pastoral, that can be related to literature, social history, and the fine arts (Monelle, 2006). Finally, the last level relates to individual differences and make music meaning such a personal experience.

The use of embodiment as a main framework to explain the link between emotions and metaphors in the context of musical meaning has already been explored in two main aforementioned theories: the conceptual blending (Fauconnier & Turner, 2008) and the multilevel grounding in musical semantics (Antovic, 2018). The conceptual blending is the mapping of two input spaces, based on a generic space, that creates a blend from which additional meaning emerges. In the case of music, these input spaces have been associated on one hand with musical features (e.g. notes, performance gestures, musical structure) and on the other hand with different aspects of either an affective event (Spitzer, 2018) or an object/concept (e.g. path) (Antovic, 2015). The act of explaining one domain (or input space) in terms of another is founding ground of the Conceptual Metaphor Theory (CMT, Lakoff & Johnson, 1980}). In such theory, a metaphor is defined as a cross-domain mapping in the conceptual system (Lakoff, 1993). These mappings are based on dynamic cognitive constructs resulting from the embodiment of physical experiences, called image schemata. While not all conceptual metaphors are necessarily grounded in bodily experiences, most might (Goschler, 2005). Similarly, these embodied experiences could support cross-domain mappings with affective domains. Juslin, for the BRECVEMA system, defined emotions themselves as "embodied phenomena that serve to guide action" (Juslin, 2013). Consequently, both metaphors and emotions could share similar embodied cognitive structures linking them in a similar fashion to the music. In the second theory, the multilevel grounding in musical semantics, the elaboration of musical meaning is based on a hierarchical process covering successively physiological, image schematic, connotational, conceptual, elaborated cultural, and individual aspects (Antovic, 2018). The third level, the connotation level, refers to emotions associated with images schemata. For example, an ascending musical sequence (VERTICALITY) could be perceived as "majestic" (Cooke, 1959). The fourth level, the conceptual level, is entirely referential or extramusical, connecting music to the experience of the world and creating conceptual metaphors. Both levels are based upon the image schematic level, referring to the embodied experiences. Consequently, looking at both theories, we suggest that embodied cognition might be at the basis of the link between musical metaphors and emotions in the context of musical meaning.

In this work, we have demonstrated that musical meaning in the form of metaphors and emotions can be extracted from Western classical excerpts. Furthermore, we highlighted that both musical metaphors and emotions seem to be connected in certain ways. Going back to the different theories introduced in this Supplementary Material, we want to link the results presented here to what other researchers have theorized. First, concerning the BRECVEMA, visual imagery, one of the eight mechanisms eliciting emotions when listening to music, seems to be a subset of all the cross-domain mappings possible (Juslin, 2013). Indeed, its visual nature is somewhat limiting the diversity of possible metaphors elicited by music. Moreover, the mechanism appears at the same time as music listening, while the metaphorical meaning of a piece can be explored after listening. Despite these limitations, we have shown that metaphors are associated with different emotions, as it is assumed by the BRECVEMA model. The directionality and timing of such interaction could unfortunately not be observed in this study and remains an important point to clarify in future research. Second, as hinted by
Koelsch, listeners were also able to decode the extra-musical meaning associated with our excerpts, both the iconic and indexal signs (Koelsch, 2011). The coherence in their answers points at the ability of our participants to pick up on the same characteristics in music, such as acoustic and perceptual cues. Lastly, the last two theories introduced in this paper, the conceptual blending and the hierarchical system of six contextual constraints, states the metaphors as a primary building block to explain meaning and musical emotions. Once again, the order of the mechanisms by which the creation of meaning occurs could not be studied in this assessment. Future studies could focus on the temporality of musical emotions and metaphors, as they most likely evolve over time, similar to emotional prosody (Pell & Kotz, 2011, Schaerlaeken et al., 2018).

References Online Supplementary Material A

Juslin, P. N. (2013). From Everyday Emotions to Aesthetic Emotions: Towards a Unified Theory of Musical Emotions. *Physics of Life Reviews, 10*(3), 235–266

Juslin, P. N., & Västfjäll, D. (2008, oct). Emotional responses to music: the need to consider underlying mechanisms. *The Behavioral and brain sciences, 31*(5), 559–75; discussion 575–621.

Osborne, J. W. (1981) The mapping of thoughts, emotions, sensations, and images as responses to music, *Journal of Mental Imagery*. Brandon House., 5(1), pp. 133–136.

Juslin, P. N., Liljestrom, S., Laukka, P., Västfjäll, D., & Lundqvist, L.-O. (2011). Emotional reactions to music in a nationally representative sample of Swedish adults: Prevalence and causal influences. *Musicae Scientiae, 15*(2), 174–207.

Marks, D. F. (1973). Visual imagery dierences in the recall of pictures. *British journal of Psychology, 64*(1), 17–24

Juslin, P. N., Harmat, L., & Eerola, T. (2014). What makes music emotionally significant? exploring the underlying mechanisms. *Psychology of Music, 42*(4), 599–623.

Koelsch, S. (2011). Towards a neural basis of processing musical semantics. *Physics of life reviews, 8*(2), 89–105.

Zbikowski, L. M. (2010). Music, emotion, analysis. *Music Analysis, 29*(1-3), 37–60.

Monelle, R. (1991). Music and the peircean trichotomies. *International Review of the Aesthetics and Sociology of Music, 99–108.*

Fauconnier, G., & Turner, M. (2008). *The way we think: Conceptual blending and the mind’s hidden complexities*. Basic Books.

Spitzer, M. (2018). Conceptual blending and musical emotion. *Musicae Scientiae, 22*(1), 24–37.

Antovic, M. (2018). From expectation to concepts: Toward multilevel grounding in musical semantics. *Cognitive Semiotics, 9*(2), 105–138.

Monelle, R. (2006). *The musical topic: hunt, military and pastoral*. Indiana University Press.

