Music tonality emotions in Brazilian musical-theory naïve individuals

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Abstract

It is elusive if musical-theory naïve individuals have the same emotional perception as professionals. This study aims to investigate emotions associated with music keys. We asked 40 musical-theory naïve individuals to label keys. Positive, negative, and neutral emotions were referred by 45, 20, and 34% of the participants for major keys, and 20, 45, and 34% of the participants for minor keys. There was no correlation between key signature and emotion. Our study showed that music naïve individuals: associated major keys to positive emotions and minor keys to negative emotions in less than half the time associated neutral emotions to one-third of the tonalities; minor keys tended to correlate with the number of accidentals in the key signature.

Keywords: music tonality, emotion, minor scales, major scales

Emoções associadas à tonalidade musical em indivíduos brasileiros leigos em teoria musical

Resumo

É incerto se indivíduos leigos em teoria musical têm a mesma percepção que profissionais. Este estudo visa investigar emoções associadas às tonalidades. Solicitamos a 40 indivíduos leigos em teoria musical que adjetivassem às tonalidades. Emoções positivas, negativas e neutras foram referidas por 45, 20 e 34% dos participantes para tons maiores e 20, 45 e 34% para tons menores. Não houve correlação entre os tons maiores e menores e emoções. Nosso estudo mostrou que indivíduos leigos em música associaram tons maiores à emoções positivas e tons menores à emoções negativas em menos de 50% das vezes e associaram emoções neutras em um terço das tonalidades. Tons menores tenderam a correlacionar com o número de acidentes de clave.

Palavras-chave: tonalidade musical, emoção, escalas menores, escalas maiores

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Introduction

The appropriate choice of music tonality may be translated into a particular emotion the composer desires to transmit to the audience. Thus, a minor key makes the piece sound serious or melancholic (Kamien, 2008). More than that, specific tonalities may have their mood. C major has been associated with pomp or festivity, e.g. (Landon, 1955). These affirmations are true for composers and music theorists or connoisseurs. Still, the target audience of a piece may be non-experts in music most of the time, especially in the current era. It is elusive if musical-theory naïve individuals have the same emotional perception of music tonality in modern times.

This study investigates emotions associated with Western music keys in musical-theory naïve individuals.

Methods

We invited 40 musical-theory naïve individuals (22 (55%) females, mean age 40 (range 23-79) years) chosen among personal network individuals as a convenience sample to participate in the study. Those with formal musical education or who played a musical instrument or sang were excluded. Concertgoers or those with basic music learning during early childhood or primary education were allowed to participate.

After agreeing to participate, individuals were sent samples of the 24 Western music keys (12 majors, 12 minors) electronically via email. They were asked to label each tone with an adjective or sentence. They were allowed to change their opinion before returning the results, complete the test consecutively or interrupted, and repeat adjectives if necessary. The sequence of samples was randomized, and a number was assigned to each key to keep participants blind to the tonality. Samples consisted of a 4-note scale with 1 second of duration followed by a 4-note chord (tetrad) with 4 seconds of duration. Samples started on the dominant note in the middle octave (C4 to B4), and the sound was produced by an electronic organ (Roland Classic C-330) tuned on A = 440 Hz and equal temperament using Principal 8´ as registration.

Tonalities adjectives were grouped as positive, negative, or neutral emotions. Places or situations were classified as neutral since they may bring different emotions to different individuals.

The Mann-Whitney test was used to compare groups, and the Person test was used to correlate variables. p<0.05 was considered statistically significant.

Results

Three (7.5%) individuals (3 females, aged 32-79) could not differentiate the samples. They were excluded from further analysis, leaving 37 active participants.

Tonalities adjectives are shown in tables 1 and 2. Positive, negative, and neutral emotions were referred by 45, 20, and 34% of the participants for major keys. For minor keys, positive, negative, and neutral emotions were referred to by 20, 45, and 34% of the participants, respectively. Positive emotions were significantly more referred for major keys and negative emotions to minor keys (p<0.001). Neutral emotions were similar for both major and minor keys (p=1).

There was no correlation between the number of accidentals for the key signature and the type of emotion for major keys (positive p=0.6, negative p=0.3, neutral p=0.1). There was no correlation between the number of accidentals for the key signature and the type of emotion for minor keys regarding positive (p=0.4) and neutral (p=0.3) emotions. There was a weak correlation for negative emotions (p=0.056).

