Aalto University

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Degree Programme in Information Networks

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# Music and Emotion in a Cross-Cultural Context: Searching for Musical Fit for an Interactive Sports Animation

Master's Thesis

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Supervisor: Professor Tapio Takala

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| AALTO UNIVERSITY<br>School of Science<br>Information Networks Degree Programme | ABSTRACT OF THE MASTER'S THESIS |
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Title: Music and Emotion in a Cross-Cultural Context: Searching for Musical Fit for an Interactive Sports Animation.

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Music is most commonly listened to influence emotions. Emotions can be expressed by musical structures and evoked by various psychological mechanisms. Evoked emotions are strongly connected to musical preference. When combined with visuals, music directs the attention of the user and enhances the emotional content of the narrative. In a commercial setting, matching the emotional qualities of the music with the qualities of the product is called musical fit.

The objective of this study was to select music that would provide musical fit for Suunto Movie, which is a short, 3D animation built on GPS data recorded from the user's own outdoor exercise. The music for Suunto Movie is built using interactive components designed to fit together flexibly to follow the dramatic curve of the video narration. This study compares and analyzes six different music samples for the Suunto Movie.

The empirical data was gathered by an online self-report questionnaire. Responses were received from 148 users of the Suunto Movescount web community, most of them from Finland, Australia, USA, and UK. The respondents evaluated three music samples regarding the Liking and Musical fit. The Emotions evoked by music were evaluated using Geneva Emotional Music Scale, and the User Experience was measured with AttrakDiff semantic differential. Both scales were abridged to suit the purposes of this study.

The results of the study illustrate that Liking, Musical fit, and User Experience all relate to each other, as they all examine Emotions. Liking correlates strongly with Musical fit (0,79), and correlates with the strongest positive emotion evoked (0,59). The average ratings of samples were overall fairly neutral. However, Sample B was rated as the most suitable composition as it received best ratings in Liking, Musical fit, and User Experience. Furthermore, it corresponded best with the Suunto Emotional Profile, presenting the emotions Suunto wishes to evoke as a brand.

Further development for the Suunto Movie Music should include driving rhythms and even better synchronization of music with visuals. The respondents wished for recorded audio instead of synthetic sounds, and more rock music to match the sporting context and user preferences. Interesting directions for further research would be cross-cultural comparison and sonification.

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Useimmiten musiikkia kuunnellaan sen herättämien tunteiden takia. Musiikki ilmaisee tunteita erilaisten musiikillisten rakenteiden avulla ja herättää tunteita useiden psykologisten mekanismien kautta. Musiikin herättämät tunteet ovat vahvasti sidoksissa kuulijan musiikkimakuun. Kun musiikkia yhdistetään liikkuvaan kuvaan, se ohjaa käyttäjän huomion kuvaan ja vahvistaa kuvallisen kerronnan herättämiä tunteita. Kaupallisissa yhteyksissä musiikin emotionaalisen sisällön yhdistämistä tuotteen ominaisuuksiin kutsutaan musiikilliseksi sopivuudeksi.

Tämän tutkimuksen tarkoituksena oli valita musiikillisesti sopiva musiikki Suunto Movielle, joka on lyhyt, kolmiulotteinen animaatio, joka on rakennettu käyttäjän oman urheilusuorituksen paikannustiedon pohjalta. Suunto Movien musiikki on rakennettu käyttäen interaktiivisia osia, jotka sopivat joustavasti yhteen, noudattaen samalla videokerronnan draaman kaarta. Tämä tutkimus vertailee ja analysoi kuutta erilaista musiikkinäytettä, jotka on sävelletty Suunto Movielle.

Tutkimuksen empiirinen data kerättiin verkkokyselyllä, jossa vastaajat raportoivat omia tuntemuksiaan musiikkinäytteisiin liittyen. Kyselyyn vastasi 148 Suunnon Movescount -verkkoyhteisön käyttäjää, joista suurin osa oli Suomesta, Australiasta, Yhdysvalloista ja Iso-Britanniasta. Jokainen vastaaja arvioi kolmea musiikkinäytettä omien mieltymystensä ja näytteiden musiikillisen sopivuuden mukaan. Vastaajat analysoivat musiikin herättämiä tunteita Geneva Emotional Music Scalella ja arvioivat käyttäjäkokemusta AttrakDiff -semanttisella differentiaalilla Molempia työkaluja lyhennettiin tämän tutkimuksen tarpeisiin sopiviksi.