Antovic, M. (2015). Metaphor in music or metaphor about music: A contribution to the cooperation of cognitive linguistics and cognitive musicology. Antović, M. (2014): *Metaphor about music or metaphor in music: A contribution to the cooperation of cognitive linguistics and cognitive musicology [Metafora o muzici ili metafora u muzici: jedan prilog za*
saradnju kognitivne lingvistike i kognitivne muzikologije]. In: Metaphors We Study: Contemporar

Lako, G., & Johnson, M. (1980). The Metaphorical Structure of the Human Conceptual System. *Cognitive Science, 4*(2), 195–208.

Lako, G. (1993). The contemporary theory of metaphor. In A. Ortony (Ed.), *Metaphor and thought* (pp. 202–251). Cambridge University Press.

Goschler, J. (2005). Embodiment and body metaphors. *Metaphorik. de, 9*(2005), 33–52.

Pell, M. D., & Kotz, S. A. (2011). On the time course of vocal emotion recognition. *PLoS One, 6*(11), e27256.

Schaerlaeken, S., & Grandjean, D. (2018). Unfolding and dynamics of affect bursts decoding in humans. *PloS one, 13*(10), e0206216.
Music excerpts were selected based on a pilot study with 20 participants (9 females, age M = 26.2, SD = 6.8) and with the help of a music expert. The list of excerpts presented in the pilot study was drawn from our previous experiment (Schaerlaeken et al., 2019). All excerpts were pieces of western classical music, from different periods of time and different genres. We selected two excerpts per emotion described by the Geneva Emotion Musical Scale (GEMS (Zentner et al., 2008)). For each of the 9 emotions, we selected final excerpts following two criteria: 1) high ratings in the pilot study for a specific emotion, preferably with high discriminability when possible, 2) consensus with the description of the excerpt as assessed by a group of musicians including a professor from the Haute Ecole de Music of Geneva. Since both "Wonder" and "Transcendence" scales were not well recognized in the pilot study, we used four excerpts from another study based on the results obtained for such emotions to complete our list (Eliard et al., 2017). The final list contained 18 excerpts (Table A). During the study, these excerpts were also rated for how much participants knew them. If the participants did not know them, this would ensure that the metaphors and emotions collected on these excerpts are not a result of episodic memory irrelevant to the music itself.

| Excerpt name                                                                 | Style  | Year | Known |
|------------------------------------------------------------------------------|--------|------|-------|
| Győrgy Kurtag, 12 Microcélules for String Quartet, Op. 13 "Hommage à Andrée Mildhly"; V. Lontanno, calmo, appena sentito | Baroque | 1978 | 0.61  |
| Mahler, Gustav. Symphony No.1 in D major. First Movement Bars 1-34         | Romani | 1887 | 0.97  |
| Massic La Rêveuse, Quatrième Livre                                               | Baroque | 1717 | 1.12  |
| Bach J.-S., The Well-Tempered Clavier, Book II: Prelude No. 19 in A Major, BWV 888 | Baroque | 1744 | 1.4   |
| Bach J.-S., "Goldberg" Variations, BWV 988 (Aria With Dovers Variations): Variation 13 a 2 Clav. | Baroque | 1740 | 1.52  |
| Dietrich Buschelude, Sonata In G, Bwv271: Allegro                           | Baroque | 1700 | 1.66  |
| Vivaldi, Concerto for flute and Strings in D Major, Op. 10, No. 3, R. 428 - "Il gardellino"; 2. Cantabile | Baroque | 1728 | 1.68  |
| Bach J.-S., Brandenburg Concerto No.1 in F, BWV 1046: II. Adagio             | Baroque | 1721 | 1.72  |
| Bach J.-S., Passacaglia in C Minor, BWV 582                                   | Baroque | 1720 | 1.76  |
| Francesco Geminiani, Concerto Grosso in C minor, Op. 2, No. 2: III. Adagio   | Baroque | 1732 | 1.76  |
| Stravinsky, Le Sacre du Printemps: Vth. Dance of the Earth                  | Modern | 1913 | 1.94  |
| Beethoven, Ludwig Van. Violin Concerto in D major, op.61. Ronde. Allegro, Bars 8-101 | Baroque | 1806 | 2.21  |
| Bach J.-S., Das Wohltemperierte Klavier, Book 1: Prelude in C Minor, BWV 847 | Baroque | 1722 | 2.42  |
| Bach J.-S., Partita No. III, BWV 1006: I. Preludio                           | Baroque | 1720 | 2.52  |
| Liszt, Liebestraum No. 3 in A Flat, S. 541 No. 3: Nocturne III: O Lied, se lang du lieben kannst (Poco allegro, Con affet. | Romantic | 1850 | 3.09  |
| Bruch, Max. Violin Concerto No.1 in G minor, op.26. Finale: Allegro energico, Bars 1-115 | Romantic | 1866 | 4.12  |
| Tchaikovsky, Piotr Ilitch. Swan Lake, ballet, op.20. Act two Bars 1-51          | Romantic | 1875 | 4.6   |
| John Williams, The Imperial March                                               | Modern | 1980 | 7.07  |

Table A. Western classical excerpts presented in the experiment with style and year of composition associated. Excerpts are sorted by how much they are known by the participants (0 = not at all, 4 = neither known nor unknown, 8 = fully known).

Reference for Supplementary Material B

Schaerlaeken, S., Glowinski, D., Rappaz, M.-A., & Grandjean, D. (2019). "hearing music as...": Metaphors evoked by the sound of classical music. Psychomusicology: Music, Mind, and Brain, 29(2-3), 100.

Zentner, M., Grandjean, D., & Scherer, K. R. (2008, Aug). Emotions evoked by the sound of music: characterization, classification, and measurement. Emotion (Washington, D.C.), 8(4), 494–521.