Discussion

We agree with Muyuan et al. that the expression of emotion is one of music's most charming and magical characters (Muyuan et al., 2004). There is a renewed interest in music and emotion. Some studies have been published, most with a psychological analysis (Swaminathan et al., 2015), but not many with a musical emphasis (Parncutt, 2012). We decided to focus on musical findings and adopt a carefully planned methodology. We opted to study naïve individuals since they may constitute much of the audience for music nowadays, and we believe that musicians may bring previous memories from specific pieces linked to their tonality. For the same reason and since other variables are involved, such as tempo, familiarity, etc., we did not use complete pieces or excerpts. Emotions were described based on free choice of descriptive terms, as others (Gabrielsson et al., 2010), but different from some that grouped possible answers (Balkwill et al., 1999). Several models exist to group emotions (Muyuan et al., 2004) and elegant and complicated mathematical models (Muyuan et al., 2004). We believe that a free choice of terms brings less bias or persuasion and allows us to create a reference table with a myriad of answers.

Music may provoke different emotions based on several music factors, such as mode, tempo, rhythm, harmony, melody, and pitch (Gabrielsson et al., 2010). Socially, cultural, temporal, and regional background are certainly important aspects. In our results, the cultural, temporal, and regional background was clearly manifest in neutral emotions. In most cases, it represented places or situations that were not real

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Table 1
Emotions prompted by Major tonalities in 37 music-naïve individuals.

KEY	POSITIVE EMOTION	NEGATIVE EMOTION	NEUTRAL
CM	18 (49%) happiness (x3), cheerfulness (x3), hope (x2), novelty (x2), serenity (x2), elation, perfection, trust, assertive, romance, pomp	9 (24%) stressing (x2), funeral (x2), unpleasant (x2), discouraging, boredom, sluggishness	10 (27%) Seriousness (x2), formality (x2), no emotion (x2), end of an act, religious, videogame opening, past
DM	18 (49%) happiness (x7), Triumph (x2), serenity, funny, pleasant, surprise, pompous arrival, motivating, welcoming, party, good news	4 (11%) stressing, sad, unpleasant, contrition	15 (40%) religious (x3), wedding (x3), the beginning of a show (x2), wakening, informal, readiness, alarm clock, solemnity, attention, no emotion
DbM	10 (27%) serenity (x3), romantic (x3), relaxing (x2), happiness, good	11 (30%) sad (x4), sad end, sleepy, discouraging, scaring, disconsolate, laziness, strange	16 (43%) attention (x3), no emotion (x2), royal, nostalgic, reflection, beginning, religious, daily life, drama, the beginning of a game, formal, celebration, wedding
EM	23 (62%) happiness (x6), serenity (x3), assuredness, playing, happiness, braveness, cheerfulness, affection, wisdom, loveable, enthusiasm, cute, pleasant, nice, action, surprise	3 (8%) suspense, annoying, funeral	11 (30%) speediness (x3), wedding (x3), end (x2), pop, wakening, nostalgia
EbM	21 (57%) happiness (x6), enthusiasm (x2), serenity (x2), playful, cheerfulness, affection, wisdom, loveable, funny, cute, pleasant, light, nice, surprise	4 (11%) suspense, angry, annoying, funereal	12 (32%) speediness (x4), wedding (x3), end (x2), pop, wakening, nostalgia
FM	11 (30%) reassuring (x2), surprise (x2), strong, good, hope, happiness, welcoming, like it, peace	14 (38%)	12 (32%) religious (x3), no emotion (x3), end (x3), speediness, childish, beginning,
F♯M	12 (32%) happiness (x4), serenity (x2), patience, trust, discovery, comfort, loveable, enthusiasm	7 (19%) Funeral (x2), frustration, laziness, uninteresting, boring, reprimand	18 (49%) no emotion (x3), nostalgia (x3), formal (x2), melancholic, introspective, end, show, speediness, king crowning, attention, reality, dance, beach
GM	15 (40%) happiness (x7), Action (x2), triumph, good, motivating, relaxing, thankfulness, peace	6 (16%) stress, annoying, fear, command, dislike, disagreement	16 (43%) speediness (x2), alert (x2), lyric, end, urbanity, attention, anthem, beginning, familiarity, wedding, party, let me through, announcement, religious
AM	21 (57%) happiness (x9), enthusiasm (x2), cheerful (x2), gentle, triumph, dynamic, serenity, relief, calm, affirmative, conquest	5 (13%) anxiety (x2), sad (x2), confusion	11 (30%) no emotion (x4), childish (x3), beginning (x2), religious, announcement
AbM	21 (57%) serenity (x7), happiness (x6), thoughtful (x2), tenderness, intense, resting, loveable, enthusiasm, intense	7 (19%) enough, arrogance, annoying, confusing, suspense, insistent, laziness	9 (24%) reminder, attention, game, treble, end, fairy tale, religious, purpose, nostalgia
BM	17 (46%) happiness (x9), excitement (x3), reassuring (x2), respect, surprise, soft	8 (22%) annoying (x2), anxiety (x2), funeral, stress, sad, detachment	12 (32%) speediness (x2), wakening, party, change, anthem, end, play, announcement, Sunday, wedding, nostalgia
BbM	14 (38%) Serenity (x2), happiness (x2), humorous, gallantry, friendship, accomplishment, surprise, awarding, loveable, enthusiasm, success, conquest	14 (38%) funereal (x2), doubt (x2), sad (x2), cold (x2), impatience, suspense, anxiety, uncertainty, agony, despair	9 (24%) speediness (x3), end (x3), speediness, amusement park, drama
Average	45%	20%	34%