Tutkimuksen tuloksista voidaan nähdä, että musiikkimaku, musiikillinen sopivuus ja käyttäjäkokemus ovat yhteydessä toisiinsa, sillä ne kaikki käsittelevät tunteita. Omat mieltymykset korreloivat vahvasti musiikillisen sopivuuden kanssa (0,79). Lisäksi ne korreloivat vahvimman koetun positiivisen tunteen kanssa (0,59). Kaikkiaan arvioiden keskiarvot olivat kohtalaisen neutraaleja. Musiikkinäyte B kuitenkin arvioitiin parhaiten sopivaksi, sillä siitä pidettiin eniten, se oli musiikillisesti sopivin ja sillä oli paras käyttäjäkokemus. Näyte B vastasi parhaiten Suunnon tunneprofiilia, joka kuvaa tunteita, joita Suunnon tuotemerkillä halutaan herättää.

Suunto Movien musiikin jatkokehityksessä tulisi käyttää eteenpäin vieviä rytmejä ja synkronoida musiikki ja kuva paremmin keskenään. Vastaajat toivoivat synteettisten äänien korvaamista äänitetyillä soittimilla sekä enemmän urheilun yhteyteen ja vastaajien musiikkimakuun sopivaa rock-musiikkia. Mielenkiintoisiksi jatkotutkimuskohteiksi nousivat kulttuurierot ja sonifikaatio.



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What a long and winding road it has been. Finally, my studies come to an end, 17 years after I first set foot in Otaniemi. I am very grateful for all the experiences I have had, although I would most certainly never recommend this path to anybody else. In the beginning, my two degrees in Pop & Jazz Music and Interaction and Media seemed to be worlds apart. Now all the pieces of the puzzle are falling into place.

I was working for Suunto as a Usability Specialist and Sound Designer when Suunto Movie was launched in August 2014. During this time I first heard about the idea of interactive music in my Sound in New Media studies and was immediately intrigued: this was something that could be used in the Suunto Movie. I started working in the project in autumn 2014 with my colleague Mikko Ahlström, creating a structure for this music. Some of the first samples were composed by me and others by my fellow Sound in New Media student, professional composer Guy Dowsett. As we worked onwards, I felt sorry that I could not continue with this interesting and inspirational project as I really had to start working on my Master's Thesis. After a while I realized that this could actually be the topic of my thesis. Luckily, Suunto was interested in funding my research and granting me a study leave. Thank you Mikko, Guy, and Antti Hermunen for the great, inspirational and fun work in the Suunto Movie project! Thank you Suunto, my employer for 14 years, for allowing me to research the topic further.

This topic very nicely combined my Bachelor of Culture and Arts degree in Pop & Jazz Music and my advanced studies in Work Psychology and Leadership as well as Sound in New Media. The methods applied came from my major subject Human and Interaction. I am truly grateful to be able to combine all these interests. Professor Tapio Takala agreed to supervise my thesis and my colleague M.Sc. Maria Pekkarinen to act as the instructor. Thank you both for your good advice and motivational meetings! You encouraged me to reach high, yet always reminded me of the focus and the main objective of the work. I would also like to thank Riikka Kangaslampi for discussing the analysis with me and reviewing my statistical calculations.

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Espoo 21.10.2015

Maria-Karoliina Tiuraniemi

# TABLE OF CONTENTS

# 1 INTRODUCTION

> *"Seek out music that lifts the soul and spirit. This is what running is"*
> *Male, age 50–59. Test subject #40857757*

The most common reason for listening to music is to influence emotions (Juslin & Sloboda 2011). Music can intensify existing emotions or modify them. Music can motivate the listener towards better performance. It can provide comfort, help reminisce important events in life or aid relaxation. (Batt-Rawden & Denora 2005, Hargreaves & North 2011, Sloboda & Juslin 2011.) Music expresses emotion by musical structures combined together (Gabrielsson & Lindström 2011). However, due to this combination, their evaluation becomes uncertain (Gabrielsson & Juslin 2003) or probabilistic at most (Thompson & Balkwill 2011). Some of these musical structures expressing emotions are culture-dependent (Balkwill & Thompson 1999) and some universal (Balkwill & Thompson 1999, Thompson & Balkwill 2011).

The emotions expressed by music can evoke same emotions (Juslin & Västfjäll 2008, Juslin & Timmers 2011), opposite emotions (Ritossa & Rickard 2004, Zentner et al. 2008) or elicit other reactions (Rozin & Rozin 2008, Schubert 2013). (Gabrielsson 2002.) Musical preference affects the emotions evoked by music (Kreutz et al. 2008, Moors & Kuppens 2008). However, the emotions evoked predict musical preference (Schubert 2007) depending on context (Hargreaves & North 2011).