Eliard, K. (2017). Dynamiques temporelles des emotions exprimees par la musique (Unpublished doctoral dissertation). University of Geneva.
The descriptors linked to acoustical and perceptual features were principal components (PC) from three PCA computed on the acoustic features, the perceptual features, and the entrainment questionnaire, respectively. The first PCA resulted in two components for the acoustical features that explained cumulatively 48.3% of the variance (respectively 27.05% and 21.27%). The first PC was positively associated with the spectral centroid and brightness. The second PC was negatively associated with the intensity of the signal (RMS) and the roughness. The second PCA, based on the perceptual features, resulted also in two components that encapsulated 65.3% of the variance (respectively 39.7% and 25.6%). The first PC was positively associated with melody and negatively with dissonance. The second PC was positively associated with rhythm and articulation. Finally, the last PCA integrated the entrainment questionnaire into one single component that explained 85.5% of the variance and was associated positively to feeling animated, wanting to move, and feeling the beat.

Figures A, B, C. Scree plot of the eigenvalues for each PCA. A, acoustic features; B, perceptual features; C, entrainment questionnaire. The red bar show the cutoff selected.
### Principal component loadings for each PCA

Only the features with a weight superior to 0.5 are displayed in color. Features with a weight superior to 0.7 are displayed not faded. Positive weights are represented in read and negative in blue.

#### Table A: Acoustic Features

| Feature                  | PC1    | PC2    |
|--------------------------|--------|--------|
| SPECTRE_CENTROID         | 0.940678 | 0.035345 |
| BRIGHTNESS_3000          | 0.938519 | -0.251984 |
| ROLL-OFF                 | 0.847769 | 0.103166 |
| BRIGHTNESS_1500          | 0.819710 | -0.406413 |
| SPECTRE_FLATNESS         | 0.782766 | 0.290597 |
| SPECTRE_SPREAD           | 0.764693 | 0.364758 |
| SPECTRE_ENTROPY          | 0.749629 | -0.490503 |
| BRIGHTNESS_1000          | 0.736551 | -0.430271 |
| FLUX_DU_CEPSTRE          | 0.702716 | 0.355707 |
| ZERO CROSS               | 0.654469 | -0.557466 |
| CEPSTRE_MEAN             | 0.519553 | 0.135845 |
| TEMPO                    | 0.371219 | -0.170255 |
| FLUX_DU_CEPSTRE          | 0.184382 | -0.896754 |
| CEPSTRE_MAX              | 0.156461 | -0.171714 |
| TEMPO_CHANGE             | 0.151476 | -0.085444 |
| NOVELTY_METRIC           | 0.140619 | 0.438252 |
| NOVELTY_CHROMAGRAM_1     | 0.103249 | 0.325284 |
| METRICAL_CENTROID        | 0.099184 | 0.102914 |
| ROUGHNESS                | 0.090817 | -0.898217 |
| KEY CLARITY              | 0.088799 | -0.067845 |
| NOVELTY_KEYSTRENGTH_2    | 0.058246 | 0.197251 |
| NOVELTY_MFCC             | 0.021970 | 0.510698 |
| NOVELTY_KEYSTRENGTH_1    | 0.019390 | -0.103011 |
| NOVELTY_AC_WAVEFORM      | 0.007971 | -0.007376 |
| NOVELTY_CHROMAGRAM_2     | 0.002343 | 0.064032 |
| RMS                      | -0.044912 | -0.903057 |
| CEPSTRE_CENTROID         | -0.064186 | 0.240669 |
| NOVELTY_SPECTRE          | -0.065941 | 0.183973 |
| MODE                     | -0.095622 | 0.050468 |
| EVENT DENSITY            | -0.105233 | -0.697273 |
| NOVELTY_CEPSTRE          | -0.155961 | -0.384054 |
| METRICAL_STRENGTH        | -0.407177 | 0.551147 |
| PULSE CLARITY            | -0.422190 | -0.323303 |
| HCFD                     | -0.614583 | -0.224264 |
| SPECTRE KURTOSIS         | -0.854768 | 0.082203 |
| SPECTRE SKEWNESS         | -0.912317 | 0.170225 |

#### Table B: Entrainment Questionnaire

| Items            | PC1    |
|------------------|--------|
| Animated         | 0.993929 |
| Move             | 0.978406 |
| Beat             | 0.969453 |
| Entrained        | 0.963807 |
| Agitated         | 0.937429 |
| Resonate         | 0.900178 |
| Physiology       | 0.837516 |
| Dance            | 0.794531 |

#### Table C: Perceptual Features

| Feature                  | PC1    | PC2    |
|--------------------------|--------|--------|
| Melody                   | 0.854216 | 0.071005 |
| Anomaly                  | 0.797815 | -0.114160 |
| Rhythm Stability         | 0.324811 | 0.631492 |
| Rhythm Complexity        | -0.220435 | 0.799236 |
| Articulation             | -0.288989 | 0.760891 |
| Mode                     | -0.521771 | -0.398711 |
| Dissonance               | -0.895100 | 0.317213 |
Online Supplementary Material D