emotions but the emotions that these situations probably brought to the individual. Curiously, religion (church, sacred) was present in half the tones, and the sounds of video games were common.

Tonality is certainly associated with different emotions. Emotional responses to the atonal pieces are lower than those for the tonal piece

Table 2

Emotions prompted by Minor tonalities in 37 music-naïve individuals.

KEY	POSITIVE EMOTION	NEGATIVE EMOTION	NEUTRAL
Cm	7 (19%) reassuring (x2), peace, serenity, love, funny, happiness	17 (46%) sad (x5), funereal (x3), melancholic (x3), annoying, pain, suspense, sorrow, anger, loneliness	13 (35%) farewell (x2), religious (x2), alert, something hidden, introspection, classic, call, dream, formal, no emotion
C#m	5 (13%) loveable (x2), serenity, exciting, evocative	24 (65%) sad (x8), funereal (x6), sluggishness (x2), suspense (x2), heavy (x2), opaque, annoying, fear, uncertainty	8 (22%) announcement (x2), formal (x2), nostalgic (x2), commotion, dinner for two
Dm	4 (11%) loveable (x2), serenity, polite	16 (43%) funereal (x6), sad (x4), haunted, scaring, dark, hesitation, suspense, heavy	17 (46%) formal (x5), thoughtful (x2), taciturn (x2), announcement (x2), drama (x2), respectful, end, pomp, no emotion,
Em	8 (22%) new idea, discovery, happiness, motivation, romantic, enthusiasm, evocative, hope	14 (38%) sad (x3), anxious (x2), enclosure, petulant, funereal, imposition, mystery, sleepy, apathy, boring, danger	15 (40%) speediness (x6), beginning (x2), nostalgic, formal, normal, announcement, theater, no emotion, alert
Ebm	5 (13%) pompous, harmonic, happiness, deep, serenity	17 (46%) funereal (x5), sad (x3), doubt (x2), solitude (x2), terror, rude, mystery, darkness, discomfort	15 (40%) formal (x4), religious (x3), announcement (x2), drama (x2), end, muffled, normal, melancholic
Fm	18 (49%) happiness (x6), surprise (x3), cozy (x2), hope, attitude, serenity, emphatic, exciting, loveable, enthusiasm	13 (35%) funereal (x2), anger (x2), suspicious, indignation, melancholic, dark, choleric, tragedy, asking for help, unhappy, sad	6 (16%) speediness, normal, nostalgic, expectancy, professional, introspection
F#m	7 (19%) serenity (x3), romantic, sensitivity, hope, rebirth	21 (57%) sad (x6), funereal (x4), suspense (x3), fear (x2), weakness, worry, terror, laziness, pessimism, heavy	9 (24%) royal (x2), curious, civility, attention, party, religious, park, no emotion
Gm	11 (30%) happiness (x2), victory, cheerful, high. action, affectionate, cozy, loveable, enthusiasm, good news	10 (27%) boring (x2), mystery (x2), melancholia (x2), suspense, frustrating, annoying, fear	16 (43%) beginning (x2), speediness (x2), no emotion (x2), expectancy (x2), formal, game, questioning, alert, party, religious, end, nostalgic
Am	9 (24%) happiness (x3), soft (x2), exciting, surprise, cheerful, funny	13 (35%) suspense (x4), melancholic (x2), annoying (x2), funereal, boring, sad, bad thing, fear	15 (40%) announcement (x4), attention (x4), drama (x2), religious (x2), nostalgia, edict, no emotion
Abm	7 (19%) happiness, serenity, worship, loveable, enthusiasm, thoughtful, success	17 (46%) sad (x4), annoying (x3), funereal (x2), anguish (x2), insistence, regret, fear, noisy, suspense, sinister	13 (35%) drama (x3), wakening, party, slow, future, classical, end, solemnity, urgency, formal, nostalgia
Bm	7 (19%) happiness (x3), good, reassuring, elevation, victory	16 (43%) terror (x3), boring (x3), funereal (x2), mystery (x2), suspense (x2), annoying, heavy, ghastly, despair,	14 (38%) announcement (x2), festival (x2), attention (x2), speediness, end, emphasis, novelty, drama, wakening, feminine, game
Bbm	4 (11%) loveable (x2), intense, delicate	25 (68%) sad (x6), suspense (x3), anguish (x2), terror (x2), mysterious (x2), funeral, threat, mistake, caution, failure, anger, indecision, expulsion, fear, sleepy	8 (22%) no emotion (x2), announcement (x2), attention, childish, sober, arriving
Average	**20%**	**45%**	**34%**

