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Music and Emotions

Daniela, Bernd Willimek

A New Theory for Musical and Emotional World

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Music and Emotions

Research on the
Theory of Musical Equilibration
(die Strebetendenz-Theorie)

Designed and conducted by

Daniela and Bernd Willimek

Translated from the German by

Laura Russell *(2013)*

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Music and Emotions

Musical selections: Bernd Willimek

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Bernd Willimek, born in 1954, studied math and physics at the University of Karlsruhe before studying music at the Karlsruhe University of Music, where he completed a graduate degree in music theory and composition under Eugen Werner Velte. Freelance work as a music theory expert and composer. Author of the Theory of Musical Equilibration. In conjunction with his wife, Daniela Willimek, he designed and conducted international study on the emotional perception of musical harmonies.

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Introduction

The link between *music and emotions* is more of an issue than ever before, and music research is increasingly focusing on understanding the complex characteristics of this interaction. After all, for a long time the fact that music has an emotional impact upon us was one of the greatest of enigmas, since fundamentally it only consists of inanimate frequencies. This is a topic something we do not usually think about in everyday life, and that is why an aura of the indescribable still hovers around music. The question as to how and why music can convey feelings seems to have a certain taboo to it — and interestingly enough, this is the case among musicians as well.

Although people like to describe music as an international language, science has still not been able to provide an explanation that deconstructs the nature of this language. For decades, it left the task of decrypting this enigma to a small group of people: *music psychologists*. Despite being well-equipped with statistics software and calculators, music psychologists to date have not had any more success than the widely-cited brain research of recent decades when it comes to resolving the question about why music can stimulate an emotional response.

The Theory of Musical Equilibration (known in the original German as the *Strebetendenz-Theorie*) is the first to create a psychological paradigm which explains the emotional effects of music. It breaks down musical sequences into one of their most essential components — harmony — and directly uses this material as the basis of its argumentation. Harmony is essentially music in its concentrated form, since within a single moment it can reflect melodic and other musical processes which otherwise can only be depicted over a given interval of time. The psychology of harmony is the psychology of musical feelings. This book uses selected examples from the repertoire to make clear that the emotional character of musical harmonies cannot only be systematically deconstructed, but plausibly justified and empirically demonstrated.

Between 1997 and 2011, over 2000 participants at German schools in Europe, Asia, Australia and South America took part in studies on the Theory of Musical Equilibration; most recently, participants included the famous Vienna Boys' Choir and the Regensburg Cathedral Choir. The results of our research offer empirical validation of the Theory which explains the correlation between musical harmonies and emotions.

In his book *Musikpsychologie*[1], musicologist Ernst Kurth offered an initial insight into understanding the psychology of listening to music. Despite the fact that his observations were primarily rooted in his personal experience, he nevertheless came to a significant and certainly universal conclusion: before we perceive frequencies and interpret them as music, they are physically experienced and then undergo an *internal translation* into something with a different essential nature. However, Ernst Kurth's description of the

[1] Ernst Kurth, *Musikpsychologie*, (1930; ND Hildesheim: Olms, 1969).

physical concept of *potential energy* was misleading when he compared musical perceptions with material processes. His hypotheses gave rise to an invalid conclusion: he saw physical potential energy as something that people can identify through pure feeling. This was probably the cause of the fateful error in his thoughts about physics, the result of which rendered his work all but useless in psychological research. In his 1987 thesis *Das musikalische Raumphänomen*[1], Bernd Willimek, then a college student, corrected Ernst Kurth's incorrect comparison of feelings and potential energy, and he created a new interpretation of this context by explaining how people identify with processes of will. The Theory of Musical Equilibration[2] which resulted is the first description of harmonic functions as the listeners' ability to identify with processes of the will; these processes run counter to the *equilibration effects* as Ernst Kurth understood them.

To anyone who has ears to hear, the many epochs and genres in music provide an endless range of material for studying the correlation between chords and emotions. In our research, we focused on compositions found in Romantic *lieder*, Impressionist music, film music and pop music: these types of music show a clear connection between the use of musical harmonies and the content of lyrics and/or scenes. The overlap found here highlights easily identifiable correlations to the Theory of Musical Equilibration's descriptions of musical harmonies. Our early research yielded promising results: we asked children of different ages to tell us their spontaneous responses to different chords. The way in which the children attribute a certain character to musical harmonies shows unmistakable parallels in the results of our later research.

It is our hope that our study will serve as an impetus for observing the emotional impact of music and will contribute to a long-overdue revival of the respective areas of musicological research.

[1] Bernd Willimek, *Das musikalische Raumphänomen*, graduate thesis as part of the music-theory degree program at the Karlsruhe University of Music, 1987.
[2] Bernd Willimek, "*Die Strebetendenz-Theorie,*" *Tonkünstlerforum Baden-Württemberg*, 1998. No. 29 and No. 30, September and December 1998.

1 Theoretical observations – the Theory of Musical Equilibration

1.1 The Theory of Musical Equilibration — *die Strebetendenz-Theorie*

Bernd Willimek's Theory of Musical Equilibration, the *Strebetendenz-Theorie,* has its roots in the music-psychology teachings of Ernst Kurth. It is the first international compilation which lists the emotional character of musical harmonies, and at the same time it is also the first general description of their emotional impact. It explains the psychology underlying the musical character of these structures as the consequence of processes in which the listener identifies with musically-encoded processes of will.

The theory was first presented at lectures at the Karlsruhe University of Music and the University of Rostock in 1997 and then published in 1998[1]. It has not been refuted since that time, and currently there is no alternative scientific theory. Nationally and internationally conducted studies yielded strikingly reproducible results: this research showed the strong correlation between specific musical harmonies and texts with emotional content, thus validating the Theory of Musical Equilibration.

1.1.1 The fundamentals of the Theory of Musical Equilibration

To a certain extent, the basic assertion of the Theory of Musical Equilibration is a revised interpretation of what Ernst Kurth described upon listening to music: the *perception of forces at work*. Willimek's original German term is "Strebetendenz," literally the "tendency to strive." It is an inherent desire for musical resolution, a driving force that anticipates musical equilibration. Ernst Kurth spoke of perceiving the musical notes' *desire to resolve*, whereas the Theory of Musical Equilibration states that this phenomenon is the listener identifying with a desire for there not to be any musical resolution — for things to remain the same. When Kurth speaks of a change in pitch in a major chord that strives to resolve into a third, the Theory of Musical Equilibration explains this phenomenon as the consequence of the listener wanting things to stay as they are: the listener identifies with a desire for the third not to change in pitch.

Another key element of the Theory involves the emotional act Ernst Kurth observed when he wrote of internally *translating* the physically perceived tone into another essential quality. This quality can best be described as something *indefinably substantial*. We do not experience a musical note as a frequency, but as an indefinable thing, albeit one which we cannot logically attribute to part of our material world. However, it is this very inability to integrate a note into the material world that is the key factor which allows us

[1] Willimek, "*Die Strebetendenz-Theorie", Tonkünstlerforum Baden-Württemberg*.

to experience music on an emotional level. Listeners experience a sense of desire which revolves around something *indefinable but substantial*, something which is a pure and nearly undefined will that opens up endless opportunities in their imagination. Starting on page 8, this principle is described using specific examples.

1.1.2 Demonstrating the emotional nature of harmonic structures

Daniela and Bernd Willimek developed musical preference tests — the Basic Test and the Rocky Test — and launched an international study to confirm the hypothesis of the Theory of Musical Equilibration, not only in terms of the underlying physics and use in the musical repertoire, but from an empirical standpoint as well. The results of this study show that short musical pieces which feature particular harmonies are clearly preferred over others with neutral cadences, giving credence to the Theory of Musical Equilibration. The Rocky Test has been held at German schools in Argentina, Austria, Australia, China, Finland, Germany, Japan, Sweden, Spain and Thailand on a total of over 2000 children. The most prominent participants included 198 members of the Regensburg Cathedral Choir and 77 singers in the Vienna Boys' Choir.

1.1.3 A critique of Ernst Kurth's work

The following quote provides a rough outline of Ernst Kurth's thoughts on music psychology:

...one must simply think of how a C sounds when it is played by itself and then how it appears to be loaded with energy as soon as the dyad G – D is added: how these notes force it toward its missing chord tone B, how additional tension comes from the "resonant" content one feels upon hearing it. This effect has always been known as suspension, and it does not take into consideration that the magnificent lure of a suspended note ranks among the greatest of emotional (not acoustic) curiosities. Another such curiosity is when suspended tension rushes into tones which are harmonically consonant[1]*.*

Whereas some musicologists accused Ernst Kurth of being too arbitrary in comparing material and musical phenomena, his approach is unobjectionable in terms of the underlying physics and psychology, as long as it remains clear that Ernst Kurth is describing his own experiences or the experiences of others. Nevertheless, there is another issue in which Ernst Kurth can clearly be disproven. He describes the effect of musical suspension as a the state of physically perceiving in the present moment that there will be a change in the future, which is to say we physically perceive that a change is intended outside of our physical selves. This notion, however, cannot be reconciled with the laws of nature, even if it only involves abstract thoughts. Individual sources in the literature have pointed out this contradiction in Ernst Kurth's work.

If we modify the beginning of Ernst Kurth's aforementioned description to bring it into line with the Theory of Musical Equilibration, we arrive at an accurate depiction of this context — one which can hold its own against any objections from a psychological and physical perspective. Furthermore, it can be practically applied to comprehending the

[1] Ernst Kurth, *Musikpsychologie* (1930; ND Hildesheim: Olms, 1969), p. 13.

emotional impact of music. The revised description of suspension would then begin as follows:

... one must simply think of how a C sounds when it is played by itself and then how one identifies with a desire <u>against</u> a modulation into the B as soon as the dyad G – D is added...

In the next section, we will use an example from the realm of physics to show in greater detail that Ernst Kurth's idea as cited here does not describe the process correctly. Furthermore, the example will illustrate that the Theory of Musical Equilibration is the only possible alternative explanation. This passage, however, assumes a far greater understanding of physics than the rest of this book, which is why the header includes the disclaimer that it is intended *for physicists*.

1.1.4 For physicists: the scientific confirmation of the Theory of Musical Equilibration

Before delving deeper into theory, let us reiterate Ernst Kurth's description of the effect of musical suspension and how this idea was redefined by the Theory of Musical Equilibration:

Ernst Kurth's description of the effect of musical suspension

...one must simply think of how a C sounds when it is played by itself and then how it appears to be loaded with energy as soon as the dyad G – D is added: how these notes force it toward its missing chord tone B, how additional tension comes from the "resonant" content one feels upon hearing it. This effect has always been known as suspension, and it does not take into consideration that the magnificent lure of a suspended note ranks among the greatest of emotional (not acoustic) curiosities. Another such curiosity is when suspended tension rushes into tones which are harmonically consonant[1].

A description revised by the Theory of Musical Equilibration

... one must simply think of how a C sounds when it is played by itself and then how one identifies with a desire <u>against</u> a modulation into the B as soon as the dyad G – D is added …

Scientific proof of the revised theory

It is helpful to apply this concept to the material world and assess it in that context. This will demonstrate that the Theory of Musical Equilibration is the only possible alternative to Ernst Kurth's scientifically invalid description of the effect of suspension.

[1] Ernst Kurth, *Musikpsychologie* (1930; ND Hildesheim: Olms, 1969), p. 13.

Imagine the following situation. A driver, **A**, is sitting in a compact car, parked on a very gentle downward slope. The parking brake is not on, but the car does not roll down the hill, because the passenger, **B**, is a strong, large man standing in front of the car and using all of his might to keep it in place.

In this example, the **c** note from Kurth's quote stands for the car, whereas **g** and **d** are the forces of gravity. Ernst Kurth himself would be the **B**, the person who is holding the car in place and claiming he can feel the forces which push the car down the hill. **B** might like to complain about how heavy the weight of the car is, but his claim can easily be refuted. It is clear that an individual person cannot stop a car from rolling downhill by pushing against it: assuming the car is not in motion, **B** would not even notice if **A** secretly put on the emergency brake. If the brake were on and **B** did not notice that the force of gravity is no longer pushing the car downward, then logically he could not have perceived it in the first place.

This may seem strange to some, but it is perfectly logical to a physicist. Of course **B** cannot feel that the car would roll down the hill if he were to let go. After all, our nerves can only truly perceive what is currently happening, not that which will happen or a dreamed-up possibility. There is no way to make our senses perceive something at this moment if it has yet to happen — not even on a speculative level. **B** can only feel where the car is at the moment in question, not where it would, could or will go if he were to step aside. What he actually does feel is the resistance of the car and his own exertion against this force; he also identifies a will — he identifies with the desire to keep the car from rolling down the hill.

A similar principle applies to Ernst Kurth's description of musical suspension. Ernst Kurth would never have been able to perceive that a **c** note could, would or intended to make any kind of change. A perception of this nature is inconceivable, even in the abstract. Kurth could only hear a note playing at a given moment. Beyond that, he could also perceive a desire that the pitch not change. And the experience of hearing suspended or leading notes can only be explained as the process of identifying with the desire for the pitch to remain unchanged. The question about how accurate Ernst Kurth's description of suspended notes is does not even touch upon the widely-discussed idea about whether a note can be considered a physical object of some sort. Instead, the question can be whittled down to a physics-related problem which only involves the factor of *time*. Furthermore, it can be unequivocally solved: Ernst Kurth made a valid observation but described it incorrectly from the perspective of physics. This alone would render his findings all but unusable from a psychological perspective.

1.1.5 For psychologists: how do the musical effects of the leading note develop?

Over the years there have been a number of traditional attempts to explain the cause of the phenomena created by musical suspension and leading notes. To date, however, there has not been a clear-cut answer which definitively resolves the question. The root of the principle described in the Theory of Musical Equilibration, however, may well be the interplay of conscious and subconscious perceptions arising from the effects of the dissonant seconds (i.e. major and minor seconds) formed by lower overtones. In typical chords which seek musical resolution, these seconds are perceived at the threshold of the subconscious mind, and when the harmonic progression continues, they resolve into consonance.

A simplified explanation of this principle is as follows: upon hearing a leading note or a suspended note, listeners subconsciously perceive the dissonance of the second in the overtones, and the dissonance which results means that theoretically this interval creates a form of annoyance. Since, however, listeners do not consciously perceive the dissonance, they are also not actively aware of the annoyance. Their subconscious desire for the dissonant friction to resolve appears in their conscious mind in its inverse form: they identify with the desire to continue hearing the leading note or suspension which generates the friction, and furthermore, they want to hear it unchanged. A principle of this kind in which the conscious and subconscious face off against one another as adversaries is widely observed in the field of psychology, e.g. in emotional disorders such as obsessive behaviors. An obsession is to be considered the manifestation of a subconscious desire. In their conscious minds, however, patients experience the very inverse of their subconscious desire: they identify with the desire to resist the obsession.

1.2 The emotional character of musical harmonies

The passages below discuss hands-on ways to apply the Theory of Musical Equilibration and to depict the emotional character of musical harmonies. In all of the examples cited below, the respective notes of the harmonies which have a critical role in each piece are shown
in red.

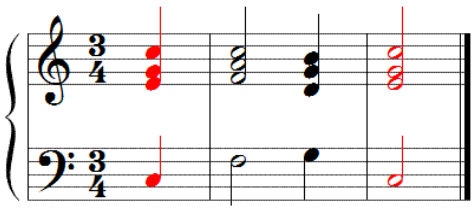
1.2.1 The character of tonic in major chords

Moser's dictionary of music describes the different emotional content of major and minor chords as follows:

There is a great deal of truth to the statement that major chords sound happy and minor chords sound sad, despite the primitive nature of the idea.[1]

The Swiss music theory expert Gustav Güldenstein described the major tonic as symbolically including an awareness of one's own will, as corresponding to a feeling of a sober-minded contentment with the present moment:

The tonic can be symbolically represented by a person standing upright in life. He is at rest as long as he is not moving, yet he is under tension in that he must constantly overcome a sensation of heaviness.[2]



The major tonic expresses a sense of sober-minded contentment.

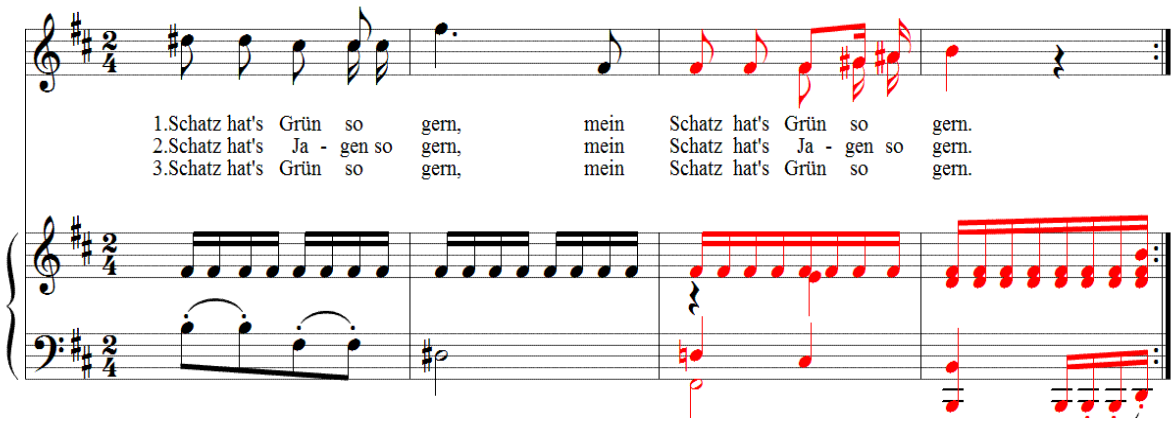
The Ullstein dictionary of music also attributes this chord with the ability to communicate an intention, describing it as "affirming".[3] Music-theory specialists concur that the third in the major tonic is a leading note which shows only a mild inclination to resolve upward. Applying the Theory of Musical Equilibration to an analysis of this leading-tone effect leads us to a logical conclusion: we identify with the desire for the third not to change. This also takes into account what Ernst Kurth described as internally *translating* the physical experience of the note into another essential quality.

[1] Hans Joachim Moser, *Musiklexikon*, Vol. 2, 4th revised ed. (Hamburg: Sikorski, 1955), p. 794.
[2] Gustav Güldenstein, *Theorie der Tonart*, 2nd ed. (Basel, Stuttgart: Schwabe, 1973), p. 39.
[3] Friedrich Herzfeld. *Ullstein-Musiklexikon* (Berlin: Ullstein, 1965), p. 351.

To phrase it differently, when a major tonic sounds, we feel only a very mild desire for something indefinable and substantial to change. From an emotional perspective, we can describe this sense of will as identifying with a sober-minded sense of contentment with the here and now. This conclusion is nearly identical in content to the way Gustav Güldenstein described the major tonic above.

1.2.2 Why do minor chords sound sad?

The effect of a minor chord can also be logically explained by applying the Theory of Musical Equilibration. The Moser dictionary of music describes the nature of the minor chords as *the major being clouded by the minor*[1]. When the definition is interpreted from this monistic perspective, the minor third is not seen as an independent interval, but rather as a "clouded" major third which has been robbed of its leading-note tension. The Ullstein dictionary of music describes a minor chord as a *suppressed major*.[2]



The melancholy effect of the minor chord can be clearly felt at this point in Schubert's song "Die liebe Farbe" ("The Beloved Color") and allows listeners to anticipate the disappointing end of the story which was set to music in the song cycle "Die schöne Müllerin" ("The Lovely Miller")

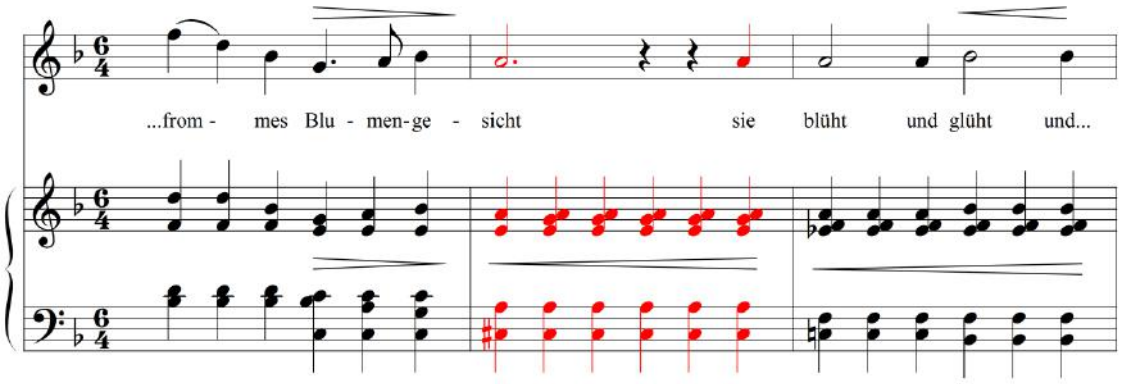
Upon applying the Theory of Musical Equilibration to the minor chord here, we see a clear result if we replace the mental image of Kurth's *effects of equilibration* (i.e. the urge for musical resolution) with the image of *identifying with the desire for things to remain as they are*. In a major tonic, we identified with a desire for the chord not to change, but in the minor key, that sense of will now appears *clouded, suppressed*. The feeling of contentment is clouded by a feeling of discontentment.

The experience of listening to a minor chord can be compared to the message conveyed when someone says, "No more." If someone were to say these words slowly and quietly, they would create the impression of being sad, whereas if they were to scream it quickly

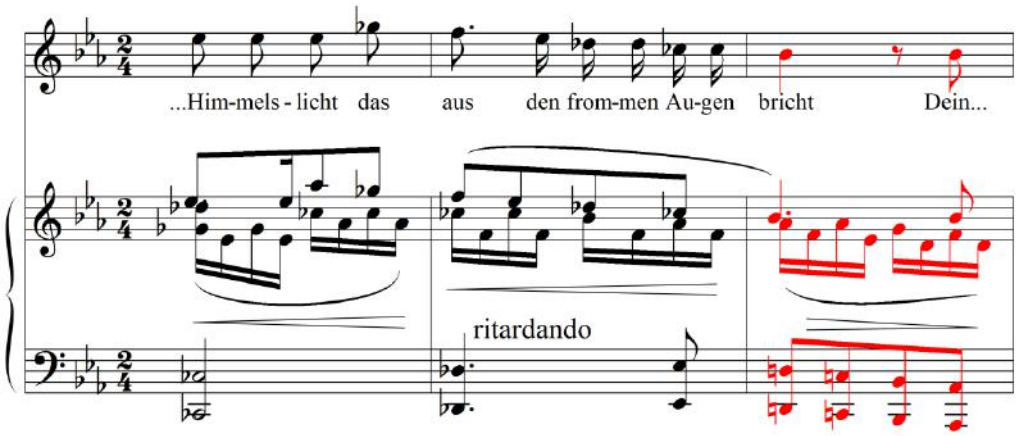
[1] Moser, *Musiklexikon*, p. 793.
[2] Herzfeld, *Ullstein-Musiklexikon*, p. 351.

and loudly, they would be come across as furious. This distinction also applies for the emotional character of a minor chord: if a minor harmony is repeated faster and at greater volume, its sad nature appears to have suddenly turned into fury. Other emotions expressed by minor harmonies will be discussed in later passages.

1.2.3 The secondary dominant chord as an expression of being emotionally moved



In his song "Die Lotosblume" ("The Lotus Blossom") (op. 25/7) , Robert Schumann uses the secondary dominant chord of the parallel tonic as an expression of being intensely and painfully moved – at the very spot in the lyrics in which the listener, who is vividly experiencing the music, looks into the anguished creature's eyes.



Another example is Schumann's "Dein Angesicht" ("Your Face") (op.127/2), where the secondary dominant chord of the tonic parallel is heard in the moment at which the listener, who is figuratively experiencing the narrative, looks into the eyes of a suffering person.

Minor chords serve as a sort of emotional negation of major chords, and the language of music is significantly enhanced by the use of secondary dominant chords. The remarkable

thing about every dominant harmonic structure is the fact that its sound is not only effective in and of itself, but it also generates an expectation in listeners that it will resolve. Music theorists agree on this. Even Jean-Philippe Rameau described the anticipatory nature of the dominant. If we want to analyze the dominant chord, we must be thorough and take two tonal characters into consideration, not just one.