At first glance, the distribution of ratings for both the GEMMES and GEMS scales did not follow a normal distribution. Both were zero-inflated distributions due to the tendency of our participants to associate each excerpt with only a part of the items proposed, leaving the rest at the minimum value. This had two consequences: first, statistical comparison of the raw ratings required non-parametric testing (permutation testing and Spearmann correlation). Second, we artificially created a binomial distribution by characterizing each scale of each trial as "1" or "0". A scale was set to "1" if the corresponding raw rating was superior or equal to the middle of the rating scale (4, noted for the participants as "neither relevant nor irrelevant"), and set to "0" otherwise. It is therefore important to note that, for the models computed, an estimated value of 0.5 correspond to the chance level. Therefore, significant effects deviated from this value either positively or negatively.
### Online Supplementary Material E

| Subscale            | Median                  | Z test              |
|---------------------|-------------------------|---------------------|
| **Arousal**         | Mdn (musician) = 4, Mdn (control) = 4 | Z = 1.14, p = 0.253 |
| **Valence**         | Mdn (musician) = 1, Mdn (control) = 1 | Z = 0.5, p = 0.62   |
| **Joyful Activation** | Mdn (musician) = 2, Mdn (control) = 2 | Z = 0.74, p = 0.462 |
| **Nostalgia**       | Mdn (musician) = 3, Mdn (control) = 2.5 | Z = 1.33, p = 0.183 |
| **Peacefulness**    | Mdn (musician) = 2, Mdn (control) = 2 | Z = 1.48, p = 0.14  |
| **Power**           | Mdn (musician) = 2, Mdn (control) = 3 | Z = -0.77, p = 0.444|
| **Sadness**         | Mdn (musician) = 1, Mdn (control) = 2 | Z = -1.01, p = 0.315|
| **Tenderness**      | Mdn (musician) = 2, Mdn (control) = 2 | Z = -0.81, p = 0.416|
| **Tension**         | Mdn (musician) = 1, Mdn (control) = 1 | Z = -0.73, p = 0.465|
| **Transcendence**   | Mdn (musician) = 2, Mdn (control) = 2 | Z = 1.52, p = 0.129 |
| **Wonder**          | Mdn (musician) = 3, Mdn (control) = 3 | Z = 0.25, p = 0.799 |
| **Flow**            | Mdn (musician) = 3, Mdn (control) = 3 | Z = 0.32, p = 0.745 |
| **Force**           | Mdn (musician) = 3, Mdn (control) = 3 | Z = -1.2, p = 0.231 |
| **Interior**        | Mdn (musician) = 3, Mdn (control) = 3 | Z = -0.8, p = 0.426 |
| **Movement**        | Mdn (musician) = 3, Mdn (control) = 3 | Z = -1.07, p = 0.284|
| **Wandering**       | Mdn (musician) = 3, Mdn (control) = 3 | Z = 0.6, p = 0.551  |
| **Flow**            | Mdn (high VVIQ) = 3, Mdn (low VVIQ) = 3 | Z = -2.21, p = 0.044|
| **Force**           | Mdn (high VVIQ) = 3, Mdn (low VVIQ) = 3 | Z = -0.41, p = 0.679|
| **Interior**        | Mdn (high VVIQ) = 3, Mdn (low VVIQ) = 2 | Z = -3.25, p = 0.005|
| **Movement**        | Mdn (high VVIQ) = 3, Mdn (low VVIQ) = 3 | Z = -1.63, p = 0.128|
| **Wandering**       | Mdn (high VVIQ) = 3, Mdn (low VVIQ) = 2 | Z = -2.32, p = 0.044|

*Z test for permutations between two groups within our participants pool.*
Online Supplementary Material F

| Scale     | Subscales     | Cronbach Alpha (standardized) |
|-----------|---------------|-------------------------------|
| Entrainment | Agitated      | 0.865                         |
|           | Animated       | 0.91                          |
|           | Beat           | 0.881                         |
|           | Dance          | 0.876                         |
|           | Entrained      | 0.865                         |
|           | Move           | 0.885                         |
|           | Physio         | 0.934                         |
|           | Resonate       | 0.904                         |
|           | Rhythm         | 0.918                         |
| GEMMES    | Flow           | 0.81                          |
|           | Force          | 0.849                         |
|           | Interior       | 0.791                         |
|           | Movement       | 0.875                         |
|           | Wandering      | 0.856                         |
| GEMS      | JoyfulActivation | 0.847                      |
|           | Nostalgia      | 0.793                         |
|           | Peacefulness   | 0.842                         |
|           | Power          | 0.895                         |
|           | Sadness        | 0.842                         |
|           | Tenderness     | 0.838                         |
|           | Tension        | 0.827                         |
|           | Transcendence  | 0.9                           |
|           | Wonder         | 0.858                         |
| VA        | Arousal        | 0.904                         |
|           | Valence        | 0.703                         |

Reliability of each subscale over the excerpts presented to each participant (Cronbach's alpha)
Online Supplementary Material G

To evaluate if the participants accurately labelled the emotionally connoted excerpts we presented, we performed a GLMM using the binary values. A model encompassing the interaction between the labels participants gave and the labels pre-selected by the music expert, and the main effects associated, statistically outperformed the model with only the main effect ($\chi^2 (83, N = 81) = 3069.5, p < 0.001, R^2_m = 0.31, R^2_c = 0.44$, AIC_{GEMS*ExcerptGEMS} = 13019, AIC_{GEMS+ExcerptGEMS} = 15960; BIC_{GEMS*ExcerptGEMS} = 13640, BIC_{GEMS+ExcerptGEMS} = 16102). Participants gave significantly higher ratings for the specific emotion associated with the excerpt presented (Figure A, Tables A, B, C) (Supplementary Material F, G, H).

Figure A. Estimated binary ratings for GEMS based on the attributed affective content of the musical excerpts. The dotted horizontal line at 0.5 symbolizes the chance level of drawing from a binary set. Values are tested to be significantly different from this value. All contrasts are FDR-corrected [*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$]