(Daynes, 2011). Our results show a myriad of emotions prompted by different tonalities. There is not among music-naive individuals the same perception or consistency found among musicians (table 3). These

findings may be related to the temporal understanding of music and lack of general knowledge of music theory. Tonality may also be used with more or less emphasis according to the period. In *musica antica*, e.g., sections within the same piece could have different tonalities; not all keys were used before equal tuning was widespread; the tone was not defined in the key signature but signaled by accidentals throughout the manuscript; transcriptions to other keys were common; and modulation was common and almost mandatory in fugues. Furthermore, the same theme, such as a prelude chorale that should transmit the same emotion, is found in different keys by the same composer.

Table 3
Emotions prompted tonalities, according to music literature.

Major keys	
CM	Pure, innocence, simplicity, naïvety, children's talk, gay, warlike, certain, decisive, powerful resolve, manly earnestness, deep religious feeling, cheerful, state of nature, virginal chastity, lovely innocence of youth, naturalness, nobility, simplicity, unadorned
DM	Triumph, halleluiahs, war-cries, victory-rejoicing, inviting symphonies, marches, holiday songs, heaven-rejoicing choruses, joyous, very warlike, gay things, grandeur, joyful, very militant, pleasant, bright, grandeur, magnificence, martial ardor
DbM	Unusual characters and feelings, leering, degenerating into grief, rapture, smile, grimace, fullness of tone, sonority, euphony
EM	Noisy shouts of joy, laughing, pleasure, full delight lies, quarrelsome, boisterous, magnificence, splendor, brightest, power, uplifting, bright
EbM	Love, devotion, intimate conversation with God, cruel, hard
FM	Complaisance, calm, furious, and quick-tempered subjects, peace, joy, light, passing regret, religious sentiment
F#M	Brilliant, very clear, triumph over difficulty, a sigh of relief, an echo of a soul, softness, richness
GM	Rustic, idyllic, lyrical, calm and satisfied passion, tender gratitude, kindness, peace, serious, magnificent
AM	Innocent love, satisfaction, state of affair, hope, youthful cheerfulness, trust in God, joyful, pastoral
AbM	Grave, death, putrefaction, judgment
BM	Strongly colored, announcing wild passions, anger, rage, jealousy, fury, despair, harsh, plaintive
BbM	Cheerful love, clear conscience, hope, aspiration for a better world, magnificent, joyful
Minor keys	
Cm	Declaration of love, lament, languishing, longing, sighing of the love-sick soul, obscure, sad
C#m	Penitential, lamentation, intimate conversation with God, despair
Dm	Melancholy, serious, pious
D#m	Anxiety, deepest distress, brooding despair, blackest depression, fear, hesitation, ghosts speaking
Em	Effeminate, amorous, plaintive, obscure, plaintive, grief, mournfulness, restlessness
Fm	Depression, funereal lament, groans of misery, grave, harrowing, melancholy
F#m	Passion, resentment, discontent, horrible, frightful, anxiety, distress, despair, depression, gloomy soul, fear, hesitation, ghosts speaking
Gm	Discontent, uneasiness, worry, resentment, dislike, serious, magnificent
Am	Pious womanliness, tenderness, plaintive
Abm	Grumbler, suffocation, lament, struggle
Bm	Patience, calm, awaiting, solitary, melancholic
Bbm	Night, unpleasant, mock, discontent, suicide, obscure, terrible, gloomy, mournful