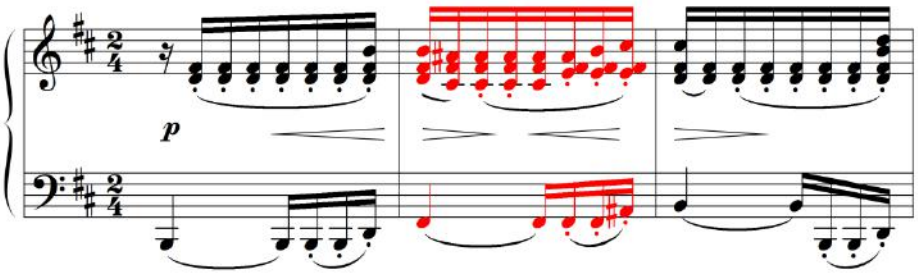
This is also true when the Theory of Musical Equilibration is applied. When a dominant chord is played, we perceive the desire for things not to change, and this is characterized by the anticipated resolution. When listeners are surprised by a secondary dominant chord (as is the case with the two Schumann examples above), which is typically expected to resolve in a minor key, they identify the secondary dominant chord as having an air of spontaneous resistance to the sudden and unanticipated “threatening” and undesired change.

Robert Schumann had a particular passion for making use of the secondary dominant chord of the parallel tonic. In the songs "The Lotus Blossom" (in the passage ...*ihr frommes Blumengesicht*...) and "Your Face" (in ...*aus den frommen Augen bricht*...) the expressive power Schumann attributed to this chord is evident: in both cases, he deploys it to surprising effect at exactly the moment in the song at which the listener, who is figuratively experiencing the narrative, looks into the eyes of a suffering person at the peak of the emotional intensity.

We must note that in this context, depending on the anticipated resolution, one and the same dominant chord can have different effects on people; even if their ears are untrained, the wide scope of sentiments they will interpret can range from anywhere from *cheerful* to *painful*. Secondary dominant chords in minor harmonies express the state of being emotionally moved, which is why they have been used as a device of harmonic contrast with an intense effect, from the Baroque age into our era of pop music.

1.2.4 Why is it that major chords sometimes sound as sad as minor chords?

The principle which explains the effect of the secondary dominant chord also applies to something which is surprising from a scientific perspective: at times major chords can sound just as sad as minor chords if they are used as the dominant in a minor key. The otherwise common emotional effect of the contrast between major and minor is completely eradicated in such cases. The cause for this can be found when the Theory of Musical Equilibration is taken into account:



The dominant major chords in the second measure of the introduction of "The Beloved Color" from the song cycle “The Lovely Miller” sound just as sad as the minor harmonies of the first measures, since they assume their emotional impact.

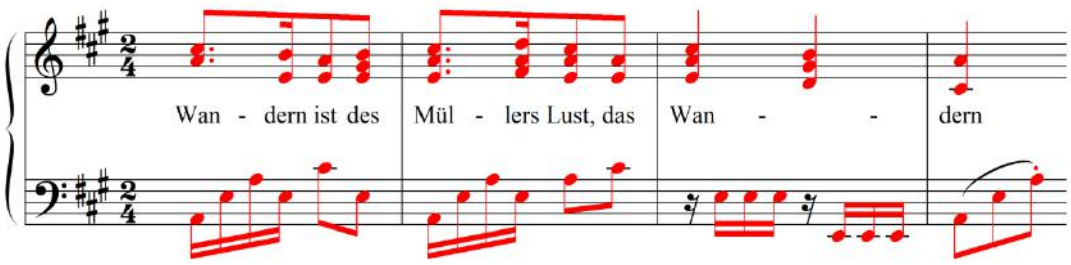
When a minor tonic is played, we sense a feeling of discontentment, and as explained above, the major dominant stirs up the wish that the minor tonic not return. As a result, the major dominant chord creates a situation which, when taken to its logical conclusion, can be explained as follows: in the dominant of a minor tonic, we perceive a *feeling of discontentment about the feeling of discontentment*. Applying our theory to the dominant-minor tonic sequence creates a kind of pleonasm.

This explains why the sequence minor tonic-major dominant- minor tonic can only convey a single common emotional content, i.e. that of the minor tonic, such as the sad nature of the aforementioned Schubert piece.

1.2.5 The dominant chord in major brings motion into music

If the tonic is a major chord, then repeatingly modulating between the tonic and the dominant creates a series of major chords. This context can be seen in a new light if we think of the Theory of Musical Equilibration's interpretation of the musical intention underlying this harmonic structure instead of examining the forces of musical resolution. The result here contains messages which appear at first glance to be contradictory.

The tonic phase, for as long as it is played, comes across as something we *desire*, although it comes across as something *undesired* beginning at the moment when the dominant is sounding. This sort of contradiction may sound illogical at first: if it were put into words, it would say, "*I want to, I don't want to, I want to, I don't want to*..." The listener can make sense of this mixed message by comparing it to forward motion. For example, if you are hiking, every step pushes you away from a certain point on your path that you had aspired to only a moment ago.



The sequence from tonic to dominant in major is perfect for generating an impression of motion, as is shown in the folk song above.

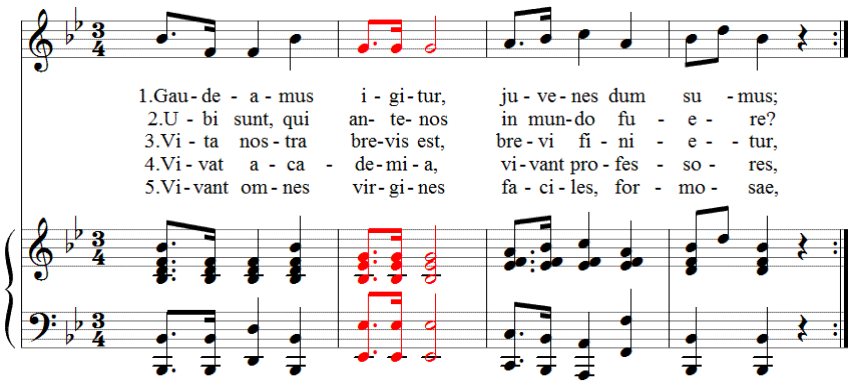
Musicologist Arnold Feil cites Franz Schubert's *"Das Wandern"* ("Wandering") from *The Lovely Miller* and states that in countless other wandering songs, the harmonic sequence tonic – dominant evokes an impression of moving:

The motion in such music cannot actually be interpreted as physical motion, but nevertheless it can be translated to a certain extent: it can be "musically envisioned" and then set to music.[1]

1.2.6 The major subdominant expresses tranquility

In both classical and pop music, the major subdominant is used as a way of communicating a relaxed and untroubled mood. In our research, passages with subdominant chords were described as the ones during which the mood was *warmest* and *friendliest*.

The music encyclopedia *Große Lexikon der Musik* writes that the major subdominant is "frequently used at melodic high points."[2] Wikipedia states that "modulation into the subdominant key often creates a sense of musical relaxation; as opposed to modulation into dominant (fifth note of the scale), which increases tension." [3]



The major subdominant is commonly used at the high point of a melody because it can convey a heightened, untroubled mood, such as in the student drinking song "Gaudeamus igitur."

In Schubert's song cycle *The Lovely Miller* a dissonance-free subdominant occurs only in *"Mein"* ("Mine") and *"Pause"* ("Pause"), the two songs in which the lyrics speak of the moment when the miller mistakenly believes that he has won the miller-maiden's heart. These are the only points in the story when the miller's state of mind can be characterized as untroubled.

[1] Arnold Feil, *Franz Schubert* (Stuttgart: Reclam, 1975), p. 58.
[2] Marc Honegger, Günther Massenkeil, *Das große Lexikon der Musik*, vol. 8 (Freiburg: Herder, 1982), p. 39.
[3] Wikipedia, "Subdominant," [http://en.wikipedia.org/wiki/Subdominant], retrieved May 15, 2013.

It is very difficult to hear the subdominant as an equilibrating chord, because its resolution — the double subdominant — is not part of this scale. It is thus described in relation to the tonic as a major interval with a vanishingly slight urge to equilibrate. Gustav Güldenstein wrote of the transition between tonic - subdominant as "a reduction of tension from a normal state to very mild."[1] Diether de la Motte speaks of the subdominant as the "low-tension interval to the center."[2]

If we replace the mental image of this urge towards equilibration with that of identifying the desire for things to remain unchanged, the harmonic structure can be described as follows:

When the subdominant is heard, we identify with the desire for things not to change, although this feeling is very passive. Emotionally speaking, it corresponds with a sense of contentment about the here and now, which is remarkable because it seems unclouded. This sentiment goes well with moments of lightheartedness, such as those in a rapturous state or after a victory. That means that the subdominant is also excellent for songs sung at cheerful occasions, and its use is widespread in this context (such as the first two lines of the refrain of the Christmas carol "Here We Come A-Wassailing"). The subdominant is also well-suited to depicting a light-hearted mood in children's songs (the first lines of "Twinkle, Twinkle, Little Star"). In national anthems, the subdominant can emphasize the emotional apex of the song, as is the case in the German national anthem, when the melody descends from the upper tonic in the penultimate line "*Blüh im Glanze dieses Glückes*…")[3] .

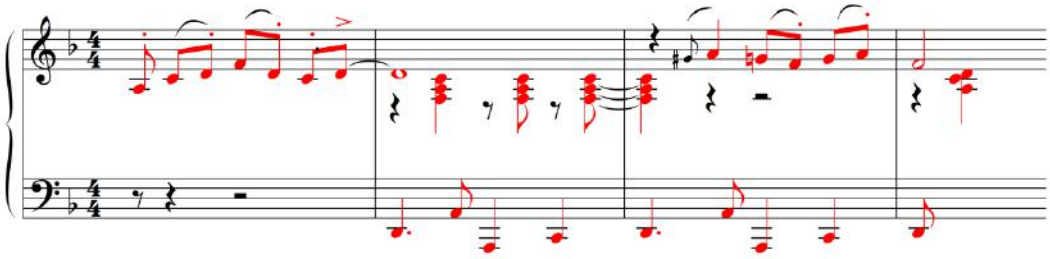
1.2.7 Natural minor goes with tension, courage and adventure

In cases where the minor tonic does not lead to a major dominant, but rather to the minor dominant (as is the case in the natural minor), the Theory of Musical Equilibration shows that this progression generates an emotional message which may seem contradictory at first.

In the minor dominant of the minor tonic, the listener identifies with a *clouded* desire (the minor dominant) for the phase of discontentment (the minor tonic) to stay the same. In other words, the listener recognizes a feeling of tolerating something that is undesired. As contradictory as this intention may initially seem to be, it quickly becomes plausible if we interpret the chord as an expression of courage. People who are courageous do things they would rather not do: they overcome their own emotions.

The theoretical conclusion we draw about the tonal character of this harmonic progression is an exact match with its emotional effect. A cadence which links a minor tonic and a minor dominant is ideal for musically expressing courage. It is frequently used in movies and on TV to score exciting scenes in thrillers. An electric bass then usually plays sequences in natural minor. One example is the theme from the TV series *Magnum*; another is the pop song "I Shot The Sheriff."

[1] Güldenstein, Theorie *der Tonart*, p. 40.
[2] Diether de la Motte, *Harmonielehre*, 4th edition. (Kassel: Bärenreiter, 1983), p. 35.
[3] Joseph Haydn, Heinrich Hoffmann von Fallersleben, "Das Lied aller Deutschen," *Deutsche Lieder: Heimat Volk Studentsein, Klavierausgabe zum Allgemeinen Deutschen Kommersbuch*. Ed. Erdmann Werner Böhme, 4th edition. (Lahr: Schauenburg, 1992). p. 6.



A natural minor does not sound sad: instead, it sounds adventurous or courageous. The classic German piano primer Rock Piano contains a piece called "The Groover" which serves as an excellent example.

Furthermore, this harmonic structure is what defines the character of classic rock and pop in natural minor which sounds outright adventurous (Deep Purple, Carlos Santana). The courageous character of the natural minor can be effectively illustrated in the example above.[1]

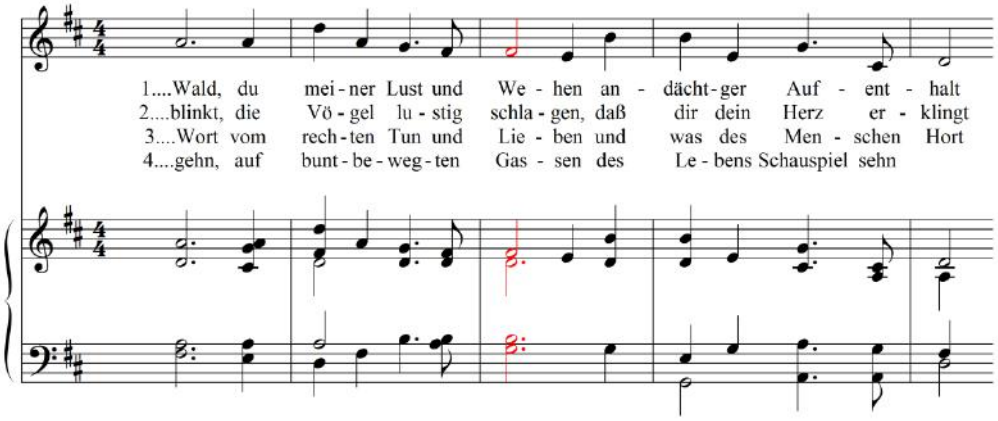
In commercial esoteric music for meditation, this harmonic progression is especially popular when played at a low volume: it expresses a sense of letting oneself go and embarking upon a meditative journey. The courageous character of these chords is intended to reflect the process of making room for emotions and new spiritual experiences.

1.2.8 The subdominant with a major seventh conveys wistfulness

The major subdominant with a major seventh is especially good for musical interpretations of wistful moods, such as a farewell. How can this be explained? As discussed above, the major subdominant can be used to express a sense of serenity. If a major seventh is added, then this consonant major chord is given a dissonance which traditional harmonic theory describes as *being in need of resolution* — as seeking *equilibration*.

According to the Theory of Musical Equilibration, if the thought of musical *resolution* is replaced with *identifying the desire for things to remain unchanged*, the effect of the entire harmony can be described as a merging of two separate factors. It combines the untroubled mood of the subdominant with the impact of the major seventh: identifying with a desire for things not to change. The impression that results is like that of a calm soul in a serene moment suddenly attempting to hold on to that instant. A fleeting character enters the tranquil mood, giving listeners the impression of wistfulness.

[1] Jürgen Moser, *Rock Piano 2* (Mainz: Schott, 2004). p. 31.

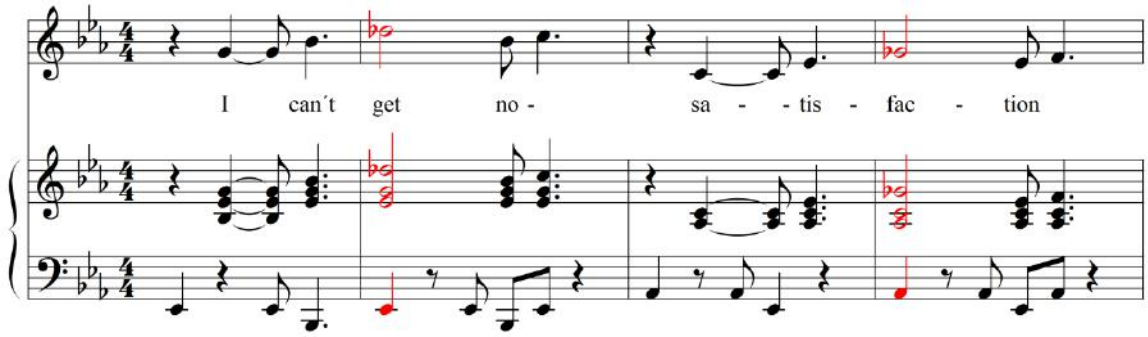


The major subdominant with a major seventh is put to its characteristically wistful effect in Felix Mendelssohn-Bartholdy's song "Abschied vom Walde."

A subdominant with a major seventh has been widely used as a device of harmonic contrast even back in the epoch of Johann Sebastian Bach (cf. "Air on a G String," during the final harmony on the long sustained note at the beginning). It has maintained this role through out the ages, all the way to the pop music of today (cf. Elton John, "Your Song," the second chord after the lyrics begin).

1.2.9 The seventh chord was part of the countercultural revolution

According to music theory, the dominant seventh chord contains two strong elements which want to equilibrate, since the third and the minor seventh are leading notes. If we look at the dominant seventh chord and interpret this *equilibration* as *identifying the desire for things not to change*, we can see this phenomenon in two different ways:



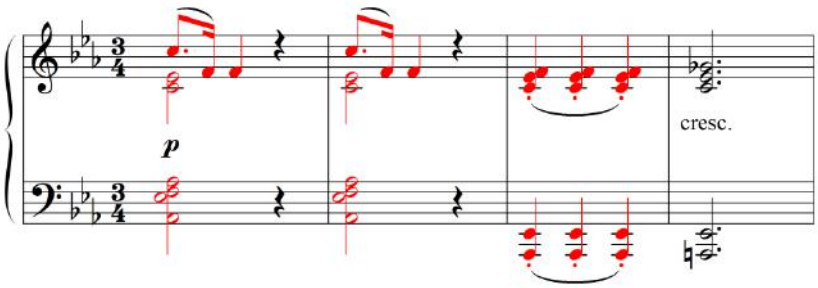
Once a shock to the bourgeoisie, the Rolling Stones song "Satisfaction" creates an effect which can be musically attributed to its two sevenths, D flat and G flat.

The tonal character of the dominant seventh chord comes from the two-pronged *desire for things not to change*. It is used as an expression of resistance, of bringing things to a halt. If a dominant without a seventh was previously used to create a musical impression of motion, then now the listener has a sense of someone putting on the brakes. This is why certain rules of harmonics state that the seventh has to be added to a dominant that is already sounding. By adding the "brake" of minor seventh, the character of a fluid motion expressed by the dominant is transformed into the character of a stepping motion (just think of wandering songs!).

If, by contrast, the dominant seventh chord of a major tonic is introduced without prior "preparation," the impression of resistance or braking may not be apparent to listeners, and they will sense this chord as being plaintive or weepy in nature. It makes us feel as if a driver is nervously stepping on the brakes before the car has even started moving.

The seventh chord has been used in a very different manner since the 1960s and the era of pop music. Here, instead of appearing only in dominant chords, the seventh appeared in tonic and subdominant chords as well. This musical device created a new means of revolting against the establishment. The resistance it expressed was aimed against the moral standards of the older generation. The musical structures and seventh chords of the blues sound rebellious and defiant through their harmonies alone. The explosive musical effect of what was once considered an anti-establishment anthem, the Rolling Stones' "(I Can't Get No) Satisfaction," came from the sevenths, D flat and G flat, in the tonic and subdominant respectively. If these sevenths were removed from the melody and replaced with a note that was a whole tone higher, i.e. E flat and A flat, the melody would suddenly lose its revolutionary nature, and at best it would be suitable as a rock anthem. Musically speaking, the counterculture character of the songs "Let's Spend The Night Together" by the Rolling Stones and "Why Don't We Do It In The Road" by the Beatles also comes from the minor sevenths in the harmonies.

1.2.10 The added sixth in a major chord as an expression of warmth and security



The subdominant with an added sixth can communicate a sense of emotional security, as can be heard at the beginning of Ludwig van Beethoven's Sonata Op. 31 No. 3.

Diether de la Motte described the equilibrating effects of the added sixth by saying that "the fifth and sixth repel against each other as dissonant notes."[1]

If we apply the principle of the Theory of Musical Equilibration to this chord, we can imagine that instead of the intervals repelling against each other, there is a will acting *against* this desire for musical resolution. Rather than *pushing apart*, then, the forces are striving to *stay together*. Reformulating the idea in this manner creates a description of the chord's character: it is an expression of profound togetherness, a feeling of warmth and emotional solace.

At the beginning of Sonata Op. 31 No. 3, Ludwig van Beethoven uses the subdominant with an added sixth in a unique fashion by sustaining it for three measures, thus allowing it to define the nature of the entire movement. Musicologist Jürgen Uhde analyzed this

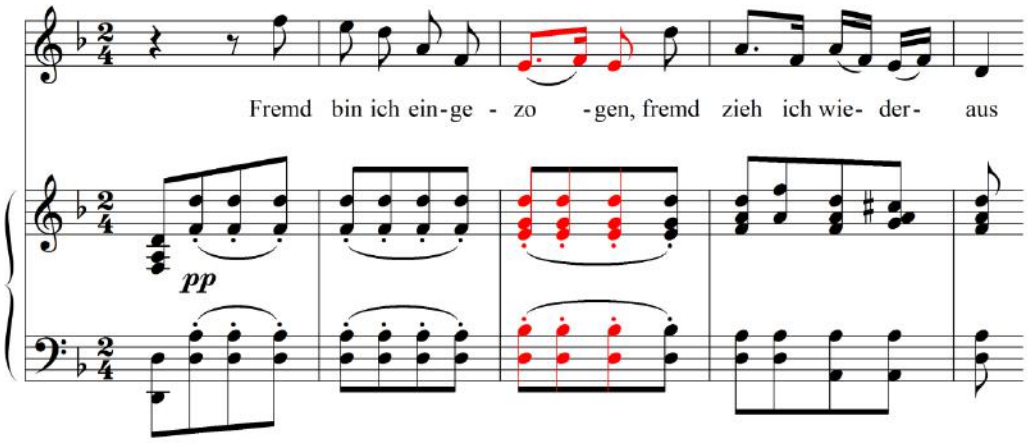
[1] De la Motte, *Harmonielehre*, p. 54.

passage and found a striking correlation with the aforementioned character of emotional solace. He wrote,

"For quite some time, something resembling security and comfort seemed to me to be expressed in this 3rd sonata (as compared to the turbulent 1st sonata and to the 2nd sonata, which is excessive in every conceivable way)...." [1]

Shortly before that passage, Uhde analyzed the cadence leading from the added sixth back to the tonic and posed a question: "Is this return a sense of going home to solace?" [2]

1.2.11 The added sixth in a minor chord represents heartbreak and loneliness



The added sixth chord in a minor chord can express the feeling of being heartbroken. Franz Schubert used this chord to start his "Winterreise" song cycle, and in doing so he established the overall theme of the work.

One popular example can be found in Schubert's *Winterreise*, which begins with an added sixth chord ("*Fremd bin ich eingezogen...*"). Schubert makes use of this harmony to present the theme of the entire journey: feeling heartbroken, lonely, and abandoned.

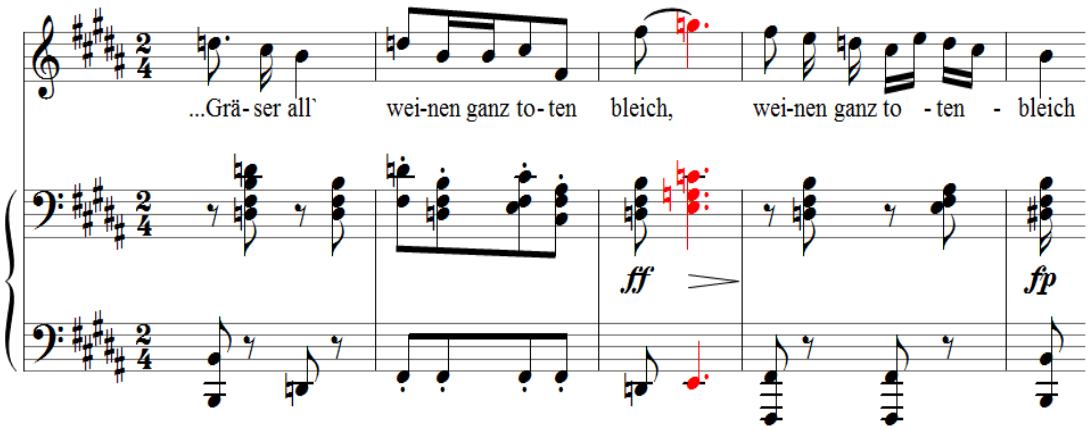
In a minor chord, the added sixth has exactly the opposite emotional effect of the added sixth in major. It is employed to express painful loneliness and heartbreak. If the Theory of Musical Equilibration is applied here, we once again find an expression of wanting to stay together, as was the case with the added sixth in major. Since the basic harmonic structure is a minor chord, however, this statement appears in the emotional context of discontentment. The feeling of *wanting to stay together* thus becomes an *unhappy wish to stay together*. Desire of this kind effectively communicates a damaged friendship, loneliness and heartache.