|                      | Joyful Activation | Nostalgia | Peacefulness | Power | Sadness | Tenderness | Tension | Transcendance | Wonder |
|----------------------|------------------|-----------|--------------|-------|---------|------------|---------|--------------|--------|
| **Joyful Activation**| $\chi^2 = 39.9$, p < 0.001 | $\chi^2 = 60.1$, p < 0.001 | $\chi^2 = 28.3$, p < 0.001 | $\chi^2 = 7.4$, p = 0.009 | $\chi^2 = 66.7$, p < 0.001 | $\chi^2 = 28.4$, p < 0.001 | $\chi^2 = 3.5$, p = 0.077 | $\chi^2 = 36.8$, p < 0.001 | $\chi^2 = 14.2$, p = 0.001 |
| **Nostalgia**        | $\chi^2 = 56.9$, p < 0.001 | $\chi^2 = 13.2$, p = 0.001 | ns     | $\chi^2 = 45.8$, p < 0.001 | ns     | ns         | $\chi^2 = 65.2$, p < 0.001 | $\chi^2 = 14.6$, p = 0.001 | $\chi^2 = 20.8$, p < 0.001 |
| **Peacefulness**     | $\chi^2 = 8.7$, p = 0.006 | $\chi^2 = 0.7$, p = 0.453 | $\chi^2 = 15$, p < 0.001 | $\chi^2 = 65.8$, p < 0.001 | $\chi^2 = 36.3$, p < 0.001 | $\chi^2 = 12.3$, p < 0.001 | $\chi^2 = 59.5$, p < 0.001 | $\chi^2 = 33.6$, p < 0.001 | ns     |

Table A. Contrast between each emotional sub-scale and the chance level (0.5) on each emotion represented by the selected excerpt. A significant difference represents a value above or below 0.5, the chance level in a binomial distribution. All contrasts are FDR-corrected [ns: non-significant]
### Table B. Contrasts between the emotional sub-scale corresponding to the emotion portrayed in the excerpts and all the other subscales for the same excerpts taken together. All contrasts are FDR-corrected.

| Excerpts       | Joyful Activation | Nostalgia | Peacefulness | Power | Sadness | Tenderness | Tension | Transcendence | Wonder |
|----------------|-------------------|-----------|--------------|-------|---------|------------|---------|---------------|--------|
| Joyful Activation | $\chi^2 = 147.4$, | $\chi^2 = 112$, | $\chi^2 = 73.2$, | $\chi^2 = 119.4$, | $\chi^2 = 111.9$, | $\chi^2 = 61.4$, | $\chi^2 = 123.7$, | $\chi^2 = 7.6$, |
| P | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p = 0.008 |
| Nostalgia | $\chi^2 = 103.5$, | $\chi^2 = 12.3$, | $\chi^2 = 92.3$, | $\chi^2 = 6$, | $\chi^2 = 22.7$, | $\chi^2 = 101.9$, | $\chi^2 = 50.6$, | $\chi^2 = 60.3$, |
| P | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 |
| Peacefulness | $\chi^2 = 41.7$, | $\chi^2 = 9.4$, | $\chi^2 = 108.9$, | $\chi^2 = 88.2$, | $\chi^2 = 91$, | $\chi^2 = 81.5$, | $\chi^2 = 15.9$, |
| P | p < 0.001 | p < 0.003 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p = 0.003 |
| Power | $\chi^2 = 143.7$, | $\chi^2 = 119.3$, | $\chi^2 = 152.5$, | $\chi^2 = 100.2$, | $\chi^2 = 122.5$, | $\chi^2 = 32.2$, | $\chi^2 = 47.8$, | $\chi^2 = 130.9$, |
| P | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 |
| Sadness | $\chi^2 = 95.4$, | $\chi^2 = 34.7$, | $\chi^2 = 83.4$, | $\chi^2 = 23.6$, | $\chi^2 = 86.6$, | $\chi^2 = 54.2$, | $\chi^2 = 57.6$, |
| P | p < 0.001 | ns | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 |
| Tenderness | $\chi^2 = 53.9$, | ns | ns | $\chi^2 = 107.1$, | $\chi^2 = 36.2$, | $\chi^2 = 84.4$, | $\chi^2 = 67.1$, | $\chi^2 = 24$, |
| P | ns | ns | ns | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 |
| Tension | $\chi^2 = 74.9$, | $\chi^2 = 114.1$, | $\chi^2 = 125.7$, | ns | $\chi^2 = 129.2$, | $\chi^2 = 130.7$, | $\chi^2 = 74.9$, | $\chi^2 = 85.8$, |
| P | p < 0.001 | p < 0.001 | p < 0.001 | ns | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 |
| Transcendence | $\chi^2 = 4.4$, | ns | ns | $\chi^2 = 4.9$, | $\chi^2 = 6.3$, | $\chi^2 = 7$, | ns | $\chi^2 = 14$, |
| P | p = 0.046 | ns | ns | p = 0.034 | p = 0.015 | p < 0.011 | ns | p < 0.001 |
| Wonder | $\chi^2 = 7.2$, | $\chi^2 = 30.9$, | $\chi^2 = 71.5$, | $\chi^2 = 9.4$, | $\chi^2 = 74.9$, | $\chi^2 = 47.8$, | $\chi^2 = 9.2$, | $\chi^2 = 20.5$, |
| P | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 | p < 0.001 |

### Table C. Contrast between the emotional sub-scale corresponding to the emotion portrayed in the excerpts and each of the other subscales for the same excerpts. All contrasts are FDR-corrected [ns: non-significant]
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| Metaphor         | Flow          | Force         | Interior       | Movement       | Wandering     |
|-----------------|---------------|---------------|----------------|----------------|---------------|
| Joyful Activation | $\chi^2 = 7.3, p = 0.012$ | ns            | $\chi^2 = 23, p < 0.001$ | $\chi^2 = 15.4, p < 0.001$ | ns            |
| Nostalgia       | ns            | $\chi^2 = 20.1, p < 0.001$ | ns            | $\chi^2 = 12, p = 0.001$ | $\chi^2 = 14.9, p < 0.001$ |
| Peacefulness    | $\chi^2 = 15.4, p < 0.001$ | $\chi^2 = 36.1, p < 0.001$ | ns            | $\chi^2 = 14.9, p < 0.001$ | ns            |
| Power           | $\chi^2 = 30.1, p < 0.001$ | $\chi^2 = 40.9, p < 0.001$ | ns            | ns             | $\chi^2 = 6.7, p = 0.016$ |
| Sadness         | ns            | $\chi^2 = 17.6, p < 0.001$ | $\chi^2 = 7.1, p = 0.013$ | $\chi^2 = 25.5, p < 0.001$ | $\chi^2 = 12.9, p < 0.001$ |
| Tenderness      | $\chi^2 = 15.4, p < 0.001$ | $\chi^2 = 16.5, p < 0.001$ | ns            | $\chi^2 = 7.3, p = 0.012$ | $\chi^2 = 3.9, p = 0.071$ |
| Tension         | $\chi^2 = 28.6, p < 0.001$ | $\chi^2 = 22.9, p < 0.001$ | $\chi^2 = 10.1, p = 0.003$ | $\chi^2 = 20.8, p < 0.001$ | ns            |
| Transcendence   | $\chi^2 = 10.5, p = 0.002$ | ns            | ns             | ns             | ns            |
| Wonder          | $\chi^2 = 4.6, p = 0.05$ | $\chi^2 = 22.7, p < 0.001$ | $\chi^2 = 23.9, p < 0.001$ | $\chi^2 = 33.5, p < 0.001$ | $\chi^2 = 6, p = 0.023$ |