They are compiled from historical sources (Rousseau, 1691; Masson, 1697; Charpentier, 1692; Rameau, 1722; Hawkins, 1776; Junker, 1777; Schubart, 1784, Knecht, 1792; Heinse, 1795; Gervasoni, 1812; Weikert, 1827) by Christian Schubart's Ideen zu einer Aesthetik der Tonkunst (1806) Translated by Rita Steblin in A History of Key Characteristics in the 18th and Early 19th Centuries. UMI Research Press (1983) and Charpentier´s Regles de Composition ca. 1682.

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Curiously, 7% of the individuals we queried allegedly could not differentiate the sounds. Some individuals may suffer from amusia – when individuals present with a pathological disorder of music memory and recognition. All three individuals certainly do not live with this condition. Although they were not objectively tested, they are part of the social network of the researchers. We hypothesize that this finding may be linked to the contemporary lack of exposure to music theory and classical music since modern music emphasizes rhythm over harmony. Another possible explanation is the lack of patience and focus that reigns among the current generation and contaminates previous ones since the study involved focused and long tasks.

Major versus minor keys

Major keys are generally associated with positive emotions (happiness, contentment, serenity, grace, tenderness, elation, joy, victory, majesty, etc.), and minor with negative emotions (sadness, anger, fear, tension, solemnity, lament, tragedy…) (Parncutt, 2012). Also, "the minor mode is not only associated with intense feeling in general but with the delineation of sadness, suffering, and anguish in particular" (Meyer, 1956). There are some complex hypotheses to explain this division, from the higher frequency of pieces in major keys in Western music to interval treatment by composers (Parncutt, 2012; Huron, 2008). This may apply, however, to whole or fragmental pieces, not to chords or scales as in our study. In our results, there was a significant proportion of positive emotions to major keys and negative to minor keys. However, although a mathematical difference was found, many individuals still referred in the opposite direction. Once more, music does not generate consensual emotions.

Emotions and key signature

It has been said that "every additional sharp in the key signature is supposed to add to the brightness and sparkle of the music, while every flat contributes softness, pensiveness, and even melancholy" (von Helmholtz, 1912). We investigated if the increase in the number of accidentals in the key signature moves the tonalities towards a specific class of emotions. This is certainly not true for major keys in our population. Regarding minor keys, our results showed a tendency for correlation that did not reach statistical significance. This may be factual due to the not large number of participants. Anyway, modulation adding or diminishing a few accidentals (such as the circle of 5ths) will not significantly change major emotion.

Study limitations

The number of participants is small (37 active). Still, the within-subjects design maximizes the power of the study to detect statistically significant differences in judgments made about major/minor valences and between specific key centers. We also did not compare music-naïve individuals with professional musicians since this was not the aim of the study.

Conclusions

Our study showed that music naïve individuals: (a) associated major keys to positive emotions and minor keys to negative emotions in less than half of the time; (b) associated neutral emotions with one-third of the tonalities; (c) minor keys tended to correlate with the number of accidentals in the key signature. These findings show that in the same way that music does not generate consensual emotions, tonalities do not as well.

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