1.2.12 The Neapolitan sixth chord as a symbol of death

The Neapolitan sixth chord has a distinctly painful effect. Its exceptionally intense impact can only be fully understood if the Theory of Musical Equilibration is applied, taking into account the unique transformation which this chord undergoes when it is played. The

[1] Jürgen Uhde, *Beethovens Klaviermusik* (Stuttgart: Reclam, 1974), III, 79.
[2] Ibid.

Neapolitan sixth chord has a different effect at the moment when it first sounds than it does a brief moment later. The reason is that it creates a sense of confusion in the listener.



Franz Schubert uses the Neapolitan sixth chord as a symbol of death, as is evident here in the song "Die böse Farbe" ("The Evil Color") from The Lovely Miller.

This confusion can be explained as follows: when first played, a Neapolitan sixth chord sounds like a normal major chord, and listeners do not perceive any unusual tonal experience. If anything, they have a sense of what Gustav Güldenstein referred to as "a person standing upright in life."[1] The listeners' perception then shifts, due to the fact that they still feel the influence of the original key. The chord appears increasingly dissonant and filled with an increasingly strong urge to resolve. If we stay with the metaphor of a person standing upright, the Theory of Musical Equilibration shows that a Neapolitan sixth figuratively transforms that once-upright person into someone in utter despair who has lost every sense of support.

It is not until we apply the Theory of Musical Equilibration to this chord that we feel the contradiction between the feeling of sober-minded contentment (= the major chord) and the well-defined identification with the desire for nothing to change. This inner conflict explains the remarkable effect of the chord.

Arnold Feil confirmed that two different characters converge in a Neapolitan sixth chord, although he did not discuss this shift in the chord while it is sounding. He wrote, "We perceive this sound as jarringly dissonant (which it fundamentally is not)...."[2]

Moser's dictionary of music mentions the potential to modulate a normal major chord into a Neapolitan sixth chord:

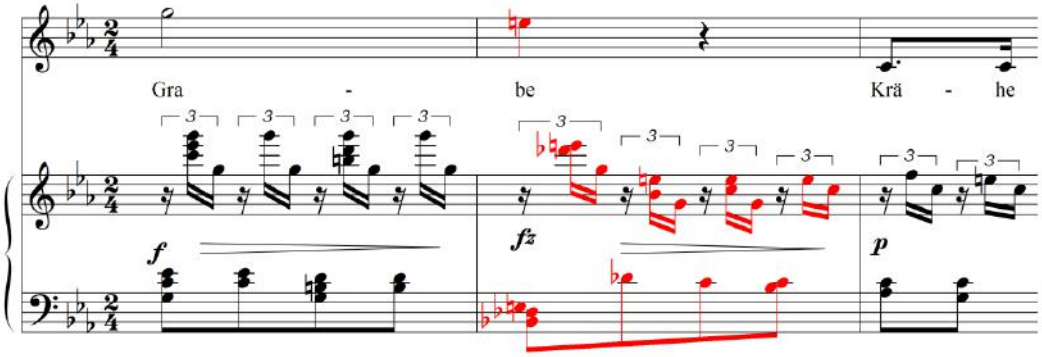
> "It is possible to "Neapolitanize" any other major chord [that is already sounding], such as those in the tonic..."[3]

[1] Güldenstein, *Theorie der Tonart*, p. 39.
[2] Feil, *Franz Schubert*, p. 70.
[3] Moser, *Musiklexikon*, p. 856.

Franz Schubert used this harmonic structure in *The Lovely Miller* and in other clear-cut cases when his lyrics referred to death or disappearance (which itself is a symbol of death). Diether de la Motte wrote of the Neapolitan sixth chord:

> "It is important to bear in mind that even in Bach's day, this chord was reserved for the most intense expression of lament and pain, and under no circumstances was it to be misunderstood as a straightforward harmonic device."[1]

1.2.13 Fright and despair in the diminished seventh chord



As this passage from "Die Krähe" ("The Crow") from Franz Schubert's song cycle Winterreise illustrates, the diminished seventh chord can communicate a sense of complete despair.

Music theory experts concur that a diminished seventh chord is considered to have several elements which strive for resolution. If you apply the Theory of Musical Equilibration here and reinterpret the urge towards musical resolution, the result is as follows: when we hear a diminished seventh chord, in multiple ways we identify with a desire that things not change. An appropriate mental image would be a person *resisting something with all of his might*. The emotional impact of this chord depends, however, on whether the anticipated tonic is a major or minor chord. If it is a minor chord and the diminished seventh chord is played loudly, it can create the impression of total despair. In Romantic music, the diminished seventh chord was played at piano volume, achieving the effect of melancholy brooding.

Author and director Reinhard Kungel described the use of the diminished seventh chord: "Consisting of three minor thirds, a diminished seventh chord is frequently used in film music to generate tension and cause people to shudder and be startled[2]."

However, the diminished seventh chord only has this characteristic when it is linked to the anticipation of a subsequent resolution in a minor tonic. If the tonic is a major chord, the diminished seventh chord can also convey the feeling of pretending to feel despair, such as the sentiment found in coquetterie. Robert Schumann liked to work with this musical effect in the double dominant to express child-like behavior. In the second

[1] De la Motte, *Harmonielehre*, p. 90.
[2] Kungel, *Filmmusik für Filmemacher* (Heidelberg: dpunkt.verlag, 2008), p. 77.

measure of *"Bittendes Kind"* from his *Kinderszenen Op. 15,* the diminished seventh chord generates the impression that a child wants to feign despair so that an adult will be moved to give the child what he wants. Robert Schumann expressed a similar scene of a humorous desperation in the song "*Ein Jüngling liebt ein Mädchen*" from *Dichterliebe op. 48*. The phrase "*…dem bricht das Herz entzwei…*" is scored with a diminished seventh chord which resolves into a major chord, thus conveying the mood of heartache within a light-hearted story.

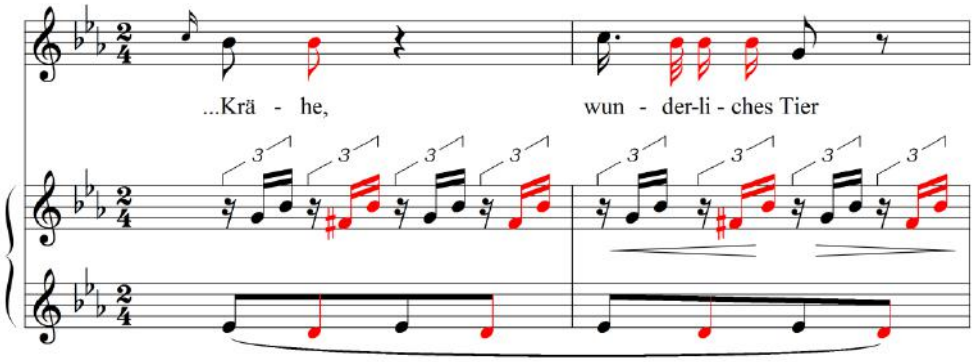
1.2.14 Astonishment and amazement in an augmented chord

A typical characteristic of the augmented chord is the ambiguous nature of the perceptible effects of musical equilibration. Diether de la Motte writes,

> "Context is what decides whether the C or the G♯ is dissonant in the triad E-G♯ -C."[1]

An augmented chord has conflicting forces of equilibration, which means that the emotional character it evokes can vary, according to the Theory of Musical Equilibration. In other words, when we hear an augmented chord, we cannot clearly identify with a will that things not change: listeners are left questioning. This chord is used to communicate amazement, surprise or astonishment. In film music, it is ideal for illustrating that something remarkable is happening in the plot. One example is the classic German movie *Das doppelte Lottchen* (directed by Josef von Baky), which was remade as the Disney movie *The Parent Trap.* A series of augmented chords is played during the scene in which the twins meet each other for the first time, utterly unaware of each other's existence until that moment.

In "The Crow" from *Winterreise*, Franz Schubert uses an augmented chord to highlight the word *wunderliches*. The dissonant effect means the chord cannot be clearly recognized at first.



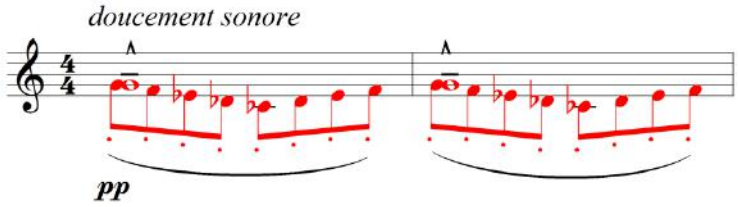
With its combination of consonance and dissonance, the augmented chord conveys a feeling of surprise because the three notes of its triad cannot be clearly interpreted, such as here in "The Crow" from "Winterreise."

[1] De la Motte, *Harmonielehre*, p. 88.

1.2.15 Floating weightlessly: the whole-tone scale

Music theorists are almost universal in their agreement about the forces of musical equilibration in the whole-tone scale: they state that it is nearly non-existent. Diether de la Motte wrote:

> "Every note of the scale can be played any every other: there is no resolution to this dissonance."[1]



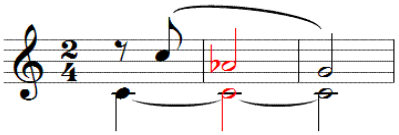
In Impressionist music, the whole-tone scale is a typical device for conveying a sense of weightlessness. In "Cloches à travers les feuilles" from Claude Debussy's Images it paints a picture of a bell ringing through the air.

Using the Theory of Musical Equilibration to interpret whole-tone sequences leads us to the following observation: when an augmented chord plays, it is extremely difficult to pinpoint the focus of the will. By a similar token, the character of the whole-tone scale corresponds to the mental image of floating weightlessly without a deliberate focus. In film music, these sorts of chords are used primarily to score moments that involve different kinds of weightlessness, such as being under water, floating in space or drifting in the subjectively gravity-free state of dreaming. A film that shows a sleeping person while playing whole-tone music is intended to convey to the audience that the sleeper is starting to dream.

1.2.16 The minor sixth is full of fear

The example of the minor sixth demonstrates that feelings can be communicated not only through complete chords but via a single interval as well. If we play a minor sixth, the chord can spontaneously produce an unusual sense of anxiety. How do we explain this? It is noteworthy that the fear-inducing effect of the sixth vanishes if the listeners' expectations can be influenced in such a way that they no longer anticipate the upper note of the interval to resolve by descending into a more consonant fifth. For example, this can be achieved by playing other harmonies and following them with a sixth as part of a consonant major chord.

[1] De la Motte, *Harmonielehre*, p. 250.



A minor sixth can generate a feeling of fearfulness.

The fear-inducing effect of the minor sixth has to be seen in the context of anticipating the resolution to the fifth. Examining this phenomenon from the perspective of the Theory of Musical Equilibration means we see it not as equilibration from the sixth to the fifth, but instead as recognizing the identification with the desire for the sixth not resolve to the fifth. And this leads us to a different question: what could be so upsetting about the fifth that we identify with the desire for this chord not to resolve — that it fills us with a sense of anxiety?

An explanation can rapidly be found if we turn to specialist literature for a description of the defining characteristics of the fifth. The Moser dictionary of music cites examples in which the fifth sounds *unearthly* or *bleak*.[1] The Ullstein dictionary of music calls the effect of the fifth *ghostly*.[2]

If we think of Ullstein's notion of ghostliness and interpret this interval using the Theory of Musical Equilibration, we reach the following conclusion: upon hearing the minor sixth, the listener identifies with desire for the music not to become eerie. The process of identifying with a desire for something not to be eerie is, however, simply another way of saying it is an awareness of a sense of fear — hence the fear-inducing effect of the minor sixth.

[1] Moser, *Musiklexikon*, p. 1001.
[2] Herzfeld, *Ullstein-Musiklexikon*, p. 431.

1.2.17 An overview of the emotional nature of harmonies

Major tonic: a feeling of sober-minded contentment.

Minor tonic: grief (when played quietly), anger (when played loudly). Also communicates all other emotions which involve *a sense of discontentment*.

Natural minor: courage, adventure, tension, danger, severity, a challenging situation.

Dominant: a feeling of motion, aspiration, liberation. The dominant of the minor tonic takes on the character of the minor and expresses stasis.

Seventh chord: resistance, protest, defiance, weepiness, weakness, braking, a walking motion. In the minor tonic, it takes on the character of the minor and expresses stasis.

Secondary dominant chord: a very adaptable character with multi-facetted uses. Telegraphs the nature of the anticipated new tonic. Can express bitter disappointment or being painfully, greatly moved. If the anticipated tonic is major: full of hope, a feeling of heading out to something new.

Major subdominant: lightheartedness, ebullience, joy, drunkenness, victory, solemnity, an emotional climax, rejoicing, satisfaction.

Major subdominant with a major seventh: like the subdominant, but with a touch of bitterness: a wistful goodbye, a final embrace, yearning, a longing dream, an awareness of the fleeting nature of joy.

Added sixth in a major chord: comfort, coziness, fidelity, warm-heartedness, warmth, togetherness, love, friendship.

Added sixth in a minor chord: loneliness, separation, abandonment, heartbreak.

Neapolitan sixth chord: disappearance, death, abandonment, immutable pain, saying goodbye forever.

Diminished seventh chord: fear, despair, panic, dismay, broody downheartedness, melancholy. If the anticipated resolving chord is a major chord: feigned despair, coquetterie.

Augmented chord: astonishment, amazement, surprise, magic, transformation.

Whole-tone scale: being weightless, under water, in space, in a dream.

Minor sixth: threat, danger, fear, feelings of anxiety.

2 Empirical observations: the tests

In the second part of this book, the empirical studies, our tests analyze harmonies and feelings to confirm the emotional effect of music. In doing so, we show that the resulting emotional responses are not a purely subjective matter, as was assumed for so long, but instead that they can be systematically classified and placed in a concrete context with certain harmonic sequences.

We will begin with the Basic Test, which was first held with 23 children and college students in January 2011. The pieces used in the Basic Test were musical selections which had been reduced to their harmonic essence, with only a few additional parameters such as tempo and volume. This bare-bones approach showed that the test subjects almost universally attributed the same emotional content to particular harmonies. After that, we will discuss the Rocky Test, which was first held in 1997 with some 300 participants. Between 2008 and 2010 over 1700 more participants around the globe took part. The Rocky Test examines people's musical preferences in correlation to emotionally moving scenes. The test results here were grouped by individual parameters such as age, sex and whether the participants played a musical instrument. The Rocky Test comes with a CD which tells the story of Sleeping Beauty and Prince Rocky, a reinterpretation of a fairy tale. The story is divided into eight scenes, each of which features a different emotional character, and the participants had to link each scene to pieces of music. The fairy-tale nature of the Rocky Test was an obvious choice for determining the musical preferences of children, although it can also be used with adults.

Since the Rocky Test and the Basic Test overlap in terms of the harmonies they present, they confirm and complement one another. This can be beneficial no matter how the tests' statistical merit is analyzed. Both the Basic Test and the Rocky Test were deliberately designed to be easily reproduced anywhere and at any time as long as a piano or CD player are available.

Looking ahead to the future, the results of our test call for a totally new approach to the scientific paradigm about music and emotions. They also emphasize that the theoretical foundation of these tests — Bernd Willimek's Theory of Musical Equilibration — is the essential key to understanding the emotional effect of music, as well as the sole possible explanation of this phenomenon.

Furthermore, our test results open up a broad range of new opportunities in research and practical applications throughout several branches of musicology, music theory, music psychology as well as music therapy.

2.1 The goal, designing the tests, and early models

2.1.1 Goal of the research

Nowadays it is an undisputed fact that certain harmonic structures trigger the same responses in people and are linked to the feelings they evoke. Until recently, this insight received very little scientific attention. Our tests were intended to validate our findings on a general level. Beyond that, they were designed to verify that the emotions generated by music generally function in keeping with the principle described by the Theory of Musical Equilibration.

2.1.2 Inspiration for the research

The inspiration for our project came from the writings of Ernst Kurth as well as observations and surveys on the effects of musical harmonies. When we studied the emotional effect of musical harmonies, our general queries among preschoolers, school children, music majors and adults yielded clear initial patterns. We then started documenting our findings systematically and using them as the basis for developing test questions.

A key source of inspiration for our work came from the musical repertoire itself. The broad depth of material led us to the realization that composers use musical harmonies quite deliberately to describe specific emotional content. This can be easily observed in vocal music and in films, where music appears in tandem with the messages conveyed by the lyrics or performance.

2.1.3 The impetus and the tests' theoretical foundation

The work which provided the impetus and theoretical underpinnings of our tests was Bernd Willimek's thesis *Die Strebetendenz-Theorie*[1], which in turn was based on his work *Das musikalische Raumphänomen*[2]. The latter described the basic principle of the Theory of Musical Equilibration.

The Rocky Test and Basic Test were both developed over the course of many years of research. It took countless surveys among children and adults of all ages to determine what kinds of tests would be especially fruitful. Correlations between lyrics and harmonies became apparent through intensive studies of musical literature across all periods and styles. TV and film scores also provided a rich range of examples which illustrated the use of harmonies in emotionally charged scenes.

[1] Willimek, *"Die Strebetendenz-Theorie", Tonkünstlerforum Baden-Württemberg.*
[2] Willimek, "*Das musikalische Raumphänomen*," graduate thesis.

2.1.4 Challenges in designing the tests

The fundamental problem of any research that attempts to analyze the emotional effects of music is that a person's feelings are not visible to others. The only data that can be gathered are reactions and statements. Music itself is obviously invisible as well: in terms of its substance, it consists of lifeless frequencies — and not of any images, terms or emotions.

Even if emotions could be quantified directly, there would still be another problem in terms of empirical analyses: how do we know that participants are really describing the sentiments they feel in response to a particular piece of music? Without even being aware of it, they could very well be describing their mood on a given day or the feeling that arises from a different stimulus, such as the color of the room they are in, or the personal charisma of the individual conducting the test.

2.1.5 Designing the tests

All of these challenges led us to conclude that our tests could work well if they took an indirect approach. One such option would be to present our participants different musical harmonies in the context of a musical fairy tale; after hearing the story, we would then ask them about how well-suited different pieces of music were as accompaniment to various scenes from the story. Another way to prevent participants from directly integrating their immediate emotions was asking people to envision themselves as movie directors who had to find the appropriate score for scenes from a film.

At the same time, we conducted direct surveys in which people had to link musical harmonies to certain emotions. We also asked children to draw pictures, create fairy tales or think back to their memories as they listened to short musical selections.

2.2 The Basic Test

2.2.1 The concept of the Basic Test

To make the insights of the Theory of Musical Equilibration viable for research purposes, we developed the Basic Test. It was the first instrument to provide quantifiable proof that people perceive the emotional impact of musical harmonies at a significantly consistent rate. The number of matches which confirmed the Theory of Musical Equilibration was the same for Part A and Part B: 92.17% each.

The Basic Test is a preference test which captures the correlation between harmonies and emotions. Participants heard short pieces on the piano which were designed in such a way that they only presented the basic tonal properties in their simplest form — the musical harmony along with volume and tempo. In extreme cases, the pieces consisted of repetitions of the same chord or brief cadences. The melody was kept to a bare minimum, if not eliminated altogether, in the pieces used in the Basic Test.

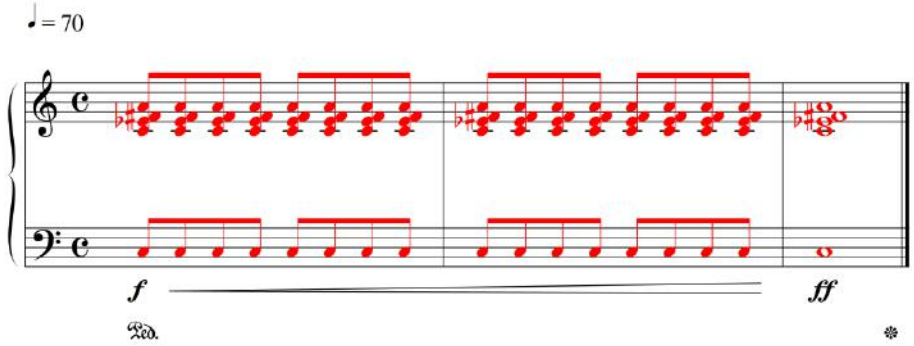
In Part A of the Basic Test, participants were asked to match pieces of music with certain scenes which featured emotional content. The music had to be allocated to one of five fictitious film scenes, each of which was linked to a particular concept: *despair*, *wandering*, *loneliness*, *magical transformation* and *dreams of summer*. At the participants' request, the pieces could be repeated as needed.

In Part B of the Basic Test, the participants were given five tasks, and in four they had to select one of two options which they felt was a better match for a particular term. For the fifth task, they had to select a multiple-choice response which best expressed their response to changes in a repeating minor chord that grew louder. The Basic Test also documented the parameters of age, sex and the participants' musical activity.

2.2.2 The pieces of music used for Part A of the Basic Test

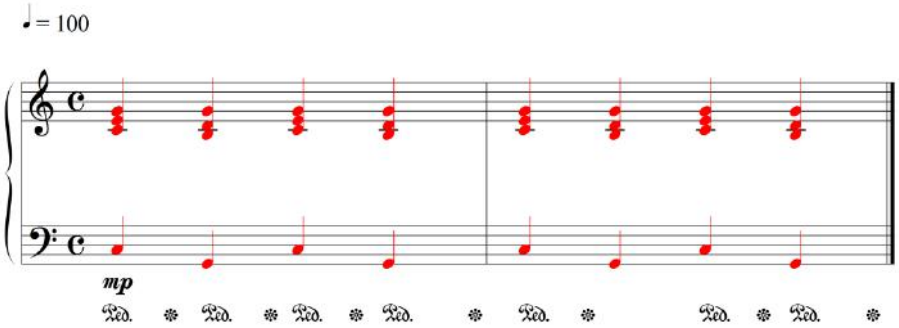
Part A of the Basic Test consists of five pieces which our participants had to match with five emotionally charged terms. The terms were *despair*, *wandering* (a *feeling of motion*), *loneliness*, *magical transformation* and *dreams of summer*. There was an average match rate of 92.17% in the responses which confirm the Theory of Musical Equilibration. This figure provides the initial validation that harmonic functions are emotionally perceived in a similar fashion and that these perceptions can be grouped in a depictable system. This system corresponds to the conclusions of the Theory of Musical Equilibration. All of the musical pieces were played on the piano. The red notes in the sheet music below indicate the passages which feature the respective harmony.

Piece 1, despair



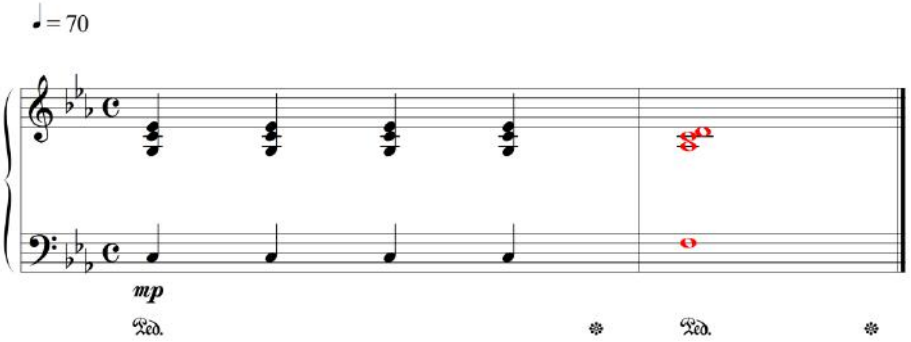
Piece 1 consists of a **diminished seventh chord** over C. 86.96% of the participants linked this diminished seventh chord to the term “despair” (cf. "Fright and despair in the diminished seventh chord," p. 20).