Contrast between each metaphor sub-scale and the chance level (0.5) on each emotion represented by the selected excerpt. A significant difference represents a value above or below 0.5, the chance level in a binomial distribution. All contrasts are FDR-corrected [ns: non-significant];
Chi-squared test comparing each model estimating the binomial value of the GEMMES scale when looking at each item of the other scales. The first model comprises the interaction between a subscale and the metaphor scale, in order to predict the metaphors’ values. The second model only contains the main effect and no interaction. All contrasts are FDR-corrected.
Contrast between the high and low values excerpts on a specific subscale to predict each metaphor subscales. A significant difference represents a different in the metaphor values between excerpts that are labelled as high in one condition and low in the same condition. All contrasts are FDR-corrected [ns: non-significant, *: p < 0.05, **: p < 0.01, ***: p < 0.001]

| Metaphor       | Flow    | Force      | Interior   | Movement | Wandering   |
|---------------|---------|------------|------------|----------|-------------|
| Acous_PC1     | ns      | $\chi^2 = 6.5, p = 0.016$ | ns         | ns       | ns          |
| Acous_PC2     | ns      | $\chi^2 = 61.4, p < 0.001$ | ns         | $\chi^2 = 23.4, p < 0.001$ | $\chi^2 = 10.4, p = 0.002$ |
| Embrace_PC1   | $\chi^2 = 48.7, p < 0.001$ | $\chi^2 = 131.5, p < 0.001$ | $\chi^2 = 57.5, p < 0.001$ | $\chi^2 = 180.1, p < 0.001$ | $\chi^2 = 36.7, p < 0.001$ |
| Embrace_PC2   | $\chi^2 = 14.6, p < 0.001$ | ns         | $\chi^2 = 9.2, p = 0.004$ | ns         | ns          |
| Midlev_PC1    | $\chi^2 = 15.5, p < 0.001$ | $\chi^2 = 13, p < 0.001$ | $\chi^2 = 42, p < 0.001$ | $\chi^2 = 45.8, p < 0.001$ | $\chi^2 = 12.1, p < 0.001$ |
| Midlev_PC2    | $\chi^2 = 15.5, p < 0.001$ | ns         | $\chi^2 = 42, p < 0.001$ | ns         | ns          |
| JoyfulActivation | ns      | $\chi^2 = 23.5, p < 0.001$ | $\chi^2 = 18.4, p < 0.001$ | $\chi^2 = 65.3, p < 0.001$ | $\chi^2 = 22.2, p < 0.001$ |
| Nostalgia     | $\chi^2 = 13.8, p < 0.001$ | $\chi^2 = 25.9, p < 0.001$ | $\chi^2 = 51.6, p < 0.001$ | $\chi^2 = 19.9, p < 0.001$ | ns          |
| Peacefulness  | $\chi^2 = 13.3, p < 0.001$ | $\chi^2 = 57.3, p < 0.001$ | $\chi^2 = 17.1, p < 0.001$ | $\chi^2 = 54.9, p < 0.001$ | $\chi^2 = 6.6, p = 0.015$ |
| Power         | $\chi^2 = 13.8, p < 0.001$ | $\chi^2 = 130.6, p < 0.001$ | $\chi^2 = 17.8, p < 0.001$ | $\chi^2 = 64.9, p < 0.001$ | $\chi^2 = 11.7, p = 0.001$ |
| Sadness       | ns       | $\chi^2 = 13.8, p < 0.001$ | $\chi^2 = 25.9, p < 0.001$ | $\chi^2 = 51.6, p < 0.001$ | $\chi^2 = 19.9, p < 0.001$ |
| Tenderness    | $\chi^2 = 31.9, p < 0.001$ | $\chi^2 = 49.4, p < 0.001$ | $\chi^2 = 8.4, p = 0.066$ | $\chi^2 = 19.9, p < 0.001$ | ns          |
| Tension       | ns       | $\chi^2 = 13.9, p < 0.001$ | $\chi^2 = 30.3, p < 0.001$ | $\chi^2 = 23.2, p < 0.001$ | ns          |
| Transcendence | $\chi^2 = 16, p < 0.001$ | $\chi^2 = 35.6, p < 0.001$ | $\chi^2 = 6.6, p = 0.015$ | $\chi^2 = 4.8, p = 0.04$ | $\chi^2 = 8.6, p = 0.04$ |
| Wonder        | ns       | ns         | $\chi^2 = 13.9, p < 0.001$ | $\chi^2 = 30.3, p < 0.001$ | $\chi^2 = 23.2, p < 0.001$ |
| Arousal       | $\chi^2 = 37.8, p < 0.001$ | $\chi^2 = 147.8, p < 0.001$ | $\chi^2 = 23.8, p < 0.001$ | $\chi^2 = 59.6, p < 0.001$ | $\chi^2 = 9.6, p = 0.003$ |
| Valence       | ns       | ns         | $\chi^2 = 15.3, p < 0.001$ | $\chi^2 = 59.7, p < 0.001$ | $\chi^2 = 28.9, p < 0.001$ |
Because every musical metaphor could be characterized by a multitude of different descriptors, ranging from emotions to acoustic and perceptual features, we decided to perform a multi regression with best subset selection to highlight a reduced number of suitable descriptors. A regression with this subset of descriptors should reasonably fit the binomial value for each metaphor. More importantly, the addition of any other descriptors should not improve the fit by a large margin. While running the multi regression analysis, we extracted the Akaike Information Criterion (AIC) for every set of descriptors, starting with one only regressor to finishing with all the regressors in the model. Across all metaphor regressions, adding more than five regressors did not seem to improve the model by a large margin (Figure A). In addition, we observed that the metaphors "Force" and "Movement" were associated with a better fit with the descriptors present in this study than "Flow," "Interior," and "Wandering". Consequently, we looked for the best subset of five regressors to fit each metaphor. While most of the five regressors for each metaphor had a statistically significant impact, some regressors showed a greater weight, meaning that each variation in this parameter resulted in a greater variation in the metaphor itself. To elaborate, we mainly report positive association between "Force" and "Power," "Arousal," and entrainment (Table A). "Movement" was positively with entrainment. "Flow" was positively associated with "Joyful activation", and negatively associated with entrainment. "Interior" was negatively associated with entrainment. Finally, the weights associated with "Wonder" were negative for "Tension" and positive for entrainment.