In sports, music has been used to make the environment more pleasurable (Karageorghis & Terry 2008; McLeod 2011, 53), to synchronize the movements of the athletes to the rhythm of the music or to arouse, relax or regulate the mood of the athlete prior an important sporting event (Karageorghis & Terry 2008.) In addition to the psychological effects, music can enhance our feelings of strength and endurance as well as enhance coordination (Batt-Rawden & Denora 2005).

Music can add emotional content to a commercial (Cook 2000, North et al. 2004) and emphasize the informative content by synchronizing important visual events with musical accents or sound effects (Chion 1994, 63–64; Cook 2000, 78). Music can suggest emotional content to a film, imply the inner thoughts of characters or steer the narrative (Bullerjahn & Güldenring 1994, Bezdek & Gerrig 2008, Cohen 2011). Music can express the emotions of a brand in sonic branding (Jackson 2003, Kusatz 2007, North & Hargreaves 2011), which may lead to increased brand loyalty (Fulberg 2003).

As music and sound are such powerful tools, they need to be considered in product development as well. Sound has often been a byproduct of technology (Rocchesso et al. 2008, Carvalho & Pereira 2015). However, there is increasing interest in sound design (Peres et al. 2008, Rocchesso et al. 2008, Csapó & Wersényi 2013) and sonic interaction design (Brazil & Fernström 2009, Rocchesso & Serafin 2009). In addition to providing information to the user (Rocchesso et al. 2008, Aaen-Stockdale 2014), sound can add to enhanced overall user experience and appreciation of the product (Peres et al. 2008, Rocchesso & Serafin 2009, Carvalho & Pereira 2015).

## 1.1 Suunto Movie

McLeod (2011) argues that the Western society is obsessed with immortality, which is displayed in sports by athletes seeking collective public acknowledgement of their skills. Previously, these performances were mainly distributed by television broadcasts. The age of the Internet and the vast amount of personal digital recording devices have enabled a major increase in archiving and memorializing athletic performance. Any individual athletic moment can be recorded and distributed via social media. Technology has served in immortalizing even the most mundane achievements. Everyone can record and broadcast their sporting achievements regardless of the level of athletic skills. (McLeod 2011, pp. 40–41.)


**Figure 1. Suunto Ambit3 Sport**

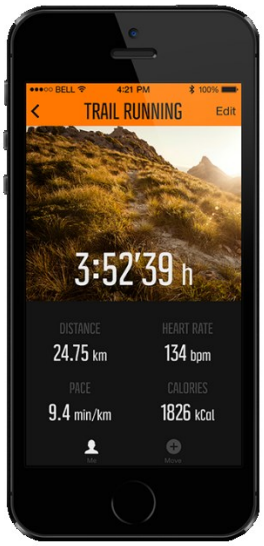


**Figure 2. Suunto Movescount App**

Suunto Ltd. is a Finnish company manufacturing sports watches, dive computers, and sports instruments for outdoor sports. The company states that they aim to provide the best tools for adventurers and sports enthusiasts, enabling them to explore and conquer new territory anywhere between the highest mountains and the deepest oceans. Movescount.com is an online sports community and training diary for Suunto users and sports enthusiasts. The users can upload and share their sporting activities while following other members. Suunto Movies are animated videos of the outdoor exercises of the users. These Movies are created with the Suunto Movescount App on the exercise that the user has tracked with either a Suunto GPS watch (Ambit3 Peak or Ambit3 Sport, Figure 1) or the App itself (Figure 2). The Movescount App is currently available for iPhone and Android phones. (Suunto 2015.) The Suunto Movie was launched in August 2014 with only visual implementation (Figure 3). Any sound added would need to be flexible, interesting and informative. As no quick solution of high quality was possible, no compromises were made. The movie was launched silent.


**Figure 3. Screenshot of the Suunto Movie**

## 1.2 Objective of the study and research questions

The objective of this study is to find a musical fit for the Suunto Movie; a musical composition with characteristics fitting together with the brand and the Movie itself. Six different original compositions were ordered from a professional composer and tested with a web questionnaire, taking different perspectives into account. As a part of a broader framework, the overall results can later on guide the construction of an entire sonic brand for Suunto. The research questions leading to solve this objective are:

1. What could be a musical fit for the Suunto Movie?
    1.1. What kind of emotions does music evoke in listeners?
    1.2. How does music affect user experience?

The emotions evoked by music (Question 1.1.) are analyzed by researching current emotion theories in psychology and in music. Moreover, musicology theories concerning musical structures are considered as well as cross-cultural research on music and emotion. The empirical part studies the subjective feeling component of the emotions evoked by different musical compositions. The theoretical overview for musical fit (Question 1) introduces several contexts relevant for this study: sports, matching music with visual content, film music, marketing and sonic branding. The empirical part evaluates various aspects of musical fit. The effect of musical variations on user experience (Question 1.2.) is approached by defining user experience and introducing different strategies for sound design and evaluation of sounds. The empirical part studies the effect of diverse musical compositions to the user experience of the Suunto Movie.