Piece 2, wandering (motion)



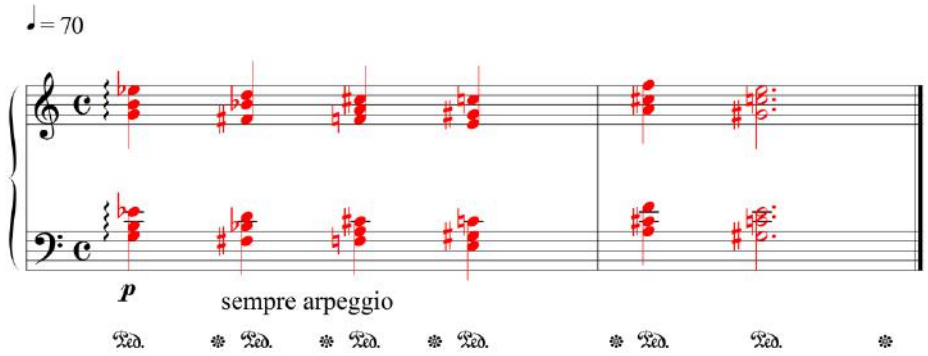
Piece 2: The shift between **tonic and dominant** is described in the Theory of Musical Equilibration as an expression of motion. Participants stated that this harmonic pattern evoked the term “wandering” at at a rate of 86.96% (cf. "The dominant chord in major brings motion into music," p. 12).

Piece 3, loneliness



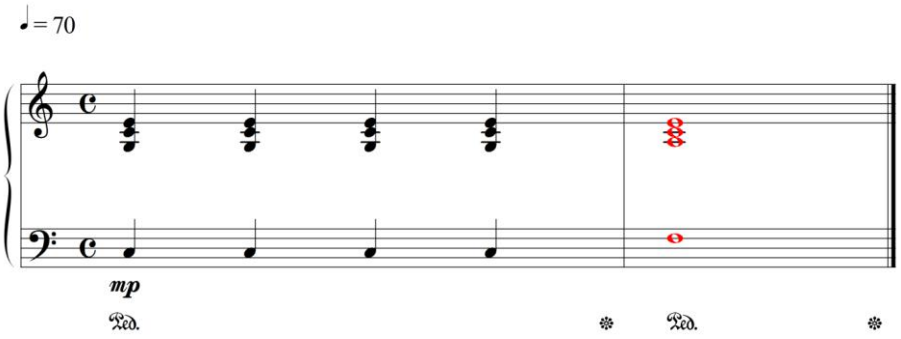
Piece 3: The Theory of Musical Equilibration describes the **minor subdominant with an added sixth** as a means of expressing loneliness. In the test 95.65% of the participants correlated this piece with the term “loneliness” (cf. "The added sixth chord in a minor chord represents heartbreak and loneliness," p. 18).

Piece 4, magical transformation



Piece 4: The Theory of Musical Equilibration describes the **augmented chord** as a way of conveying surprise or astonishment, which can be explained by the wandering leading notes in this chord. Participants recognized this effect rather clearly, and 95.65% of them linked this piece with the term “magical transformation” (cf. "Astonishment and amazement in an augmented chord," p. 21).

Piece 5, dreams of summer

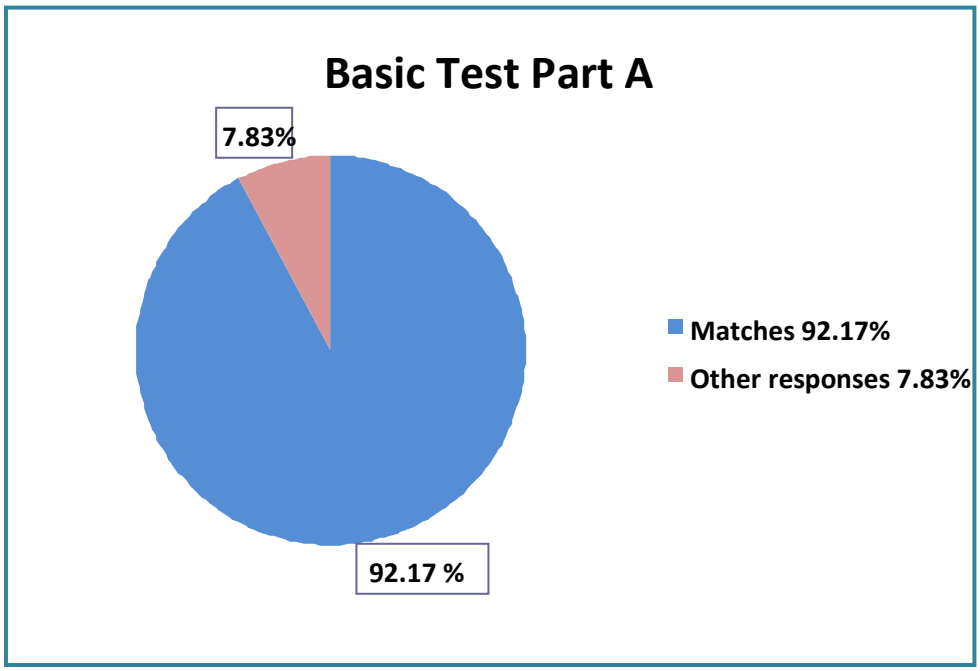


Piece 5: The majority of participants felt that this piece, which ends on the **subdominant with a major seventh**, fit the term "dreams of summer," and 95.30% of them matched the two. The Theory of Musical Equilibration describes this chord as an expression of wistfulness (cf. "The subdominant with a major seventh as an expression of wistfulness," p. 15). In light of the fact that we dream of summer when it is not summer, the link between the ideas of a summer dream and wistfulness can be explained by a definition

found in the *Wörterbuch der philosophischen Grundbegriffe* (p. 691): "Wistfulness is the emotional state of sadness which arises either from the memory of a past pleasure, a lost good or a realization about the impossibility of attaining a sought-after good. This sorrow is also tinged with a feeling of desire."[1]

2.2.3 Overall results of Part A of the Basic Test

In Part A of the Basic Test, the 23 participants had a 92.17% match rate when it came to linking the music and concepts in a manner that confirms the Theory of Musical Equilibration. The figure of 92.17% resulted from 106 correct responses to the 5 questions in Part A.

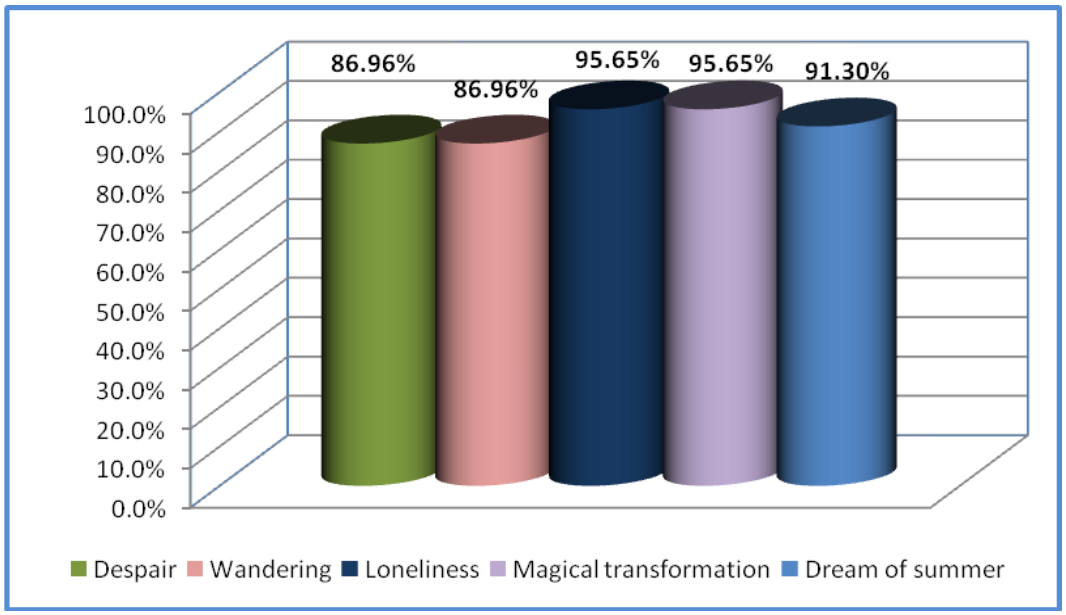


In Part A of the Basic Test, the 23 participants selected the right piece of music 92.17% of the time. The major degree of correlation in the responses to individual questions cannot be interpreted using standard scientific approaches, but the Theory of Musical Equilibration clarifies why this is possible.

[1] Friedrich Kirchner, Carl Michaëlis, *Wörterbuch der philosophischen Grundbegriffe*, 5th newly revised edition (Leipzig: Verlag der Dürr'schen Buchhandlung, 1907), p. 691.

2.2.4 Individual results of Part A of the Basic Test

Despair	Wandering	Loneliness	Magical transformation	Dream of summer
86.96%	86.96%	95.65%	95.65%	91.30%



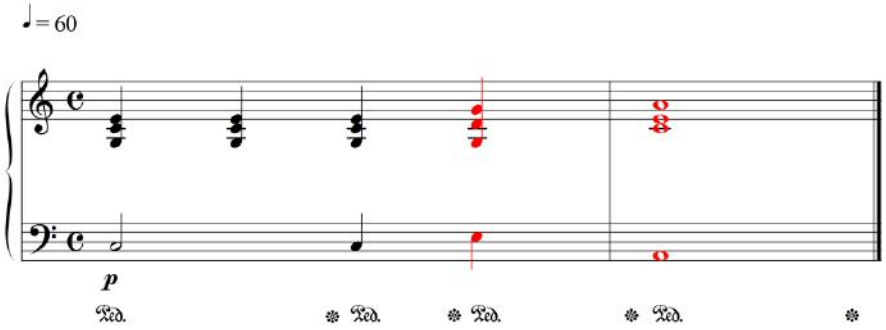
At a mean rate of 92.17%, Part A of the Basic Test yielded a high number of matches when it came to selecting harmonies that bear out the Theory of Musical Equilibration. The diminished seventh chord in the fortissimo was identified as a sound of despair, and the progression from tonic to dominant was deemed an expression of motion. The minor added sixth chord as a chord of loneliness and the augmented chord as a sound of magical transformation generated the largest number of matches at 95.65%. The participants said that in comparison with other harmonies, the wistful subdominant with a major seventh clearly conveyed the idea of summer dreams. Since the participants who took Part A had five different pieces to match with a given emotion, the high match rate of 92.17% serves as a significant confirmation of the general effects described in the principles of the Theory of Musical Equilibration.

2.2.5 The music used in Part B of the Basic Test

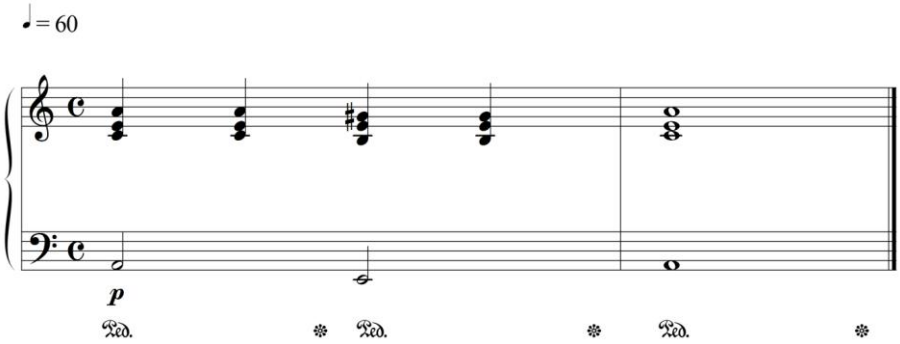
Part B of the Basic Test entails four tasks in which participants express a preference about which piece best reflects an emotional term. In the fifth task, participants are asked about the way the character of a minor chord changes as it grows louder. As was the case in Part A of the Basic Test, these pieces are played on piano.

Question 1: *Which piece sounds more adventurous?*

Piece 1



Piece 2



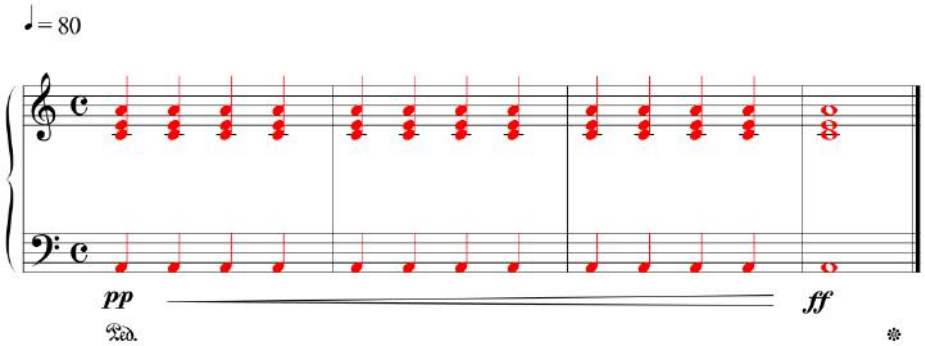
In the first selection played, the minor harmonies do not create the sense of sorrow people usually equate with minor chords. Instead, they have a more adventurous effect. The Theory of Musical Equilibration explains this fact as a product of the **natural minor** in the last two chords, which rule out the anticipation of the dominant leading note. 69.52% of the participants thought Piece 1 sounded more adventurous than piece 2 (cf. "Natural

minor goes with tension, courage and adventure," p. 14). The second example contains minor

harmonies and dominant major chords. The Theory of Musical Equilibration describes this combination as an expression of sorrow. (cf. "Why is it that major chords sometimes sound as sad as minor chords?", p. 11)

Question 2: *Which of the following statements best describes the way the chord changes?*

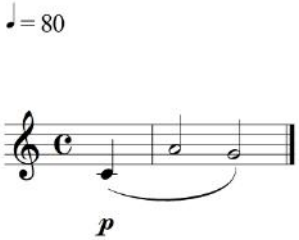
Piece 1



A **minor chord** is repeated several times and grows louder. The participants are to listen to the three pieces and select the phrase they think best describes the change: *sorrow turns into anger; sorrow turns into joy; anger turns into sorrow*. All of the participants chose "sorrow turns into anger." The Theory of Musical Equilibration explains that minor chords communicate the idea of "No more," which plausibly justifies both possible emotional interpretations — sorrow and anger — depending on the volume (cf. "Why do minor chords sound sad?," p. 9).

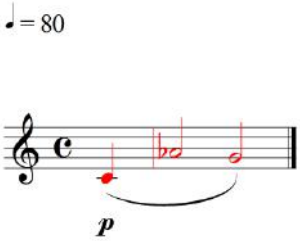
Question 3: *Which piece sounds more threatening to you?*

Piece 1



Major sixth

Piece 2

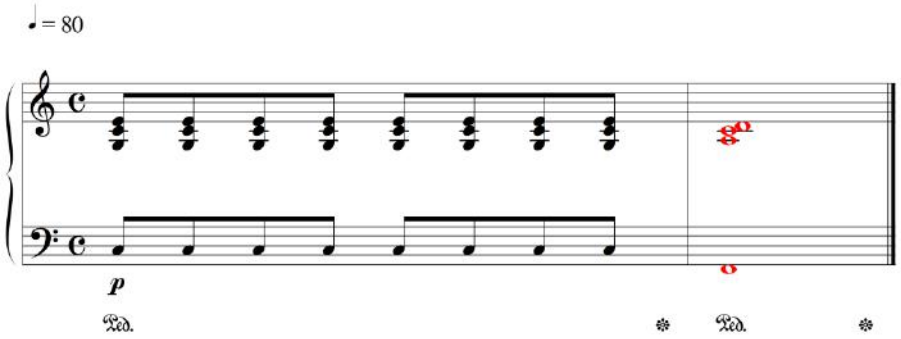


Minor sixth

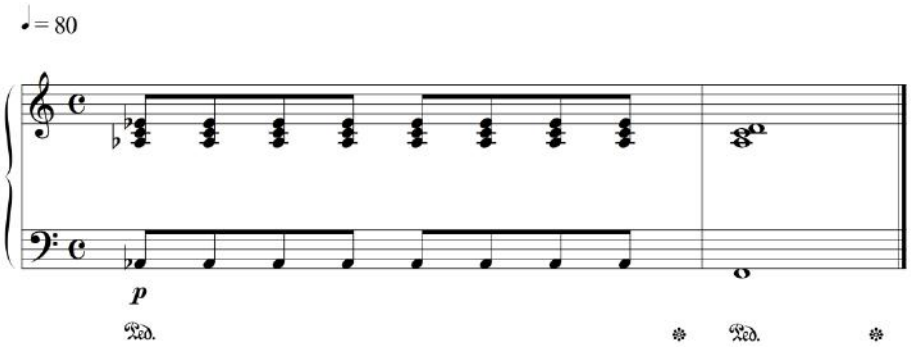
The participants were to choose which of these two pieces – one with a major sixth, one with a **minor sixth** – sounded more menacing in their opinion. All of them selected the piece with the minor sixth. The only explanation for this phenomenon is found in the Theory of Musical Equilibration (cf. "The minor sixth is full of fear," p. 22).

Question 4: *In which of the two pieces does the final chord convey a stronger sense of warmth and comfort?*

Piece 1



Piece 2

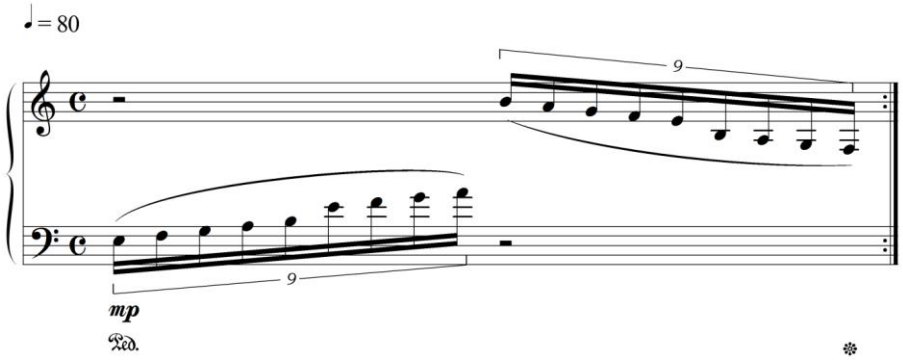


The first piece ends on a **subdominant with an added sixth**. The Theory of Musical Equilibration explains why this chord can convey a sense of emotional comfort (cf. "The added sixth in a major chord as an expression of warmth and security," p. 17). In keeping with this theory, 95% of the participants chose this harmony for the scene expressing comfort. It may come as a surprise that the same chord was used in both pieces and yet elicited different responses. The difference, however, is that in the second piece, the final

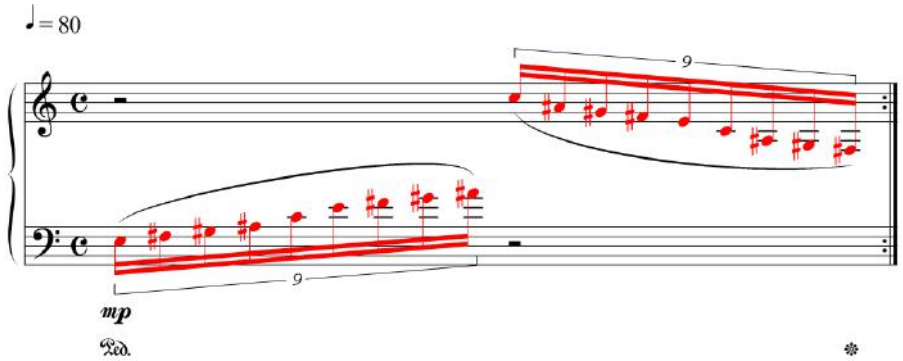
chord does not have a subdominant function. The participants' choice clearly shows that different harmonic functions can have different emotional effects, even if they involve the same chord. These results unequivocally confirm the validity of the Theory of Musical Equilibration, which explains the emotional effect of chords based on their function.

Question 5: *Which piece would go better with an underwater scene?*

Piece 1



Piece 2

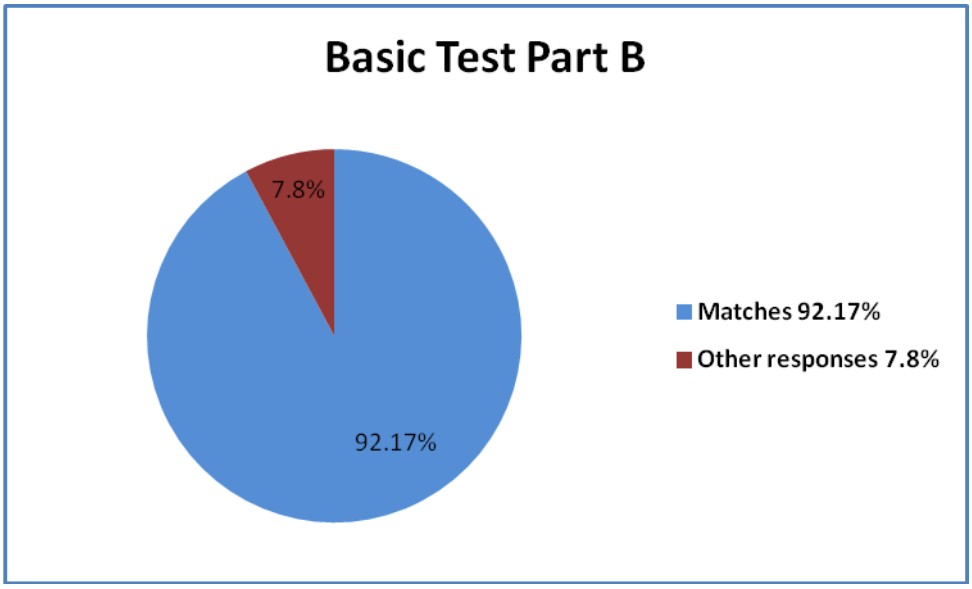


The ninth notes in the first piece consist of notes from the Phrygian scale. Only 5% of the participants said it went well with an underwater scene. The other 95% preferred the same ninth notes from the **whole-tone scale** in the second piece. Both pieces were designed to resemble each other as closely as possible otherwise and are only different in terms of the scales they feature. As a result, this comparison is a clear confirmation that the Theory of Musical Equilibration is valid in how it interprets the emotional character of chords based on the effects of their leading notes. Due to its lack of leading notes, the whole-tone scale is perceived as an expression of weightlessness, whereas the Phrygian

scale in the first piece does not seem suitable for the scene because it contains leading notes (cf. "Floating weightlessly: the whole-tone scale," p. 22).

2.2.6 Overall results of Part B of the Basic Test

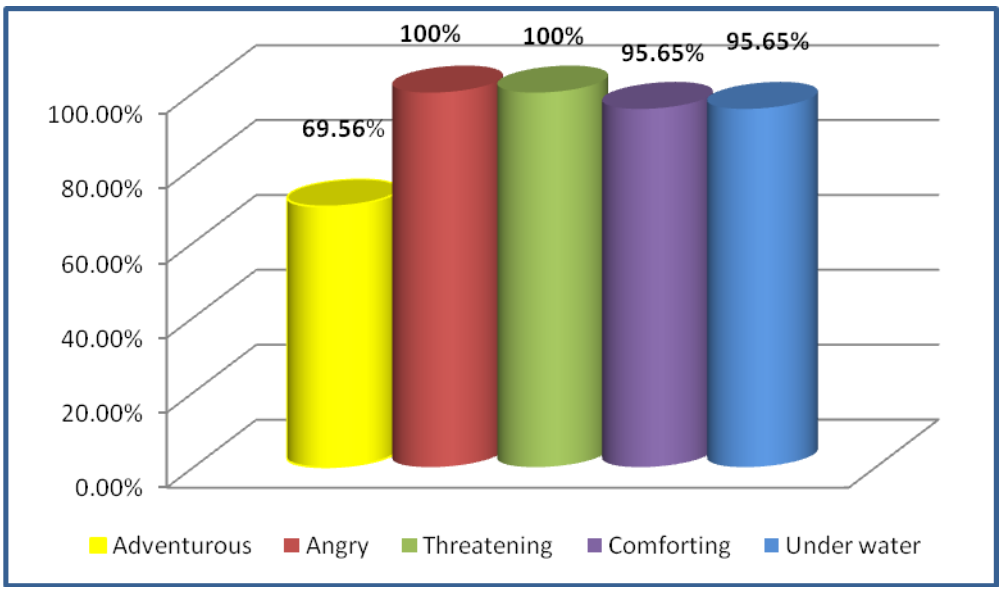
All in all, the 23 participants selected the appropriate examples in Part B of the Basic Test at a rate of 92.17%. This 92.17% was also the outcome of Part B with 106 correct responses to the 5 questions.