A potential issue with using multiple regressors to describe metaphors lies in multicollinearities. Some of the descriptors might be strongly correlated and therefore might explain the same part of the variance in our models. To explore that, we decided to compute the individual variance ($R^2$), the variance inflation factors (VIF), and the correlation matrix. First, not all regressors explains the same amount of variance. Some might explain more of the variance of a certain model when taken individually. For example, the variance associated with the metaphor "Force" is better explained by "Power" ($R^2 = 0.251$), arousal ($R^2 = 0.282$), and entrainment PC1 ($R^2 = 0.191$) than "Wonder" ($R^2 = 0.005$) despite all of these regressors being in the best subset (Table B). "Movement" is best explained by entrainment PC1 ($R^2 = 0.259$). Second, not all regressors share the variance explained. The variance inflation factor shows which regressor is linked with others, with values approaching 1 when the regressor is independent of other regressors. In our data, some were characterizing the same variance. It is the case, for example, for "Tenderness" and "Nostalgia" in the "Movement" model, with very high VIF (respectively 22.08 and 22.19). "Joyful activation" and entrainment PC1 seemed to be sharing a part of the variance, with VIF = 3.48 and 4.45 respectively.
Figures A, B, C, D, E, F. **Multi regression using best subset selection.** 

A. Evolution of Akaike Information Criterion associated with models with increasing subset sizes. 

B. Weights associated with the best subset of regressors to estimate the binomial value of the metaphor "Wandering". 

C. Weights associated with the best subset of regressors to estimate the binomial value of the metaphor "Interior". 

D. Weights associated with the best subset of regressors to estimate the binomial value of the metaphor "Flow". 

E. Weights associated with the best subset of regressors to estimate the binomial value of the metaphor "Movement". 

F. Weights associated with the best subset of regressors to estimate the binomial value of the metaphor "Force". The faded bar represents the intercept present in every regression. [ns: non-significant, *: p < 0.05, **: p < 0.01, ***: p < 0.001]
| Metaphor | Regressor      | Estimate | Statistique |
|----------|---------------|----------|-------------|
| Flow     | (Intercept)   | 0.454    | $z = 1.674, p = 0.094$ |
|          | JoyfulActivation | 2.26     | $z = 9.482, p < 0.001$ |
|          | Nostalgia     | 1.326    | $z = 7.598, p < 0.001$ |
|          | Peacefulness  | 0.768    | $z = 4.615, p < 0.001$ |
|          | Acous. PC2    | -1.48    | $z = -6.586, p < 0.001$ |
|          | Entrain. PC1  | -1.855   | $z = -7.293, p < 0.001$ |
| Force    | (Intercept)   | -0.519   | $z = -1.38, p = 0.168$ |
|          | Power         | 1.252    | $z = 5.498, p < 0.001$ |
|          | Wonder        | -0.705   | $z = -3.462, p < 0.001$ |
|          | Arousal       | 1.335    | $z = 6.16, p < 0.001$ |
|          | Acous. PC2    | -0.778   | $z = -2.175, p = 0.03$  |
|          | Entrain. PC1  | 1.046    | $z = 4.834, p < 0.001$  |
| Interior | (Intercept)   | 1.275    | $z = 5.552, p < 0.001$  |
|          | Tension       | -0.328   | $z = -1.661, p = 0.097$ |
|          | Transcendence | -0.33    | $z = -2.428, p = 0.015$ |
|          | Acous. PC2    | -0.646   | $z = -2.978, p = 0.003$ |
|          | Entrain. PC1  | -0.975   | $z = -4.893, p < 0.001$ |
|          | Percept. PC2  | -0.806   | $z = -5.856, p < 0.001$ |
| Movement | (Intercept)   | -2.068   | $z = -9.787, p < 0.001$ |
|          | Nostalgia     | -1.178   | $z = -1.884, p = 0.06$  |
|          | Tenderness    | 2.031    | $z = 3.34, p < 0.001$   |
|          | Tension       | 0.822    | $z = 3.908, p < 0.001$  |
|          | Valence       | 0.36     | $z = 2.097, p = 0.036$  |
|          | Entrain. PC1  | 2.586    | $z = 10.369, p < 0.001$ |
| Wandering| (Intercept)   | -1.093   | $z = -9.577, p < 0.001$ |
|          | Tension       | -0.302   | $z = -1.754, p = 0.079$ |
|          | Valence       | 0.776    | $z = 5.748, p < 0.001$  |
|          | Acous. PC1    | -0.321   | $z = -2.744, p = 0.006$ |
|          | Entrain. PC1  | 1.065    | $z = 6.372, p < 0.001$  |