In Part B of the Basic Test, the 23 participants picked the appropriate piece at a rate of 92.17%. As was the case with Part A, the high correlation in the response rate cannot be explained with standard scientific methodology: the Theory of Musical Equilibration is the only valid explanation.

2.2.7 Individual results of Part B of the Basic Test

Adventurous	Angry	Threatening	Comforting	Under water
69.56%	100%	100%	95.65%	95.65%



Part B of the Basic Test yielded results of 92.17% in the preference for harmonies which reinforce the hypothesis of the Theory of Musical Equilibration. 69.56% of the participants thought that the example with the parallel tonic sounded more adventurous than the one with a minor tonic and major dominant. Everyone identified the rising minor chord as an expression of anger. In an equally unanimous fashion, all of the participants indicated that the minor sixth expressed more of a threatening character than the major sixth. The outcome for "comforting" unequivocally confirms that the same chord can have an entirely different emotional effect if it is used in different harmonic functions. This is excellent proof of how solid the Theory of Musical Equilibration is.

2.2.8 Where was the Basic Test held?

The test was held among 18 school students at the Municipal Music School of Mannheim and 5 music majors at the Karlsruhe University of Music.

2.2.9 How was the Basic Test held?

Each participant received a questionnaire divided into Part A and Part B. Part A is a preference test in which they were asked to link five terms — *despair*, *wandering*, *loneliness*, *magical transformation* and *dreams of summer* — to five brief musical selections. Part B is also a preference test consisting of 5 tasks. In the first four, participants listened to two pieces and chose which was a better match for an emotionally charged term. The fifth task involved assigning one of three descriptions to a series of increasingly loud minor chords (cf. "Basic Test questionnaire," p. 77). All of the pieces were played on the piano.

The questionnaire asked about the participants' sex and age as well as whether or not they played a musical instrument. Once the participants were adequately informed about the test procedure, the pieces were performed by the monitor. Upon the participants' request, the pieces could be repeated. Once all of the questionnaires had been filled out, the monitor collected them.

2.2.10 Analyzing the Basic Test

The statistical analysis of the questionnaires covered the participants' preferences and their other responses.

2.2.11 Interpreting the results

The results of the Basic Test leave no doubt that musical harmonies serve as a means of conveying emotional messages. The fact that the participants gave almost identical responses in attributing five key words to five pieces in Part A of the Basic Test also confirms that linking harmonies to the emotions they trigger is something that is not a merely subjective process: it can be systematically categorized on a generally applicable level. In every way, this system clearly reflects the conclusions of the Theory of Musical Equilibration.

2.3 The Rocky Test

2.3.1 The Rocky Test concept

We developed the Rocky Test so we could take a nuanced approach to exploring the hypothesis of the Basic Test, which was that musical harmonies are largely perceived in the same manner, emotionally speaking. This is a preference test which presents a musical fairy tale featuring various scenes with emotional content, such as feelings of comfort, despair, courage or weightlessness. Two musical selections were designed to accompany each scene, and only one of each of these pieces corresponded to the harmonies which the Theory of Musical Equilibration linked to the emotions in question.

2.3.2 Designing and developing the Rocky Test

We developed a test CD for the Rocky Test which tells the musical fairy tale of Sleeping Beauty and Prince Rocky. Loosely based on a story by the Brothers Grimm, the fairy tale contains eight scenes with varying emotional content. Each of these scenes was accompanied by a particular piece and then repeated with a different score. The intention was for the fairy tale to induce the respective feelings in the participants directly, as it were, instead of simply presenting people with the description of an emotion. The participant was supposed to feel the respective emotion first-hand.

For the musical choices, we isolated eight particular chords or cadences, the majority of which we had observed in the literature of the Romantic and Impressionist epochs as well as film and pop music. These pieces correlated with passages that were relevant in terms of their lyrics or emotional content (cf. also " Noteworthy examples of musical harmonies," p.71ff.). Specifically, they were as follows: the whole-tone scale, the diminished seventh chord, the augmented chord, the added sixth chord in major, the added sixth chord in minor, the natural minor, a progression of alternating tonic – dominant, and the subdominant with a major seventh.

The pieces of music were designed in such a way that they had no other significant musical characteristics other than their harmonic structure. In some cases this was quite simple, whereas in others it was more complicated since some harmonies cannot fundamentally be determined until they have been preceded by other harmonies.

2.3.3 The fairy tale used in the Rocky Test

In the Rocky Test, participants listened to a CD which told the fairy tale of Sleeping Beauty and Prince Rocky. The text of the fairy tale can be found below. The passages marked in blue were read twice with different music each time. The participants had to decide which piece they found more appropriate for each scene.

The tale of Sleeping Beauty and Prince Rocky

A long, long time ago, there was a castle in a faraway land. A king and queen were the rulers of this land, and they had a beautiful daughter. On her eighteenth birthday, her parents held a huge party and invited many of their friends and relatives. They failed, however, to include one person: the princess' piano teacher. As the party was in full swing, the teacher appeared at the door, full of fury, and pronounced a terrible curse: the castle and all who lived in it, be they humans or beasts, would fall into a deep sleep for one hundred years, and this spell could only be broken by the true love of a prince.

Scene 1 **(Piece 1)**

And thus it was. The entire castle fell into a deep sleep, and a forest of thorns began to grow around the castle. Year by year it grew higher and thicker, and soon the castle was completely covered and could not be seen any more.

(Piece 2)

And thus it was….

Soon the tale of the castle amidst a forest of thorns spread through the land. Many brave young men tried their luck in finding the castle and breaking the spell, but with no success. None of these adventurers ever returned.

Scene 2 **(Piece 1)**

One day Prince Rocky set out to find the castle. Cheerful and brave, he put on his boots and went on his way. As he walked, he happily whistled and sang joyful wandering songs.

(Piece 2)

One day Prince Rocky set out….

Along his journey through many countries, Rocky saw all sorts of things: forests, wild mountain canyons, cities, lakes and rivers. One day it was very hot and he was quite thirsty, so he stopped to drink some water from the bubbling headwaters of a clear lake. He was suddenly startled: at the bottom of the lake, he thought he saw a figure fighting for its life.

Scene 3 **(Piece 1)**

Immediately he dove into the water, swimming down deeper and deeper. A strange feeling overcame him at the sight of the bizarre, glittering reefs beneath him.

(Piece 2)

Immediately he dove….

The struggling creature turned out to be a mermaid who was desperately trying to get free: her long hair had been caught in the seaweed at the bottom of the lake. Rocky helped her untangle herself. Astonished, he realized that he could not only breathe underwater but speak as well. So he asked the mermaid if she was hurt. “Eh, nothing serious,” she said with a wave of her hand as she thanked Rocky for his help. She said, "Since you set me free, I will grant you three wishes." Without hesitating, Rocky said, “First of all, I definitely need a motorcycle so I can get to the castle as quickly as possible and free the princess who has been sleeping there for one hundred years. Second, I need the right kind of gear, and last but not least …..” — “Not so fast,” said the mermaid, “You've already used two of your wishes. Think long and hard about the third: the day may come where you need the wish more than you do today.” – Rocky said thank you, put on his new leather jacket, hopped onto the Harley and took off. – After a long journey, he finally arrived at the castle, exhausted from his travels. From far away he could see the thick high forest of thorns. As he grew closer, he saw that there were three other princes who were also trying to make their way through the thorns and reach the princess.

Scene 4 **(Piece 1)**

But then he was overcome by absolute horror. The branches of thorns turned into terrible tentacles which grabbed the three princes, ensnared them and tossed them around in the air. As desperately as they fought, they all died a terrible death.

(Piece 2)

But then he was overcome….

When Rocky saw this, he was horribly afraid and sank to the ground, despondent. Wouldn't it be better if he turned back?

Scene 5 **(Piece 1)**

Suddenly, though, Rocky got in touch with his inner hero. Cool as a cucumber, he straddled his motorcycle, put on his shades and helmet, and started up the bike with a steely look in his eye. “It's now or never,” he said, determined. He revved the engine, and the heavy bike slowly started to move. He then abruptly accelerated and popped a wheelie. He raced towards the forest of thorns, driving faster and faster.

(Piece 2)

Suddenly, though….

As if by magic, the forest of thorns opened up around him, and Rocky safely made his way into the courtyard of the castle. There he could feel the profound silence of the hundred-year sleep. Rocky crossed the courtyard and made his way through the enchanted rooms until he found himself in Sleeping Beauty's room. She was lying on her bed, asleep. Rocky remembered that in fairy tales you always had to kiss the princess to lift the evil curse, so he went to her side and kissed her. She opened her eyes and sat up. Overjoyed, she thanked him for saving her, and since she really liked Rocky and he liked her, they decided they would stay together forever.

Scene 6 **(Piece 1)**

In the evening they sat at the fireplace and enjoyed the coziness of being together. Rocky was tired but very happy. He caressed the princess' hand, and both of them felt happy, warm and safe. They promised they would be true to each other for all eternity. Rocky leaned his head on her shoulder. He had never felt such peacefulness in his entire life.

(Piece 2)

In the evening they sat at the fireplace….

The next morning, however, the evil piano teacher reappeared, even though everyone had long since forgotten about her. She looked at the princess with a heart full of hatred and reminded her that it was actually time for Sleeping Beauty to go practice: it had already been one hundred years since she last practiced, and now that she had a boyfriend she was bound to lose interest altogether. The piano teacher commanded the princess to say farewell to her sweet prince immediately, or else she would turn him into a piano stool. Rocky and the princess saw they had no choice, and they decided to part.

Scene 7 **(Piece 1)**

Tears came to their eyes. They looked at each other full of longing and swore their love would never die. Rocky took the princess into his arms again and told her how much he wished he could stay with her. Then he gave her one last kiss and headed out.

(Piece 2)

Tears came to their eyes….

When Rocky left, there was great sorrow. The princess stood at the window and looked out, miserable.

Scene 8 **(Piece 1)**

She bleakly watched the clouds as they passed by, and she felt terribly alone. "I slept for one hundred years, and it was all for nothing," she said. "I must be the loneliest person in the world." Sadly she turned away from the window in her tower, covered her face with her hands, and wept bitterly.

(Piece 2)

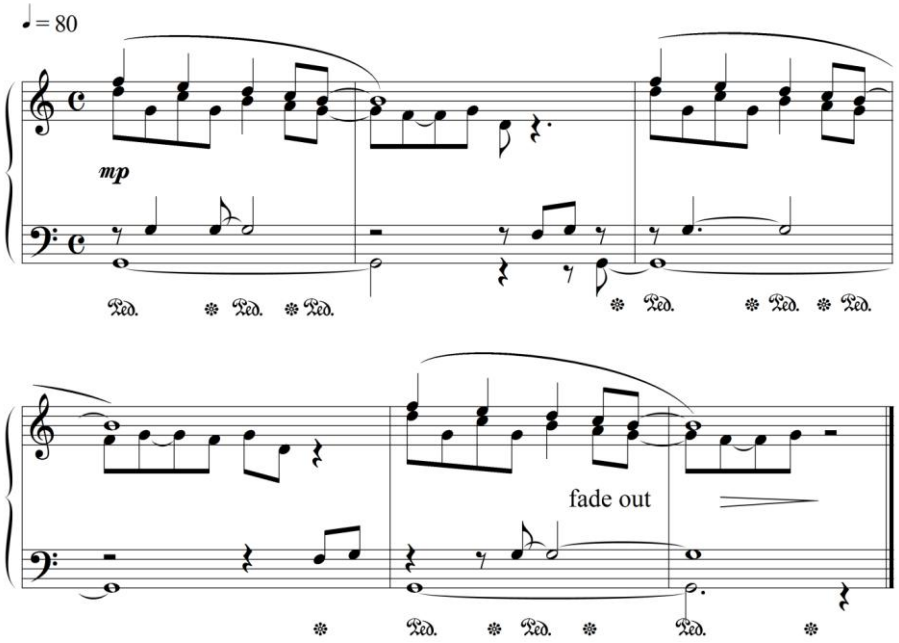
She watched the clouds….

Rocky, who was already far away from the castle, felt just as miserable and lonely. But all of a sudden he remembered — the wish! He still had wish he hadn't used yet! How could he have forgotten! The only thing he wanted was for the piano teacher to lose her powers forever and ever. It'd be worth a try. So he said his wish out loud and returned to the castle. Even from far away, he could hear the piano teacher screaming at Sleeping Beauty, who was in the middle of a lesson. "F♯! F♯! F♯!" she shrieked, because the princess always missed the sharp and played an F natural. As Rocky walked in, the piano teacher became so enraged at the sight of him that her face changed color: first she turned a greenish-yellow, then black, then white as a sheet. Her voice trembling, she hissed, "I warned you! Now you shall be turned into a piano stool for ever and ever!" – But nothing happened. She simply could not manage to do anything to the prince. When she noticed that her magic powers were gone, she stomped on the ground in fury and ran as fast as her feet could carry her. She was never seen again. And the princess and Prince Rocky lived happily ever after.

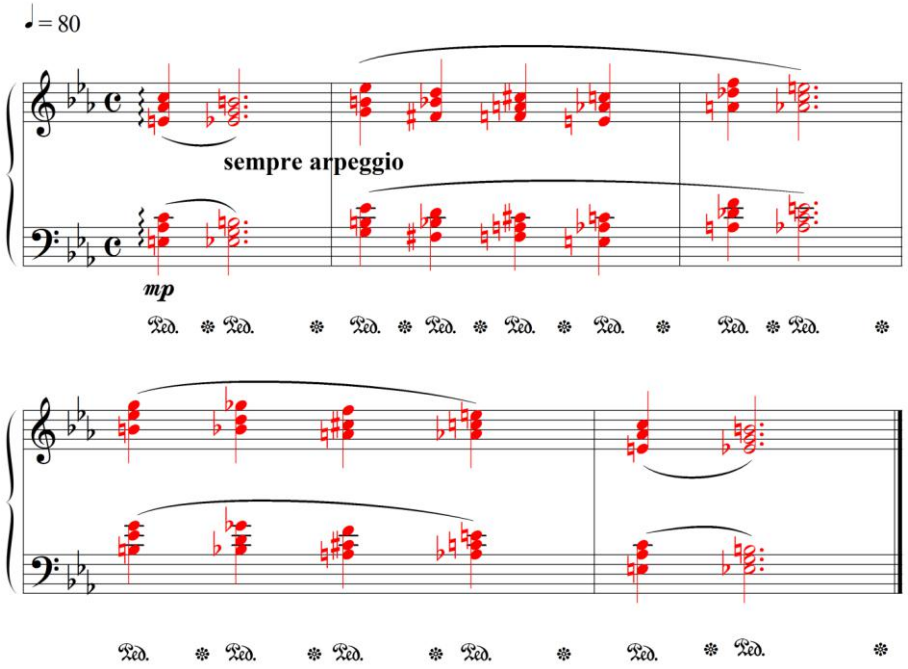
2.3.4 The music used in the Rocky Test

Scene 1, astonishment

Piece 1 – rarely selected



Piece 2 – selected most frequently

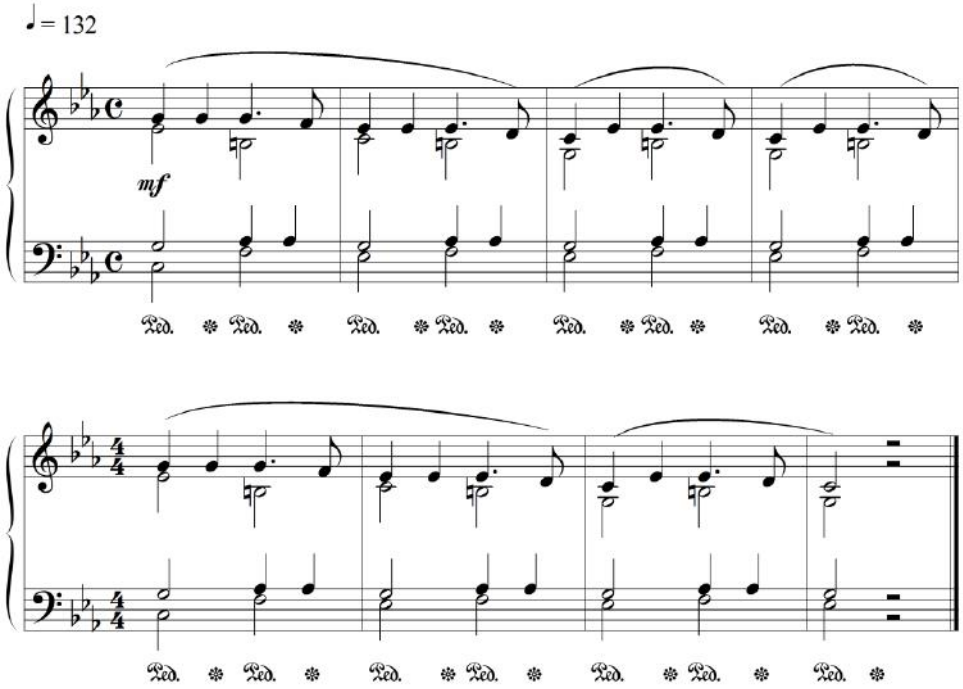


The second piece contains nothing but **augmented chords**, which are described in the Theory of Musical Equilibration as an expression of amazement and astonishment. At a rate of 68.2%, this piece was chosen over the first example as a good match for the scene in which the forest of thorns surrounds Sleeping Beauty's castle.

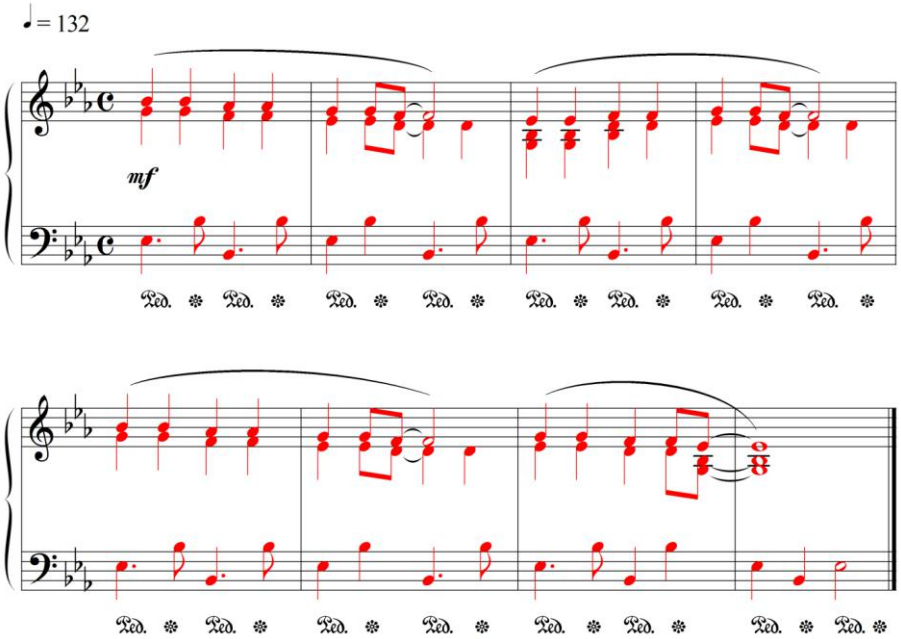
By contrast, the first piece played in the Rocky Test consists of dominant seventh chords, although it was modified to resemble the second piece in terms of its tempo, volume and structure. Only 31.8% of the responses indicated this was a suitable choice for Scene 1. Several participants who selected this piece said when they heard the music, they thought about the thorns growing, whereas participants who selected the piece with the augmented chords said they thought it was more appropriate for the magical nature of the scene. Both statements perfectly validate the way the Theory of Musical Equilibration describes the dominant and the augmented chord (cf. "The dominant chord in major brings motion into music," p. 12, and "Astonishment and amazement in an augmented chord," p. 21).

Scene 2, motion

Piece 1 – rarely selected



Piece 2 – selected most frequently

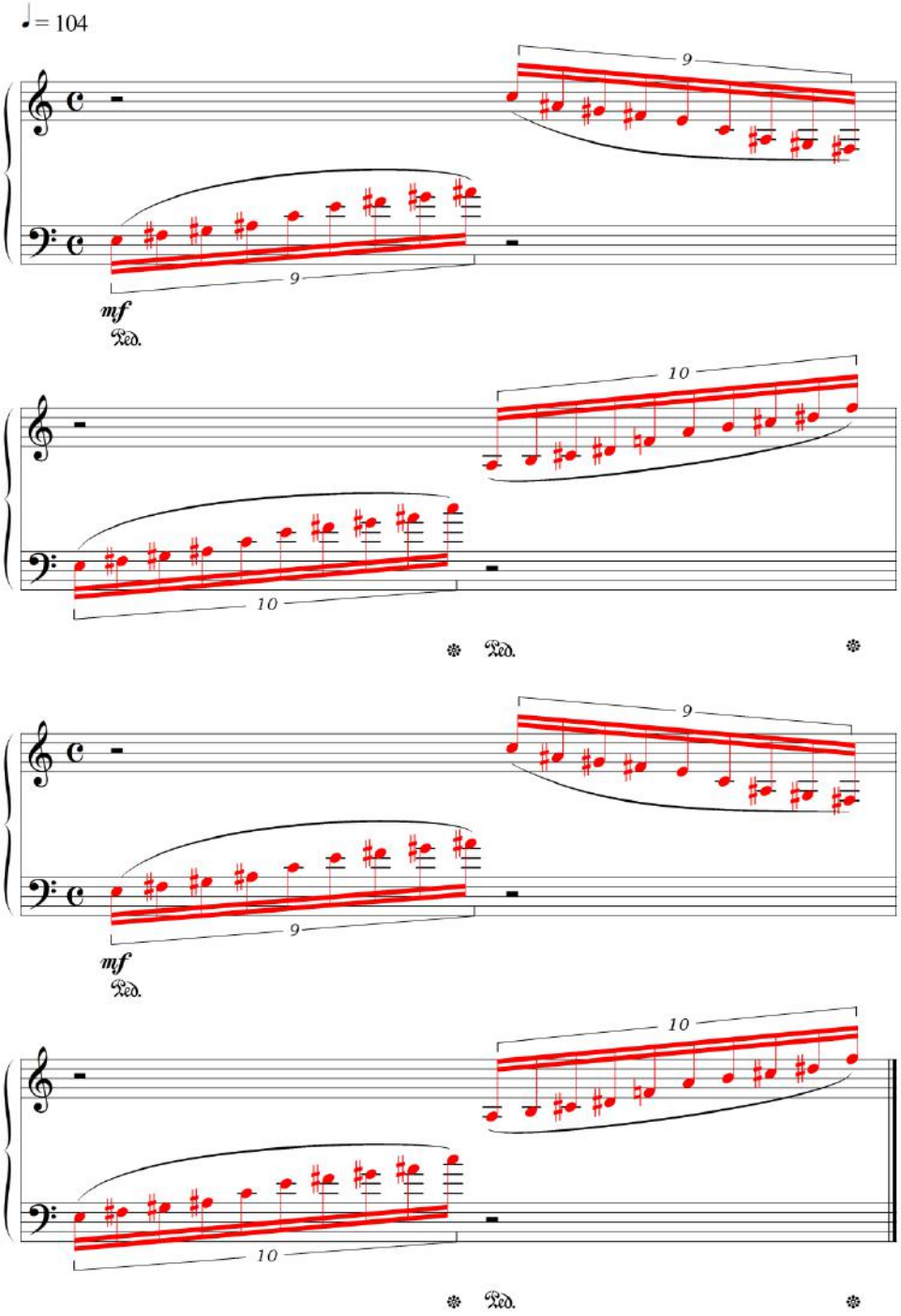


The first piece consists of cadence-like harmonies in a minor key. To make it more comparable to the second piece, not only was a similar tempo chosen, but a syncopated structure was used as well. Upon listening casually, this accentuated rhythm could certainly suggest a sense of motion and thus steer people's preference. Despite this, the first piece was not the popular favorite.

The harmonies in the second piece alternate between the **major tonic** and **dominant**. 84.62% of the participants voted for this piece with harmonies which the Theory of Musical Equilibration describes as an expression of motion (cf. "The dominant chord in major brings motion into music," p. 12).

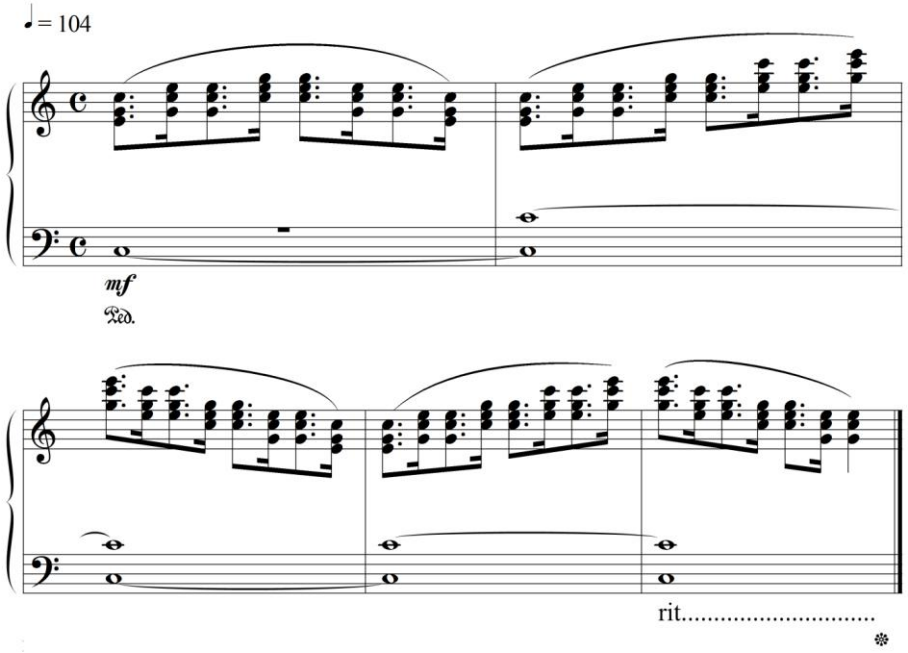
Scene 3, weightlessness

Piece 1 – selected most frequently



The **whole-tone scale** can convey a state of weightlessness (cf. "Floating weightlessly: the whole-tone scale," p. 22) and is thus suitable for accompanying underwater scenes. The participants clearly understood of this scale, and 84.07% deemed it a suitable piece.

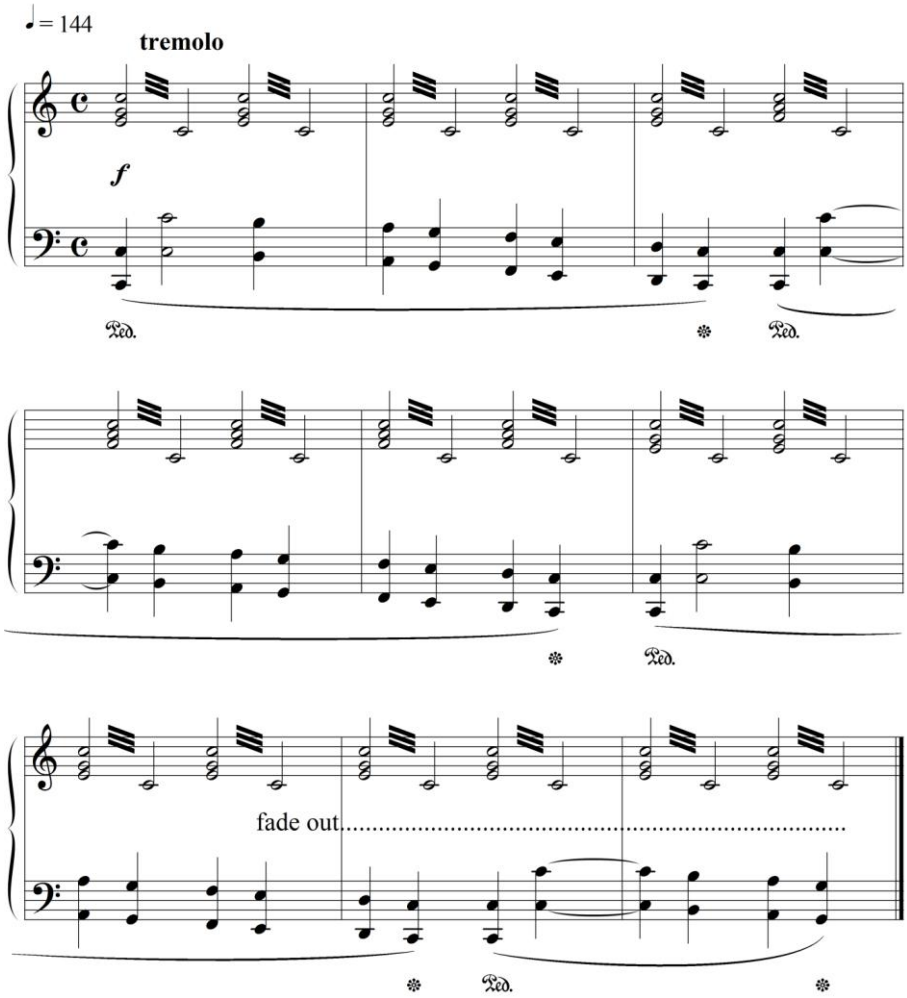
Piece 2 – rarely selected



In the second example, the major chords have leading tones that make them far too "strong-willed" to convincingly depict weightlessness under water. The participants overwhelmingly voted against this example.

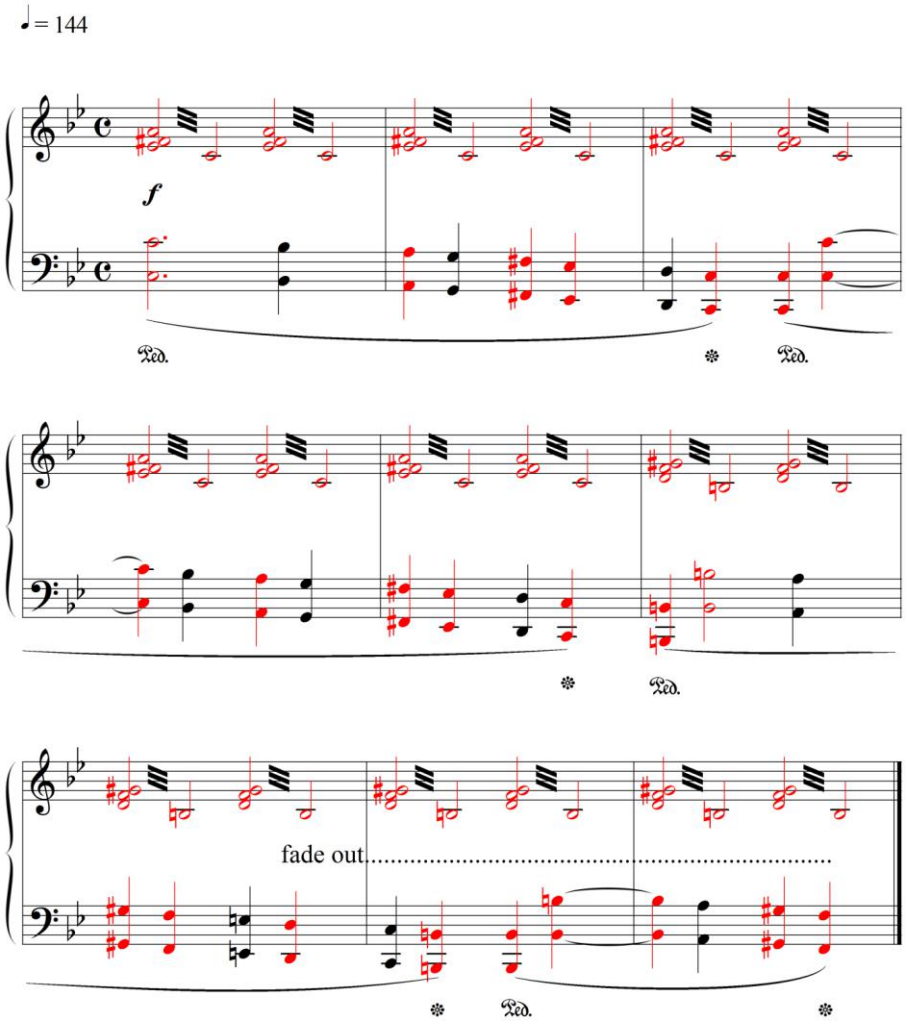
Scene 4, despair

Piece 1– rarely selected



The triumphant effect of the tonic and subdominant chords in the first piece is far too conspicuous for its mood to be associated with despair, even though this music is not only very similar to the far more frequently selected second piece: it is almost identical in terms of its structure, tempo and volume. Only 11.61% of the participants chose the first piece.

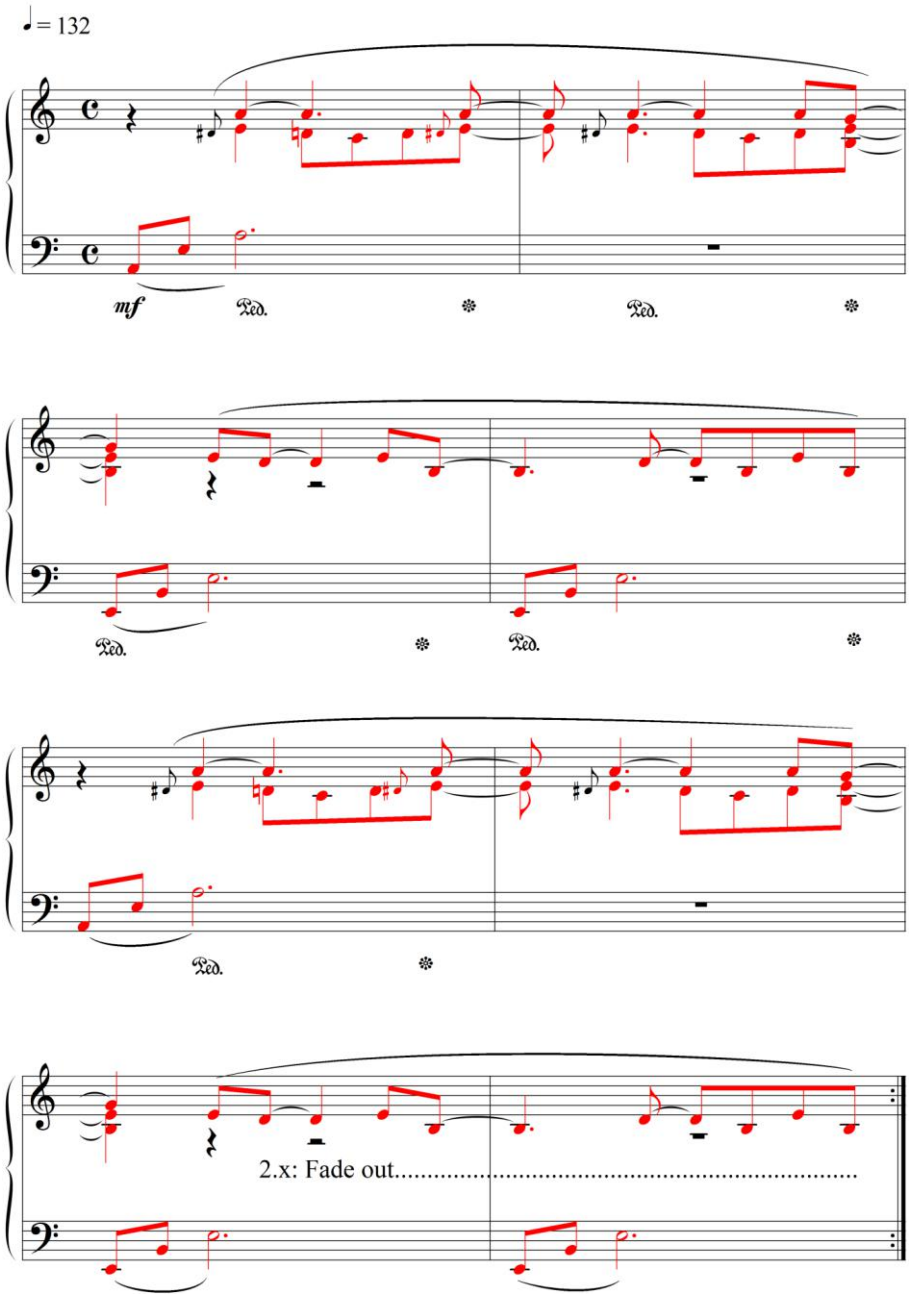
Piece 2 – selected most frequently



The Theory of Musical Equilibration describes the **diminished seventh chord** as an expression of despair, due to its leading notes and the anticipation that it will resolve in a minor tonic. The participants responded to this effect and selected it 88.39% of the time as a suitable choice for this scene (cf. "Fright and despair in the diminished seventh chord," p. 20).

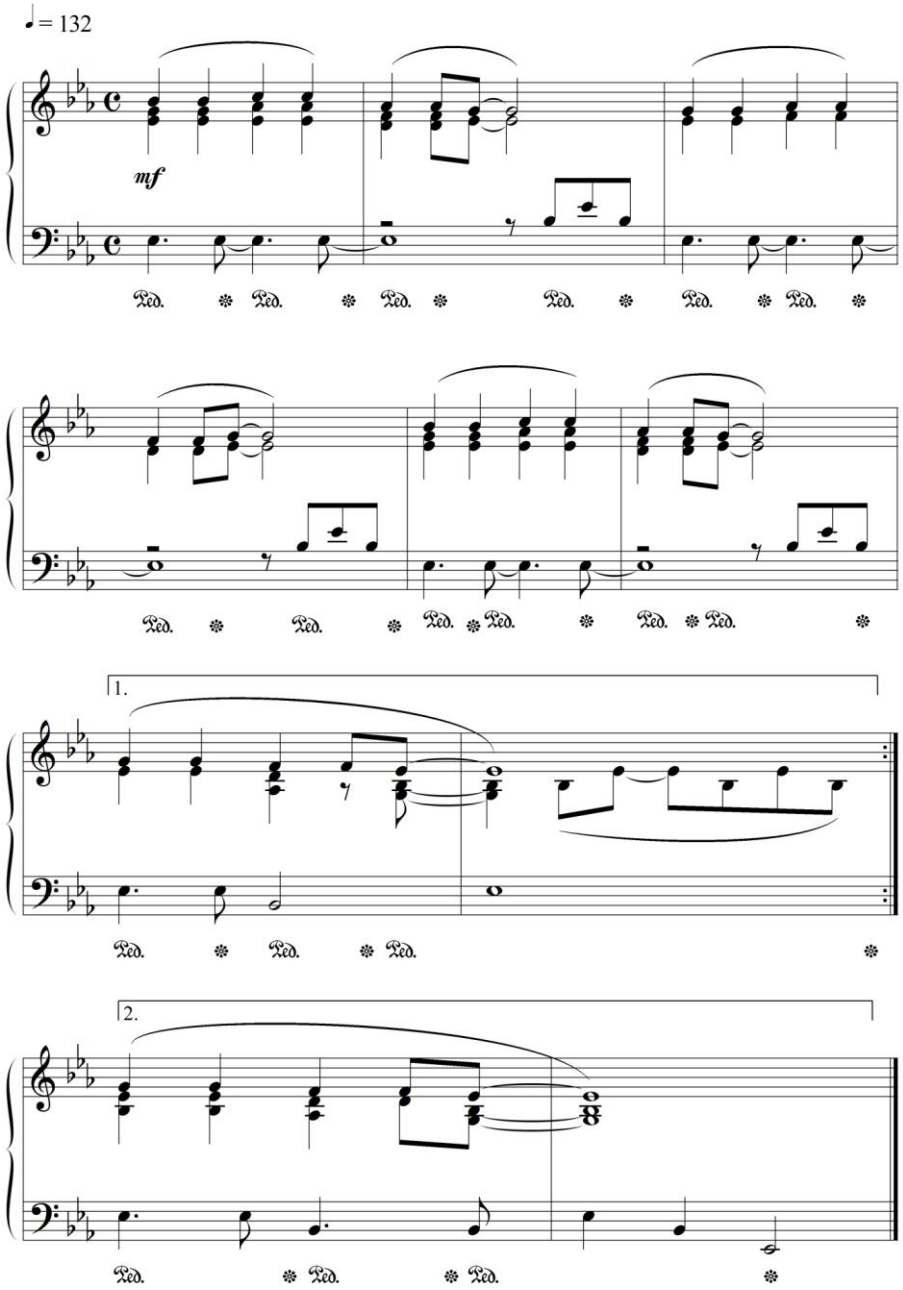
Scene 5, courage

Piece 1 – selected most frequently



In this example, the **natural minor** does not at all seem sad: instead, it creates a more adventurous or courageous impression. 91.72% of the participants found this to be a good match for the scene in which Rocky boldly approaches the thorns (cf. "Natural minor goes with tension, courage and adventure," p. 14).

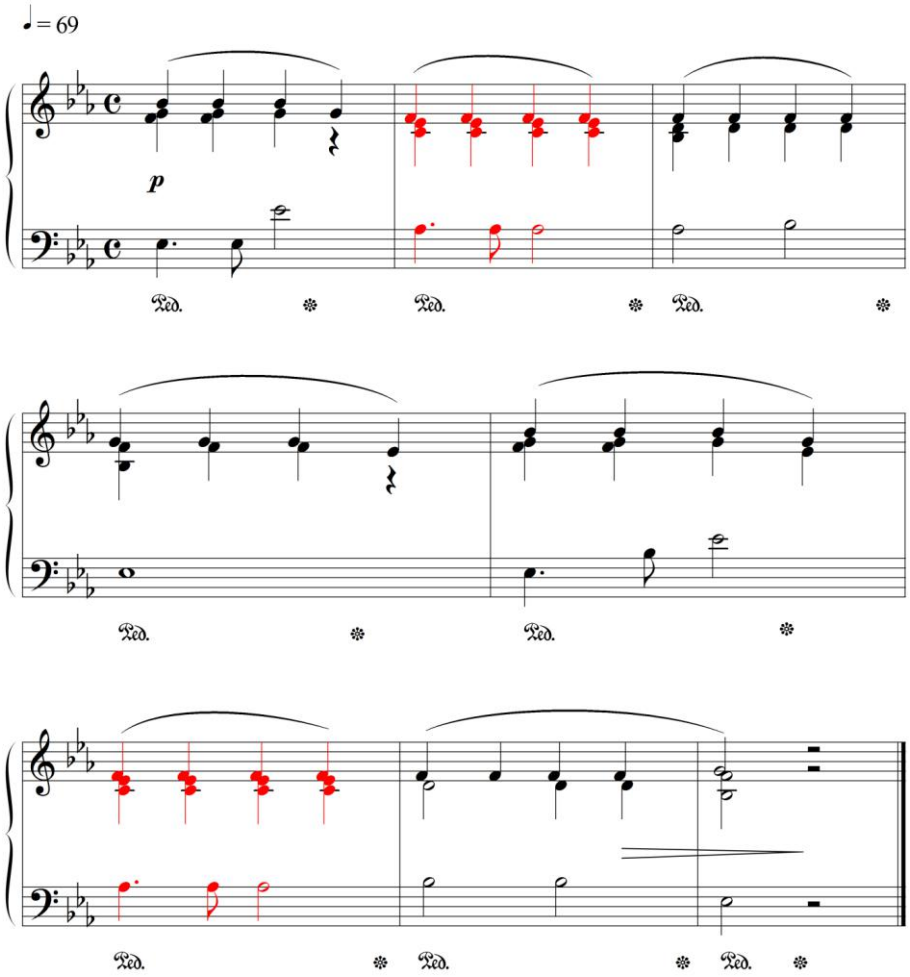
Piece 2 – rarely selected



Most of the participants who heard this piece clearly felt that the mood was too cheerful and lighthearted to be a good match for the tension of a motorcycle scene. Only 8.28% selected this option. These results may be surprising, since this preference completely contradicts the widespread impression of major and minor chords: the minor in the more frequently selected first piece does not convey a sad character, but instead it has an active, positive disposition. By contrast, the major chord in the second example is seen as being completely unsuited for a courageous, active mood. This perfectly corresponds to the way the natural minor is described in the Theory of Musical Equilibration.

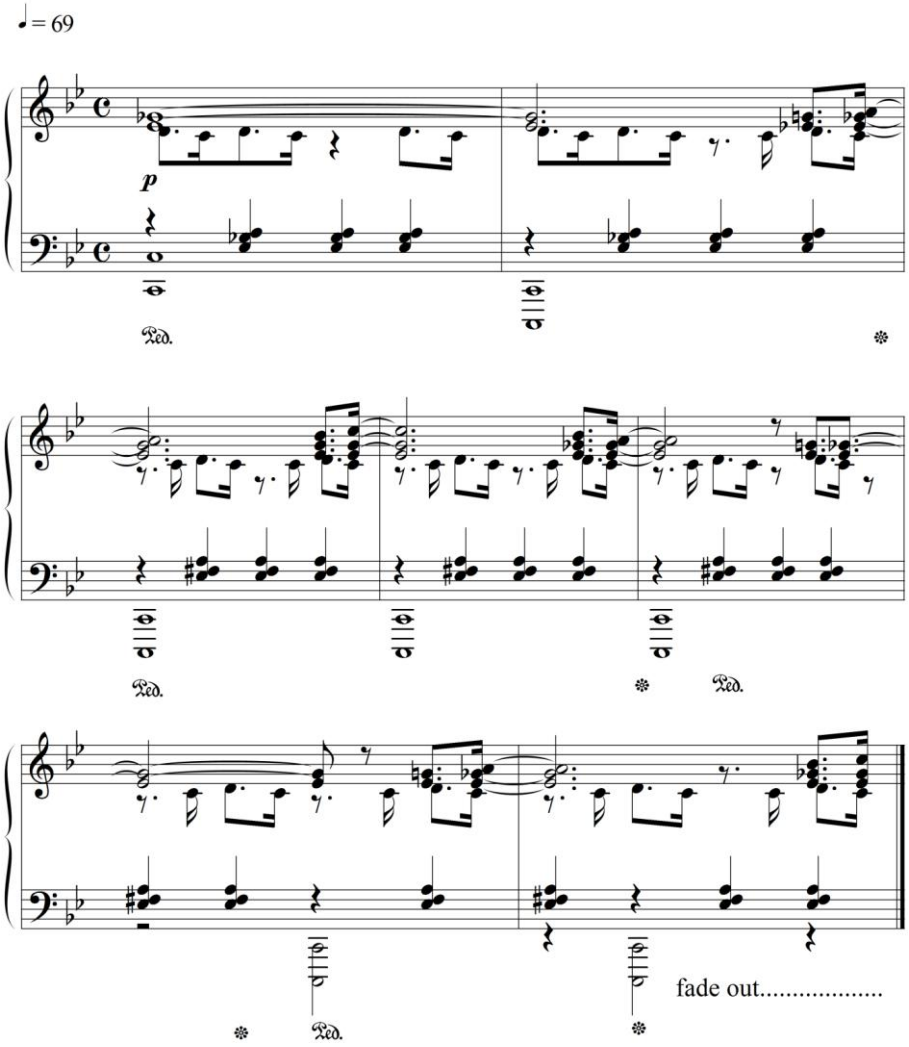
Scene 6, comfort

Piece 1 – selected most frequently



The use of the **subdominant with an added sixth** can give music the character of warmth and emotional comfort. 93.25% of the participants recognized this characteristic and chose the example as a suitable score (cf. "The added sixth in a major chord as an expression of warmth and security," p. 17).