Table A. Coefficient estimates and significant level when compared to zero for each regression with best subset. [ns: non-significant, *: p < 0.05, **: p < 0.01, ***: p < 0.001]
| Model     | Condition          | $R^2$ | Variance inflation factors |
|-----------|--------------------|-------|----------------------------|
| Flow      | Joyful activation  | 0.006 | 3.48                       |
| Entrainment PC1 |  | 0.072 | 4.45                       |
| Acoustic PC2  |  | 0.001 | 1.33                       |
| Nostalgia   |  | 0.068 | 2.16                       |
| Peacefulness|  | 0.082 | 1.87                       |
| Force      | Arousal            | 0.251 | 2.22                       |
|            | Power              | 0.282 | 2.38                       |
| Entrainment PC1 |  | 0.191 | 2.43                       |
| Acoustic PC2  |  | 0.089 | 1.14                       |
| Wonder      |  | 0.005 | 2.07                       |
| Interior    | Entrainment PC1    | 0.085 | 2.79                       |
| Perceptual PC2 |  | 0.085 | 1.34                       |
| Acoustic PC2  |  | 0.001 | 1.42                       |
| Tension     |  | 0.063 | 2.02                       |
| Transcendence|  | 0.013 | 1.04                       |
| Movement    | Entrainment PC1    | 0.259 | 3.49                       |
| Tenderness  |  | 0.04  | 21.08                      |
| Nostalgia   |  | 0.081 | 22.19                      |
| Tension     |  | 0.149 | 1.85                       |
| Valence     |  | 0.078 | 1.31                       |
| Wandering   | Entrainment PC1    | 0.055 | 2.2                        |
| Valence     |  | 0.045 | 1.17                       |
| Acoustic PC1  |  | 0.003 | 1.02                       |
| Tension     |  | 0.013 | 2                          |

Table B. Multicollinearities in form of variance inflation factors and variances explained in term of $R^2$ for each regressor in each regression with best subset.
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| Cluster | Distance | Silhouette |
|---------|----------|------------|
| 2       | 14.02    | 0.55       |
| 3       | 9.8      | 0.51       |
| 4       | 7.8      | 0.47       |
| 5       | 6.23     | 0.53       |
| 6       | 4.94     | 0.52       |

Computed mean distance between the barycenter of each cluster and the constituent items as well as mean silhouette value for each cluster. The cluster analysis conducted was K-mean with city block.
Online Supplementary Material M

The prevalence of zero ratings in our dataset can be explained by multiple reasons. The first one is associated with the way the scales are designed. While being continuous scales, both GEMS and GEMMES feel like categorical scales. Even if music is capable of eliciting mixed emotions (Juslin et al., 2011), participants, in our study, tend to choose very few or even sometimes only one category to represent one musical piece. This kind of behavior was already observed in the study leading to the creation of the GEMMES (Schaerlaeken et al., 2019). The way both GEMMES and GEMS were created, by allowing rotation in the confirmatory factorial analysis, resulted in maximizing the discrimination between the different factors (Schaerlaeken et al., 2019; Zentner et al., 2008). The more discriminable the items in a scale, the more zeros we found in the participants responses on the not relevant subscales. It reflects that participants favour some descriptive patterns over others. In contrary, valence and arousal are seen as dimensions and not categories (Russell, 1980), consequently, they invite the participants to rate both independently. Furthermore, the presence of zeros in our dataset might reflect the ineffability of music in general. It has been argued that participants sometimes "lack the necessary vocabulary to provide accurate verbalizations of their emotional experience" (Zentner and Eerola (2010), p. 193)). People also tend to categorize their subjective experience rather than representing them in a more complex mixed feeling. Evaluating the emotional content of one entire excerpt at once rather than dynamically over the course of the piece may also bias the listener's judgment. Actually, it has been shown that this integration process changes a lot the reported emotions compared to dynamic judgments for the same excerpts (Eliard, 2017). Furthermore, some subscales are used less frequently than others (e.g. "Transcendence" and "Wonder"), as they lead to more zeros in the data collected (Aljanaki, Wiering, & Veltkamp, 2016). This might be related to the fact that people are less used to represent these categories, or that these categories are ill-defined, or that these categories are more rarely induced than others.

References Online Supplementary Material L

Juslin, P. N., Liljestrom, S., Laukka, P., Vastfjall, D., & Lundqvist, L.-O. (2011). Emotional reactions to music in a nationally representative sample of Swedish adults: Prevalence and causal influences. *Musicae Scientiae, 15*(2), 174–207.

Schaerlaeken, S., Glowinski, D., Rappaz, M.-A., & Grandjean, D. (2019). "hearing music as...": Metaphors evoked by the sound of classical music. *Psychomusicology: Music, Mind, and Brain, 29*(2-3), 100.

Zentner, M., Grandjean, D., & Scherer, K. R. (2008, aug). Emotions evoked by the sound of music: characterization, classification, and measurement. *Emotion (Washington, D.C.), 8*(4), 494–521.

Russell, J. A. (1980). A circumplex model of aect. *Journal of personality and social psychology, 39*(6), 1161.

Zentner, M., & Eerola, T. (2010). Self-report measures and models. *Handbook of music and emotion, 187–221.*

Eliard, K. (2017). *Dynamiques temporelles des emotions exprimees par la musique* (Unpublished doctoral dissertation). University of Geneva.

Aljanaki, A., Wiering, F., & Veltkamp, R. C. (2016). Studying emotion induced by music through a crowdsourcing game. *Information Processing & Management, 52*(1), 115–128.