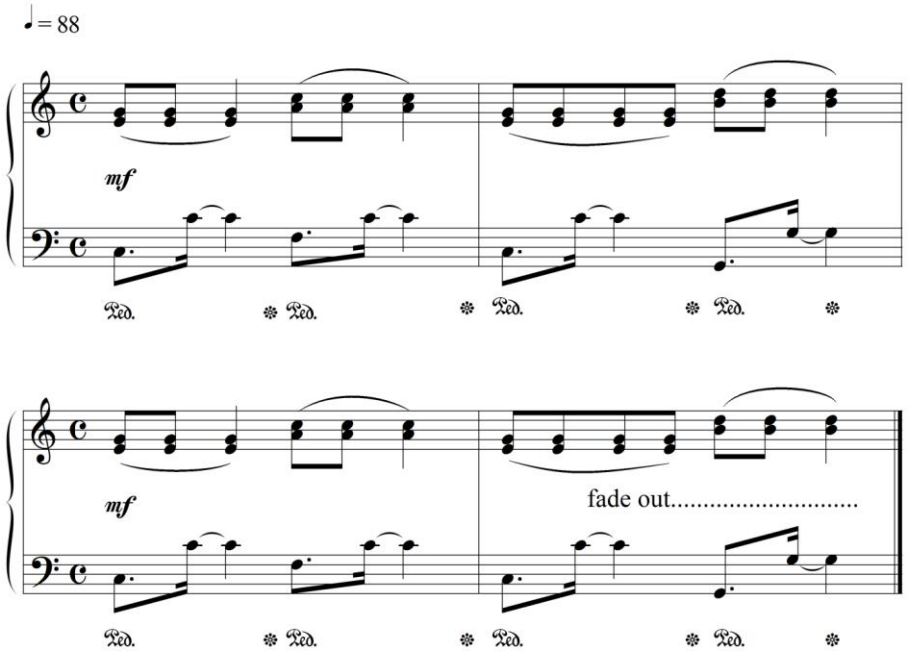
Piece 2 – rarely selected



The second piece comes across as the extreme opposite of a sense of emotional comfort due to its harmonies (diminished seventh chords with dissonant shading). Despite the fact that it is quiet and calm, it seems eerie and even threatening. The static structure of the accompaniment did not do anything to offset this effect: only 6.75% of the participants chose this piece.

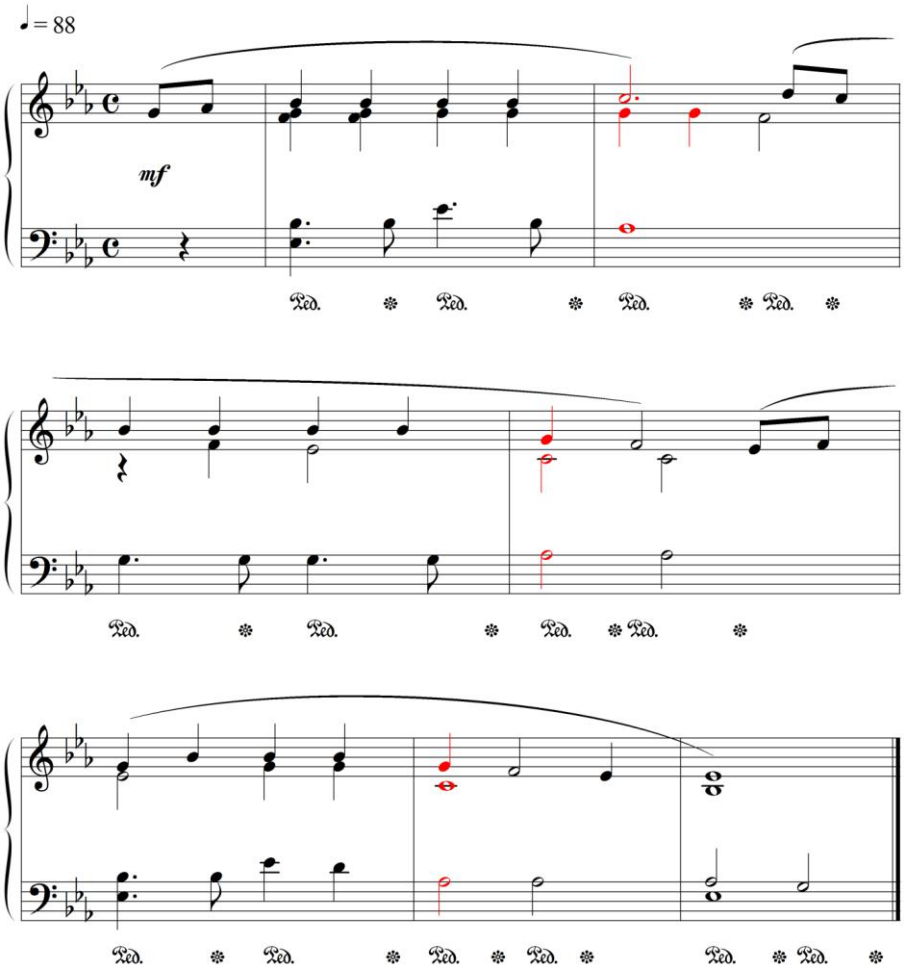
Scene 7, wistful goodbye

Piece 1 – rarely selected



In its harmonic structure (tonic - subdominant, tonic - dominant), this first example is very similar to the second piece with the exception of the lack of dissonance, but nevertheless the minority of the participants associated it with a farewell scene. Only 7.44% chose this piece. The light-hearted nature of the subdominant (cf. "The major subdominant expresses tranquility," p. 13) was clearly a reason for the majority of the participants to reject this selection.

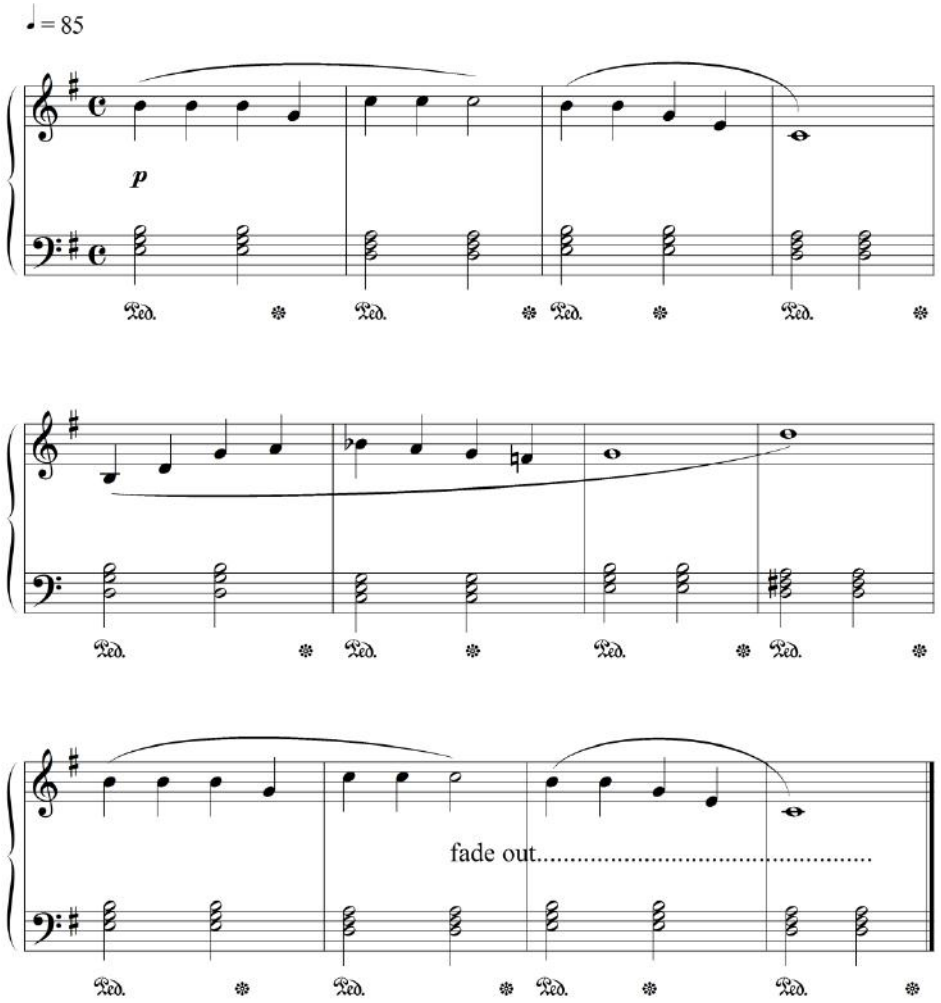
Piece 2 – selected most frequently



The second piece seems outright painful and wistful. This may seem unusual to some, since the music consists exclusively of major chords, and much like the first piece, it contains the progression tonic – subdominant. The reason for this effect, however, is the **subdominant with a major seventh**, the wistful impact of which is explained by the Theory of Musical Equilibration. Most of the participants saw this, and 92.56% stated this piece was good for a farewell scene (cf. "The subdominant with a major seventh as an expression of wistfulness," p. 15).

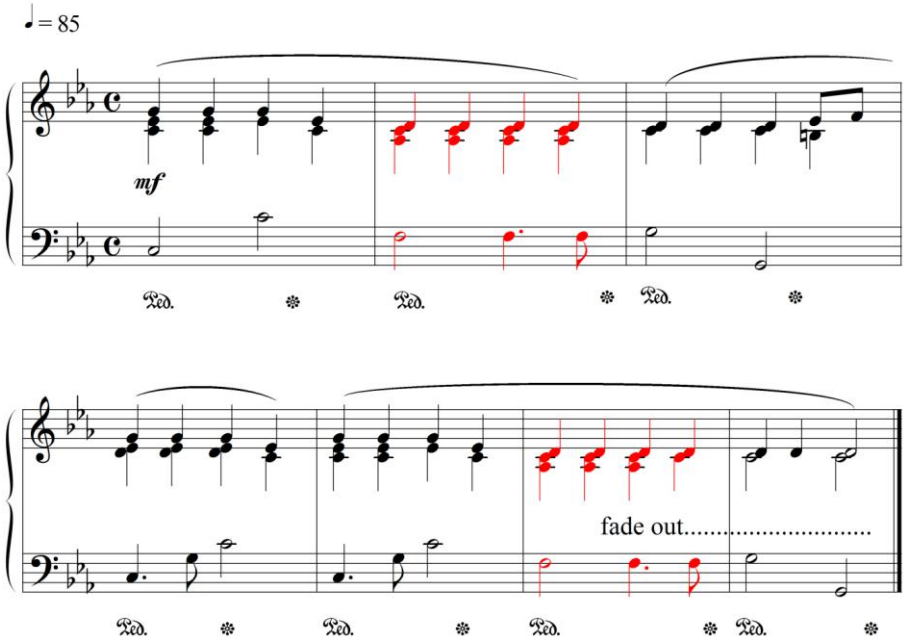
Scene 8, loneliness:

Piece 1 – rarely selected



This piece is in a minor key, has the same tempo as its counterpart, and also has a strikingly static structure, all of which could evoke a dejected mood. Regardless of these factors, very few of the participants found it adequate to express loneliness. Only 9.33% chose it.

Piece 2 – selected most frequently



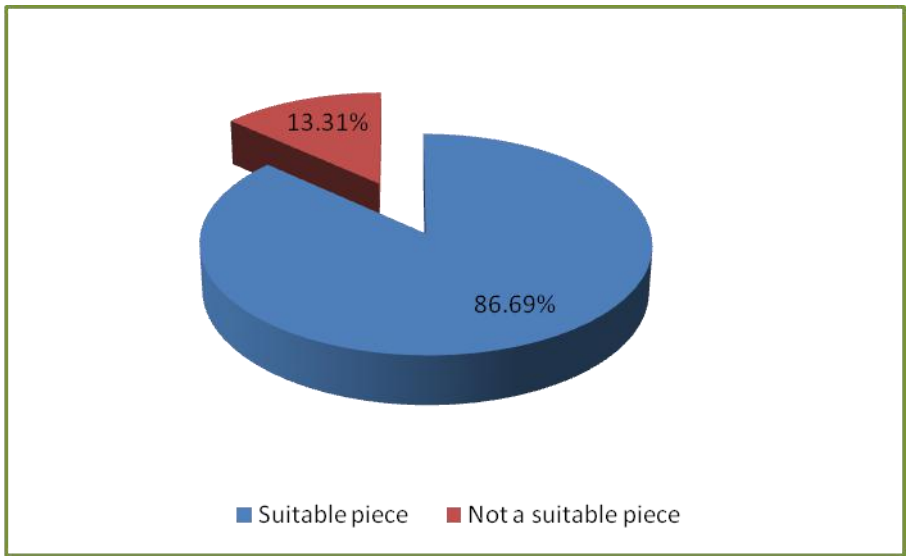
The second piece uses the **subdominant with an added sixth in minor**. This harmony triggers a sense of loneliness, and 90.67% chose it to go with the scene (cf. "The added sixth chord in a minor chord represents heartbreak and loneliness," p. 18).

2.3.5 Overall results of the Rocky Test

An average of 86.69% of the participants who took the Rocky Test selected the examples which corroborate the way the Theory of Musical Equilibration describes particular emotions. These high rates of correlation are noteworthy.

In addition to the determining mean values, the analysis also gathered data about individual results for each scene as well as the participants' age, sex and musical activity. We also took into account whether the school in question focused on the fine arts or was a "general" school.

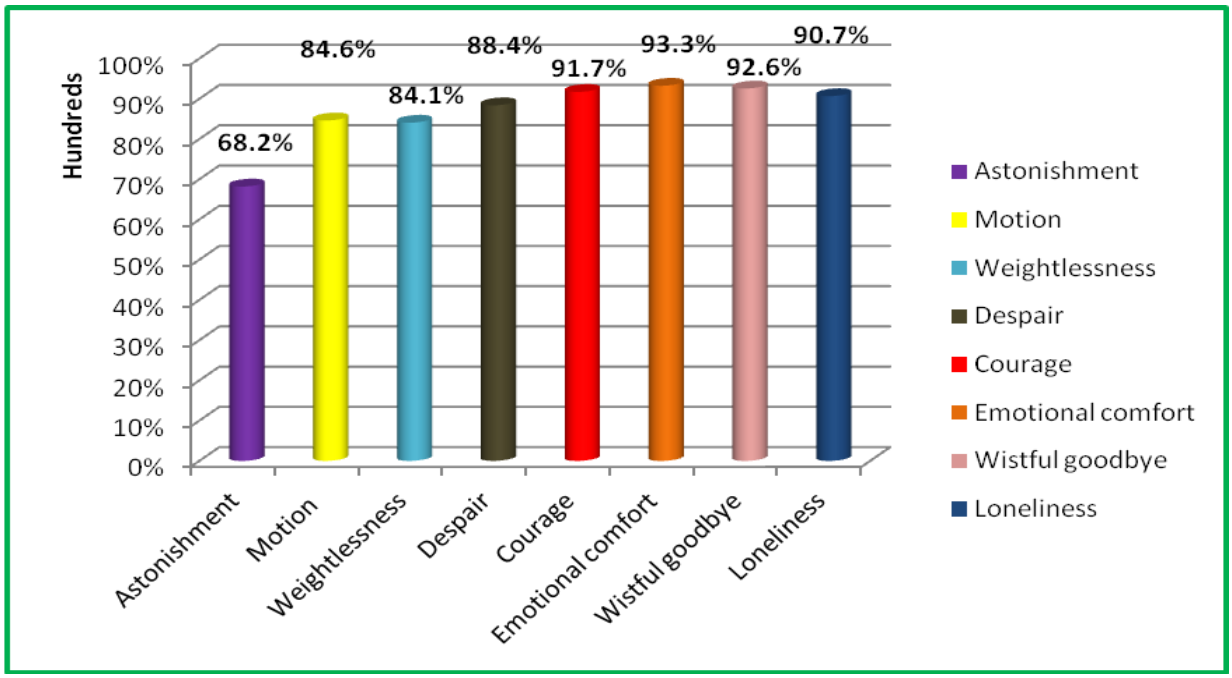
Suitable piece	Not a suitable piece
86.69%	13.31%



A mean 86.69% of the 2016 Rocky Test participants chose pieces which validated the Theory of Musical Equilibration. As was the case with the Basic Test, standard scientific methods do not adequately explain the high match rate of the Rocky Test. In light of these results, it appears that it is time for an entirely new approach to the question about how music generates emotions.

2.3.6 Individual results of the Rocky Test

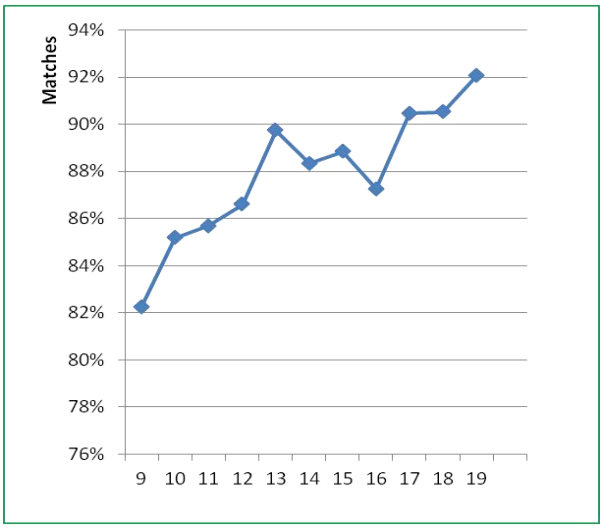
Astonishment	Motion	Weightlessness	Despair	Courage	Emotional comfort	Wistful goodbye	Loneliness
68.2	84.62	84.07	88.39	91.72	93.25	92.56	90.67



Of the 2016 participants, a mean 86.69% selected the musical compositions which bear out the Theory of Musical Equilibration. The diagram shows the distribution of the matches in the overall results for each of the fairy-tale scenes. An analysis of individual results tended to yield comparable results within individual schools.

2.3.7 Age of the participants

Matches in %	Age in years
82.24	9
85.17	10
85.68	11
86.60	12
89.73	13
88.33	14
88.84	15
87.26	16
90.46	17
90.52	18
92.05	19



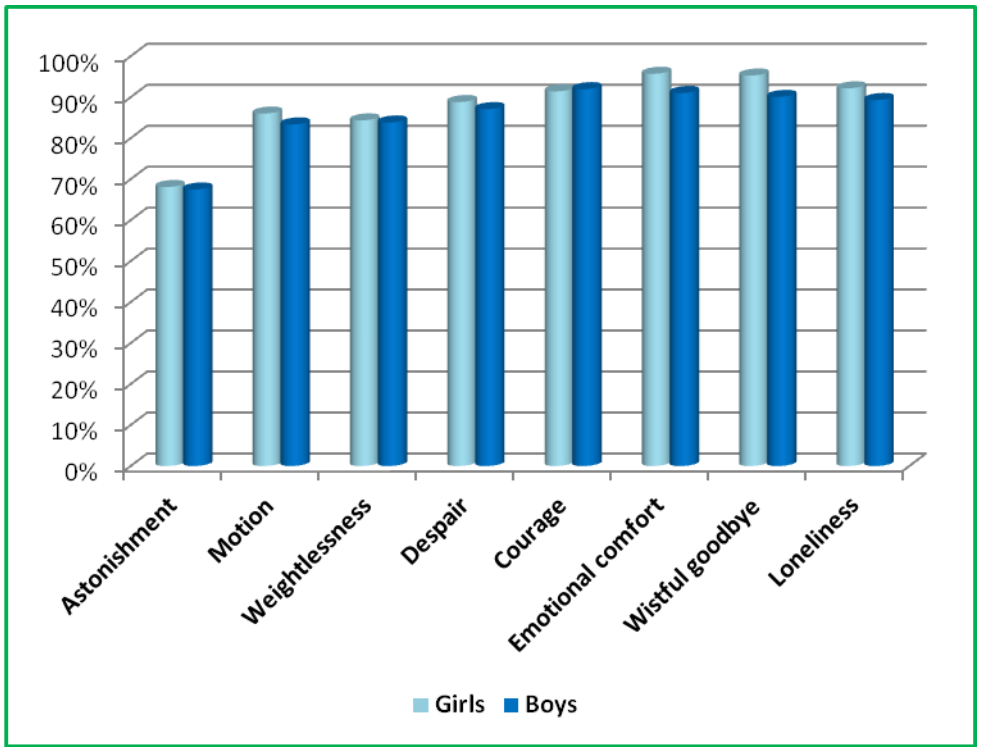
The y-axis shows the percentage of matches; the x-axis shows the children's age. The diagram shows a correlation between an increase in age and an increase in the number of matches. This could be interpreted in two different ways: it might be a factor of older children having a greater ability to cope with test situations, or it could be due to the fact that taking music lessons increases childrens' potential for developing musical sensitivity.

The pattern is interrupted starting when children reach the age of 13, however. This disruption may be due to puberty in general and a lack of concentration in particular. It

may also be linked to disinterest in the fairy tale-nature of the test, or to the challenges teenagers face in assessing their own emotions.

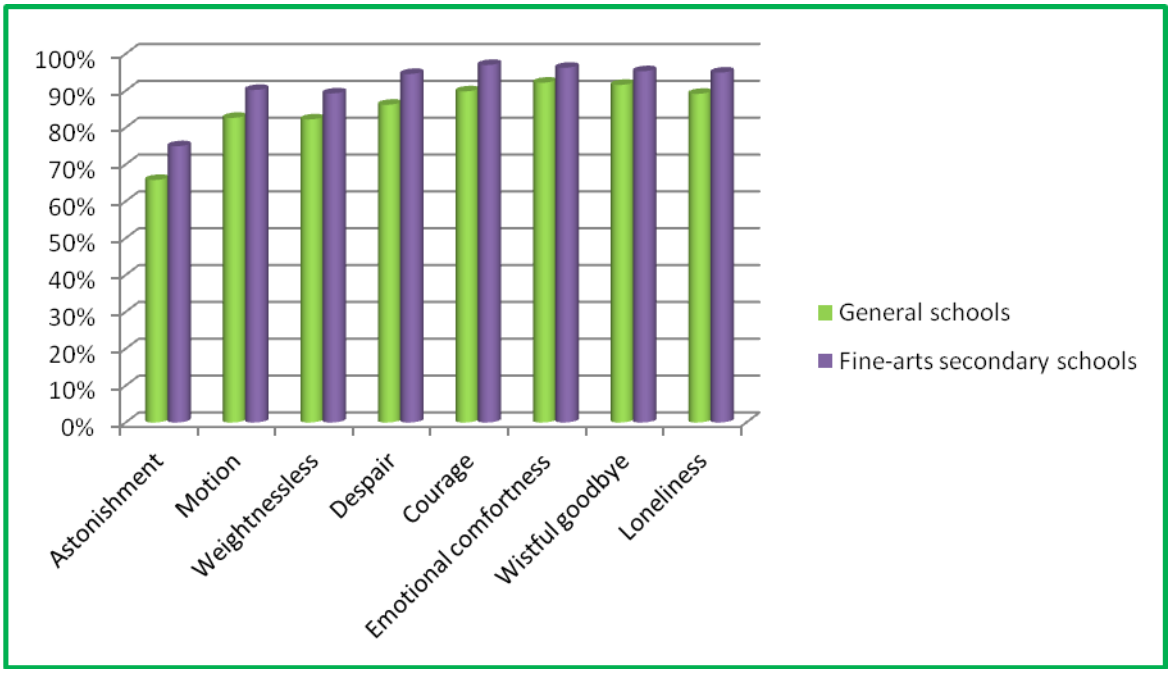
2.3.8 Sex of the participants

Scene	Girls	Boys
Astonishment	68.10%	67.49%
Motion	86.01%	83.36%
Weightlessness	84.34%	83.84%
Despair	88.83%	87.10%
Courage	91.44%	91.97%
Emotional comfort	95.72%	91.02%
Wistful goodbye	95.30%	90.08%
Loneliness	92.17%	89.32%



2.3.9 Fine-arts secondary schools and general schools

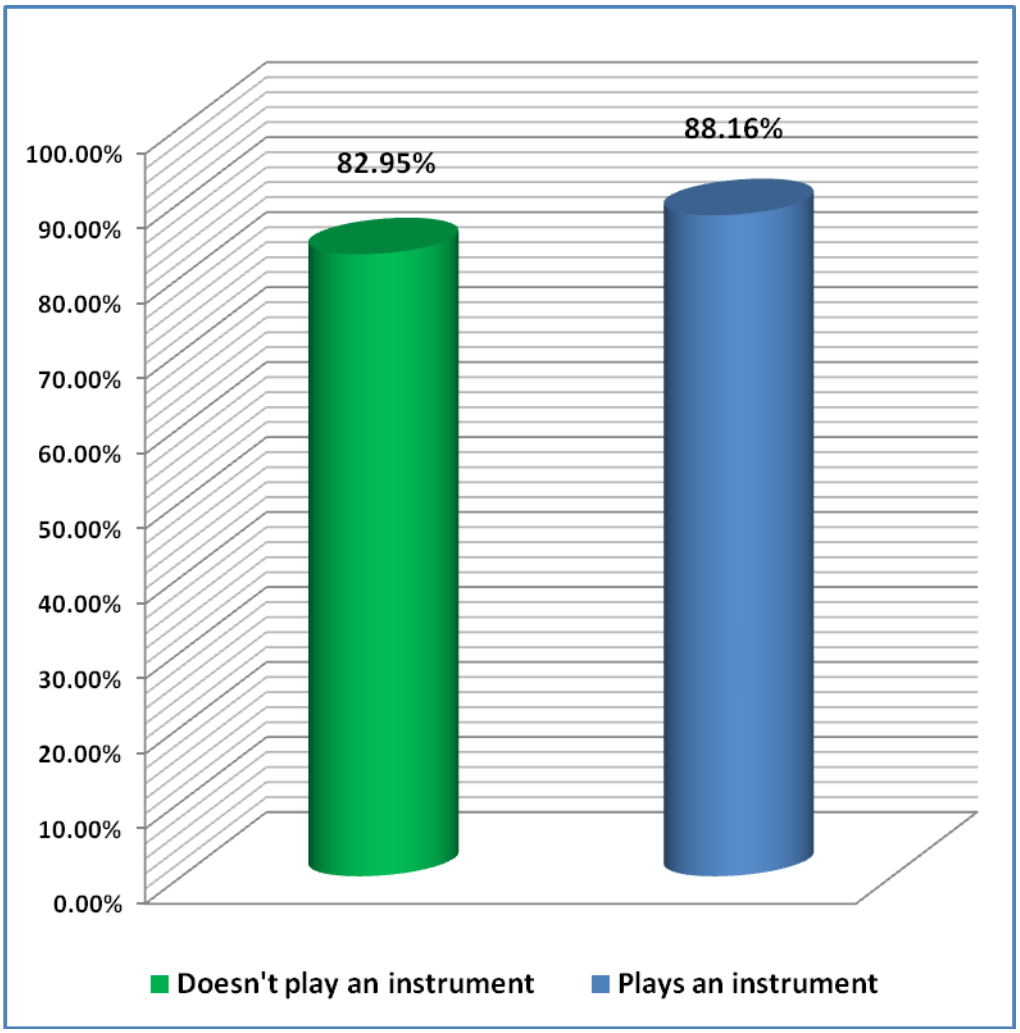
Scenes	General schools	Fine-arts secondary schools
Astonishment	65.79%	74.95%
Motion	82.63%	90.21%
Weightnessless	82.22%	89.27%
Despair	86.20%	94.54%
Courage	89.83%	96.99%
Emotional comfortness	92.19%	96.23%
Wistful goodbye	91.58%	95.29%
Loneliness	89.16%	94.92%



For all pieces, there was a higher rate of matches at fine-arts schools than at "general" ones. Children at the former may have a greater sense of musical awareness since they spend more time dealing with music. At the same time, an argument could also be made that the more musically sensitive children are more likely to focus their attention on music anyway.

2.3.10 The participants' musical activities

Doesn't play an instrument	Plays an instrument
82.95%	88.16%



The children who played an instrument had better results than those who did not. Here too, the slight discrepancy may be explained by the range in participants' musical talent or by the differing levels of musical awareness due to their musical activity. Among the participants who played an instrument, the highest number of matches came from children who played both piano and cello.

2.3.11 Where was the Rocky Test held?

As of this writing (November 2011), the Rocky Test has been held among 2016 participants at German schools in Europe, Asia, South America and Australia. The following schools have taken part:

Swiss School Bangkok, Melanchthon Secondary School (Bretten), Hebel School (Bretten), Colegio Pestalozzi (Buenos Aires), Saxonian State Secondary School for Music Carl Maria von Weber (Dresden), Old Secondary School (Flensburg), German School of Helsinki, Karl Friedrich Secondary School (Mannheim), Salzach Secondary School (Maulbronn), Pestalozzi Secondary School (Munich), German Embassy School (Beijing), Regensburg Cathedral Choir Secondary School, German School Stockholm, German International School Sydney, German School Tokyo Yokohama, State Secondary School for Music Saxony-Anhalt (Wernigerode) and the secondary school of the Vienna Boys' Choir.

2.3.12 How was the Rocky Test held?

Every participant was given a questionnaire with eight options, each accompanying a scene from the story. Each option had two columns labeled *Piece 1* and *Piece 2*. The questionnaire also asked about the participants' age, sex and whether or not they played a musical instrument (see the Rocky Test questionnaire, p. 79).

Once the participants fully understood how the test would take place, the CD played *The Fairy Tale of Sleeping Beauty and Prince Rocky*. For each of the eight scenes, the participants were to put a check in one of the two columns. The teacher then collected the questionnaires.

2.3.13 Analyzing the Rocky Test

The questionnaires were statistically analyzed by calculating the participants' preference and the other information they provided.

2.3.14 Interpreting the results

When it comes to linking music and emotions, the results of the Rocky Test reveal clear preferences for certain harmonies. Very interesting aspects become apparent when various parameters are taken into account, and they also suggest that the young people who can be already assumed to have a more well-developed sense of musical awareness also happen to be the ones who do better on the Rocky Test. This confirms the rigor of the Rocky Test and its immense significance. Furthermore, both the Basic Test and the Rocky Test speak to the emotional side of the participants in different ways. Yet at the same time, both approaches yield comparable findings which validate the findings of the Theory of Musical Equilibration in every way.

2.4 Children's descriptions of harmonies

Students at the municipal music school in Mannheim were surveyed about the effect of harmonies. The questions were: *What does this music make you think of? A scene in a movie? A word? A situation? Can you describe the sounds somehow? Which scene from the fairy tale Sleeping Beauty would go with the music?*

In response to the whole-tone scale, the children said …

1. Stella (10): *a ship that sunk.*

2. Isabella (12): *water that is bubbling up.*

3. Alicia (12): *something with water.*

4. Sandra (12): *a waterfall.*

5. Jasmin (17): *the atmosphere before a storm, or a river.*

6. Klaudia (16): *wind, water.*

7. Isabel (18): *transcendent.*

8. Andreas (18): *surreal, like under water.*

9. Nikola (12): *like water.*

10. Michelle (8): *in that Western where Winnetou the Indian went diving.*

In response to the augmented chord, the children said …

1. Stella (10): *fits the part in Sleeping Beauty when everyone falls asleep.*

2. Isabella (12): *when everyone falls asleep.*

3. Alicia (12): *when the thorns grow around Sleeping Beauty's castle.*

4. Michelle (8): *fits the part in the frog king when the ball falls into the water. In response to the Sleeping Beauty question: when she falls asleep.*

5. Sandra (12): *something unusual. In response to the Sleeping Beauty question: when she wakes up.*

6. Jasmin (17*): creepy somehow. In response to the Sleeping Beauty question: when something happens.*

7. Klaudia (16): *ethereal, surreal, weird somehow. In response to the question as to when she would use the music to score Sleeping Beauty: Maybe when Sleeping Beauty climbs the stairs to the fairy godmother — oh, no, that's not mysterious enough.*

8. Isabel (18): *transcendent, surreal, magic, a witch waving her magic wand.*

9. Andreas (18): *surreal, like underwater or in space.*

10. Nikola (12): *like water.*

11. Tobias (16): *The beginning of a dream.*

In response to the major subdominant with an added sixth, the children said …

1. Klaudia (16): *the sound would go well with a happy ending.*

2. Isabel (18): *resting, standing still.*

3. Andreas (18): *like a perfect world, somehow — a meadow of flowers, girls picking flowers.*

4. Michelle (8): *a love story.*

In response to the natural minor, the children said …

1. Michelle (8): *exciting, adventure, like a thriller.*

2. Lale (13*): something with cowboys.*

3. Roshen (9): *a scene playing outdoors.*

In response to the diminished seventh chord, the children said …

1. Lale (13): *somebody having a nervous breakdown.*

2. Jabir (7): *something horrible.*

3. Juliette (14): *someone running through the forest, trying to run away from a monster.*

4. Roshen (9): *a creepy story.*

2.5 Chords and emotions in literature

From the Baroque-era doctrine of the affections to the modern day, there have only been a very few critical analyses of the emotional effect which musical harmonies have. This can be explained by the widespread concern that such hypotheses could make the speaker appear ridiculous. After all, before the Theory of Musical Equilibration, there was absolutely no way to provide a rational explanation for the emotional responses music evokes. If authors ever allowed themselves to be drawn into an emotional analysis of harmonic chord sequences, they usually did so with the greatest of caution. Their statements were frequently even paired with a sort of apology or partial reserve. Far less hesitation was evident in the process of describing *how music triggers emotions*, although authors to date have failed to explain in detail exactly how this was to be interpreted.

Descriptions of the emotional effects of chords

The Moser dictionary of music states, "There is a great deal of truth to the statement that major chords sound happy and minor chords sound sad, despite the primitive nature of the idea."[1]

Gustav Güldenstein said of the tonic, "Tonic could be symbolically represented by a person standing upright in life. He is at rest as long as he is not moving, yet he is under tension in that he must constantly overcome a sensation of heaviness."[2]

The Ullstein dictionary of music writes that the sound of the major tonic is "affirming."[3]

The Moser dictionary of music describes the nature of the minor chord as "the major being clouded by the minor."[4]

The Ullstein dictionary of music defines a minor chord as a "suppressed major."[5]
Das Große Lexikon der Musik states that the major subdominant is "frequently used at melodic high points..." [6]

Wikipedia states that "modulation into the subdominant key often creates a sense of musical relaxation."[7]

[1] Moser, *Musiklexikon,* p. 794.
[2] Güldenstein, *Theorie der Tonart*, p. 39.
[3] Herzfeld, *Ullstein-Musiklexikon,* p. 351.
[4] Moser, *Musiklexikon*, p. 793.
[5] Herzfeld, *Ullstein-Musiklexikon,* p. 351.
[6] Honegger, *Das große Lexikon der Musik*, p. 39
[7] Wikipedia, "Subdominant."

Gustav Güldenstein wrote of the transition between tonic and subdominant as "a reduction of tension from a normal state to very mild."[1]

Diether de la Motte speaks of the subdominant as the "low-tension interval to the center."[2]

Jürgen Uhde studied the cadence Beethoven leading from the added sixth to the tonic and posed the question: "Is this return a sense of going home to solace?"[3]

Diether de la Motte wrote of the Neapolitan sixth chord: "It is important to bear in mind that even in Bach's day, this chord was reserved for the most intense expression of lament and pain, and under no circumstances was it to be misunderstood as a straightforward harmonic device."[4]

Author and director Reinhard Kungel described the use of the diminished seventh chord: "Consisting of three minor thirds, a diminished seventh chord is frequently used in film music to generate tension and cause people to shudder and be startled."[5]

Spiegel Online Wissenschaft reported about a team of researchers working with Thomas Fritz from the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig. They were studying the culturally isolated Mafa tribe in Cameroon to learn more about the extent to which people who had never heard western music could identify three basic moods expressed in this music. Their field work showed that 19 of 21 participants were able to pinpoint three basic moods clearly: happy, sad or fearful. Fritz stated that it appeared as if emotional aural patterns were innate much in the same way that emotional facial expressions are also innate. The Mafa were thus accurately able to categorize western music as being happy, sad or fearful. [6]

[1] Güldenstein, *Theorie der Tonart*, p. 40.
[2] Diether de la Motte, *Harmonielehre*, 4th ed. (Kassel: Bärenreiter, 1983), p. 35.
[3] Uhde, *Beethovens Klaviermusik*, p. 79.
[4] De la Motte, *Harmonielehre*, p. 90.
[5] Kungel, *Filmmusik*, p. 77.
[6] Spiegel Online Wissenschaft, *Musik wird weltweit gleich verstanden* ("Music is understood the same around the world"), March 20, 2009 [http://www.spiegel.de/wissenschaft/mensch/00,1518.614340,00.html] retrieved June 14, 2011.

2.6 Noteworthy examples of musical harmonies

as found in vocal literature, piano literature and TV and film scores

Natural minor (tension, danger, adventure, courage)

Mike Post: "Magnum"

Bob Marley: "I Shot the Sheriff"

Bob Dylan: "All Along the Watchtower"

Jürgen Moser: "The Groover," in *Rock Piano 2*[1]

Major dominant in a minor tonic (taking on the character of the minor):

Franz Schubert: *"Die liebe Farbe,"* measure 2, from *Die schöne Müllerin.*

Franz Schubert: *"Gefrorne Tränen,"* measure 1f, from *Winterreise.*

Whole-tone scale (water, weightlessness):

Claude Debussy: *"Cloches à travers les feuilles,"* measure 1ff, from *Images, Deuxième Série.*

Claude Debussy: *"Voiles,"* measure 1ff and the last two measures of *Préludes, Deuxième Livre.*

Neapolitan sixth chord (death, abandonment):

Franz Schubert: *"Die böse Farbe,"* measure 20, the phrase *"…weinen ganz totenbleich…"* from *Die schöne Müllerin.*

Franz Schubert: *"Der Müller und der Bach,"* measure 67, the phrase *"…weißt du, wie Liebe tut…"* from *Die schöne Müllerin.*

Added sixth in major (emotional comfort, intimacy):

Carl Loewe: *"Die Uhr,"* measure 49, the phrase *" …sie schlug am Traualtar…"* from *Die Uhr,* op. 123/3.

Franz Schubert: *"Im Frühling,"* measures 2, 4, 12, 15, 16, the prelude and the phrases *"Still sitz ich an des Hügels Hang"; "…wo ich an ihrer Seite ging so traulich und so nah, und tief im dunklen Felsenquell den schönen Himmel blau und hell and sie im Himmel sah…"* from *Im Frühling,* posthumous op. 25.

[1] Jürgen Moser, *"The Groover,"* Rock Piano 2 (Mainz: Schott, 1985), p. 31.

Added sixth in a minor chord (loneliness):

Carl Loewe: *"Die Uhr,"* measure 45: the phrase *"Sie schlug am Sarge des Vaters, sie schlug an des Freundes Bahr,"* from *Die Uhr*, op. 123/3.

Franz Schubert: *"Gute Nacht,"* measure 9, the phrase *"Fremd bin ich eingezogen,"* from *Winterreise.*

Subdominant (tranquility, cheerfulness, victory, hymns and anthems)

Joseph Haydn/

H. H. von Fallersleben: *"Das Lied aller Deutschen"* (German national anthem), the melodic climax at measure 12, the phrase "*Blüh im Glanze dieses Glückes.*"[1]

Trad.: "Amazing Grace," the progressions in the first and third lines[2].

G. H. Sanders, C. Z. Kelley: "I'm A Little Teapot," the first two lines

Don Schlitz: "The Gambler," the first and third lines of the chorus

Robert Schumann: "The Happy Farmer," measure 2, from *Album for the young.*

Classic student drinking song: *"Gaudeamus igitur,"* measure 2, phrase *"gaudeamus igitur"*[3].

Z. Horton/F. Hamilton: "We shall overcome," measure 1ff[4].

Subdominant with a major seventh (wistful goodbye, wistfulness):

Elton John: "Your Song," measure 3, the phrase *"It's a little bit funny…"*[5]

Felix Mendelssohn: *"Abschied vom Walde"*[6], measure 9, the phrase *"…du meiner Lust und Wehen…"*

[1] Haydn, von Fallersleben, *"Das Lied aller Deutschen"*.
[2] Trad.: Amazing Grace
[3] Christian Wilhelm Kindleben (ed.), "*Gaudeamus igitur*," *Deutsche Lieder*. p. 165.
[4] Z. Horton et al, Walter Maurer (ed.), "We shall overcome", *Folk Complete: Für Akkordeon* (Cologne: Edition Metropol, no year), I, p. 77.
[5] Elton John, Bernie Taupin, Hans-Günther Kölz (ed.), "Your Song," Akkordeon pur: Elton John (Manching: Holzschuh, 2008). p. 18ff.
[6] Felix Mendelssohn-Bartholdy, "*Abschied vom Walde", Deutsche Lieder*. p. 87.

Seventh chord (an expression of the countercultural revolution):

The Beatles:	"Why Don't We Do It In The Road," measure 1ff, the seventh chord as the tonic and subdominant[1]
The Rolling Stones:	"(I Can't Get No) Satisfaction," measure 6, the phrase *"I can't get no satisfaction…"*[2]
The Rolling Stones:	"Let's Spend The Night Together," measure 17ff, the phrase *"…let's spend the night together…"*[3]

Augmented chord (astonishment):

Alois Melichar:	score from *Das Doppelte Lottchen* (1950, dir. Josef von Baky), scene when the twins see each other for the first time.
Franz Schubert:	*"Die Krähe,"* measure 16ff, the phrase *"…Krähe, wunderliches Tier…"* from *Winterreise.*

Diminished seventh chord (despair, fright):

Johann Sebastian Bach:	Aufschrei *Barrabam!*, Pontius Pilate scene from *St. Matthew Passion*, NBA 45a, BWV 54, measure 30.
Franz Schubert:	*"Die Krähe",* measure 33, the phrase *"…Treue bis zum Grabe…"* from *Winterreise.*
Franz Schubert:	*"Der stürmische Morgen",* measure 16, the phrase *"…es ist nichts als der Winter kalt und wild…"* as well as the piano interlude in measure 8ff. and postlude in measure 18ff., from *Winterreise.*
Robert Schumann:	*"Bittendes Kind,"* measure 2, in Schumann, *Kinderszenen* op. 15.
Robert Schumann:	*"Ein Jüngling liebt ein Mädchen,"* measure 31, from *Dichterliebe* op. 48.

[1] Music Sales Limited, The Beatles Complete (London, 1983). p. 252.
[2] Ibid. Best of the Rolling Stones, Vol.1 (London, 1979). p. 42.
[3] Ibid. p. 26

Alternating between major and minor

Carl Loewe: *"Erlkönig"* op. 1 Nr. 3, measure 70ff, phrase *"…ich lieb' dich, mich reizt deine schöne Gestalt, und bist du nicht willig, so brauch ich Gewalt…."*

Franz Schubert: *"Tränenregen,"* measure 23/34, phrase *"…Da gingen die Augen mir über…"* from *Die schöne Müllerin.*

Franz Schubert: *"Der Lindenbaum,"* measure 24/25, from *Winterreise.*

Alternating between tonic - dominant (motion):

Franz Schubert: *"Das Wandern,"* measure 1ff, from *Die schöne Müllerin.*

Friedrich-Wilhelm Möller: *The Happy Wanderer*

Elvis Presley / trad.: "Wooden Heart *(Muss I Denn)*," measure 7/8, the phrase *"…muss i denn zum Städtele hinaus, und du, mein Schatz, bleibst hier…."*[1]

Secondary dominant chord (expression of being emotionally moved)

Robert Schumann: *"Dein Angesicht,"* op. 127/2, measure 17, the phrase *"…das aus den frommen Augen bricht…. "*

Robert Schumann: *"Die Lotosblume," Myrten* op. 25/7, measure 16/17, the phrase *"…ihr frommes Blumengesicht…. "*

[1] Ibid, "Abschiedslied", p. 75.

Summary

The results of our tests have demonstrated for the first time that musical harmonies can be seen as media of emotional messages. Furthermore, they show that the development of emotional responses to music is not a purely subjective process; instead, it occurs in accordance with a particular system which can be statistically documented and clearly described. This system closely correlates with the conclusions of the Theory of Musical Equilibration.

Many of the pieces used in our tests consist of nothing other than the pure presentation of the respective chords with only the parameters of volume and tempo. This approach was designed to minimize other factors which had the potential to influence the participants' emotional response. There were also other examples featuring harmonic functions which required a cadence-like introduction to contextualize the harmony in question. Here too, the impact of other musical parameters could not entirely be ruled out, although the potential for external influence was also kept to a minimum. No other parameters could be identified which might have played a key part in shaping the emotional tonal character of the music.

In a certain sense, the Theory of Musical Equilibration is unparalleled in its ability to explain the outcome of our tests, because to date no other concept has been developed which effectively shows how music affects us emotionally. Antiquated views from the previous century stating that emotions stirred during music were only the product of learning processes are now untenable, and they have to be abandoned in light of the new insights of this research.

It would be presumptuous to attempt to assess the utility of our tests at the present moment. However, in many different regards they can already be seen as a significant contribution to the field, in addition to their documentary and statistical relevance for musicology.

These studies can open up a fruitful re-orientation across all spheres of musical analysis. They make it possible to articulate and explain musical processes, bringing them out of the stigmatized fog of the inexplicable. One of the authors of this book, Daniela Willimek, wrote more about this phenomenon in the context of Schumann's *Träumerei.* See also *Eine emotionale erfahrbare Erzählung: Schumanns "Träumerei" (*"A narrative that can be experienced emotionally: Schumann's *Träumerei*"*), Tonkünstlerforum Baden-Württemberg, 2000, Nr. 37.* (German only).

Our research provides a useful tool of orientation for the fields of musicology and music theory, particularly analysis — fields in which it seems that there has been nothing but helplessness and inertia for decades.

Those who perform music are of course interested in communicating the composers' intentions, and the Theory of Musical Equilibration allows them to gain clarity about feelings which had otherwise remained vague. The Theory also elucidates factors that affect how the music is interpreted. Music teachers can now work with pieces from the repertoire to make the interpretations they wish to teach more concrete and comprehensible. Composers, especially those who write for films, can turn to the Theory to make better use of music when scoring scenes, and they no longer have to rely as strongly on their intuition. Last but certainly not least, we could envision this research being a particular asset in the work of music therapists: these professionals approach their patients (e.g. autistic children) on an emotional level and must understand how they express themselves through music.

Our research has given rise to multi-faceted forms of inspiration, and we would be pleased if this inspiration were to lead to a fundamental discussion about the exciting topic of music and emotions.

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Daniela and Bernd Willimek

Bretten, June 2011

Basic Test questionnaire – Page 1

Dear student, please start out by answering the following questions:

Sex:

- ☐ female
- ☐ male

Age: ……

Do you play an instrument?

- ☐ yes
- ☐ no

If so, which instrument? (multiple replies possible)

…….

Part A - Emotions and harmonies

In Part A, you will hear five short pieces. Imagine you are a film director with five scenes and five pieces of music, and you need to select the right music for each scene. Check the appropriate box in the list below.

Movie scene:	**Music 1**	**Music 2**	**Music 3**	**Music 4**	**Music 5**
Loneliness					
Dreams of summer					
Despair					
Wandering					
Magical transformation					

Basic Test questionnaire – Page 2

Part B – Minor chords/whole-tone scale

1. Now you will hear two pieces of music that are fairly similar. One of them is supposed to be used in a sad scene, and the other in an adventurous scene. Please select the piece you think sounds adventurous:

- ☐ Piece 1
- ☐ Piece 2

2. Now you will a quiet minor chord which will be repeated several times and get louder and louder. As the volume increases, the chord will change. Which of the following statements best describes the way the chord changes? Choose one:

- ☐ Sorrow turns into anger
- ☐ Sorrow turns into joy
- ☐ Anger turns into sorrow

3. You will now hear two pieces that are musically similar. Which sounds more threatening to you?

- ☐ Piece 1
- ☐ Piece 2

4. Here are two music pieces with a similar structure. In which of the two does the final chord express a stronger sense of warmth and comfort?

- ☐ The first piece
- ☐ The second piece

5. Once again, you will hear two similar-sounding pieces. Which one would go better with an underwater scene?

- ☐ Piece 1
- ☐ Piece 2

Rocky Test questionnaire

Dear student,

Please answer the questions, and after the following fairy tale is played for you on CD, please mark the example you find to be the best the musical accompaniment to each scene. (Each scene will be read twice with different background music each time).

Age:

Grade:

Sex (female: f, male: m):

I play a musical instrument: yes no (circle appropriate answer)

If yes, which instrument(s)? (multiple answers possible)

	Piece 1	**Piece 2**
Scene 1 (Astonishment) The forest of thorns is growing		
Scene 2 (Motion) Rocky sets out		
Scene 3 (Weightlessness) Rocky dives into the water		
Scene 4 (Despair) Princes are attacked by thorns		
Scene 5 (Courage) Rocky drives up to the thorns		
Scene 6 (Emotional comfort) Cozy mood at the fireplace		
Scene 7 (Wistful goodbye) Rocky leaves Sleeping Beauty		
Scene 8 (Loneliness) The princess mourns		

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