The effect of musical performance on emotions is left out at this stage, although this option is left for further development of the Suunto Movie Music. The effect of the personality and mood of the listener on emotions evoked is not taken into accoung. An in-depth analysis of the musical structures of the different compositions is not in the focus of the study. Mapping the emotional reactions to individual musical structures is not

possible as it would require continuous recording of the emotions. This is why the compositions were approached as a whole, taking a perspective of user experience.

The empirical part of this thesis consisted of a global web questionnaire (148 responses) with responses from Europe (97), North America (20), Australia (16), and Asia (11). The first questionnaire was sent to 234 users of the Suunto web service Movescount via email, receiving 54 responses. Additional 94 responses were gathered with an open link published on the Suunto Movescount Facebook page. The users listened to different compositions for the Suunto Movie, rated their liking of the pieces and thoughts of musical fit, analyzed the emotions that the music made them feel using the GEMS (Geneva Emotional Music Scale) and evaluated the music from different perspectives of user experience with the AttrakDiff semantic differential adjective pairs.

## 1.3 Thesis structure

Chapter 2 discusses music and emotion, commencing from the emotion models in psychology, continuing to theories relevant to emotions perceived in music and evoked by music, and a final focus on measuring music and emotion. Chapter 3 discusses the various contexts relevant for this study; sports, matching music with visual content, film music, marketing and sonic branding. Chapter 4 presents the concept of user experience, discusses sound design and introduces a method for measuring overall user experience. Chapter 5 concludes all relevant topics from the theoretical part.

Chapter 6 presents the methods and materials for the empirical part of the thesis, describes the different variations of the Suunto Movie Music and presents the web questionnaire. Chapter 7 introduces the demographics of the respondents and the results of the questionnaire, and Chapter 8 analyzes the results further. Finally, Chapter 9 examines the reliability and validity of the results, presents feedback on the test, conclusions on the empirical research, discussion and suggestions for further research.

# 2 MUSIC AND EMOTION

The research on music and emotion utilizes different emotion models of psychology. Section 2.1 presents the most frequently used emotion models; the discrete model of basic emotions and the dimensional model of emotions. Section 2.2 concentrates on emotions in music; the reasons for listening, and the emotions evoked by music described in the Geneva Emotional Music Scale. The section explains the difference between emotions perceived and emotions evoked, the psychological mechanisms involved in evoking emotions, and the effect of musical preference on emotions. Section 2.3 introduces musical structures that can be used to express emotions. Section 2.4 discusses how the culture of the researcher, the listener, and the music effects the emotions perceived in music. This chapter also introduces musical universals providing common ways to influence emotional responses. Finally, Section 2.5 presents ways to measure music and emotion using the different emotional models, focusing especially on subjective feelings measured with self-report questionnaires.

## 2.1 Emotion theories

There is no clear overall agreement on what emotions are. However, previous research can be concluded that emotions have more than one psychological or behavioral manifestation; subjective feeling, action tendencies, physiological arousal, cognitive appraisals, and expressive motor behavior. (Zentner et al. 2008.) Emotions are relatively intensive responses focusing on specific objects. These responses can last from a few minutes to several hours. Moods are of lower intensity, do not have a clear object and may last much longer than emotions, from several hours to days. Feelings are subjective experiences of emotion, which can be measured via self-report and reflect any or all other emotion components (Juslin & Västfjäll 2008).

In psychology, the two major models of emotion are the discrete model of basic emotions and the dimensional model of emotion. Both models have their advantages and limitations, especially in the context of music. Nevertheless, both have been used in the research for music and emotions.

### 2.1.1 Discrete model of basic emotions

The first major model of Emotions, the Basic Emotion Model, was presented by Ekman (1992). This model has also been referred to as a categorical or discrete model of basic emotions. Although introduced two decades ago, the Basic Emotion Model is still used frequently as a theoretical framework. By defining basic emotions, Ekman (1992) emphasizes that distinct emotions differ considerably from each other. Other emotions are formed from combinations of six basic emotions: anger, fear, sadness, enjoyment, disgust, and surprise. Emotions have primarily developed for enabling rapid reactions to the actions of other people or animals. However, emotional reactions can occur without the presence of others, for example, when hearing the sound of thunder or listening to music. (Ekman 1992.)

The six basic emotions form families of related states sharing certain characteristics in physiological activity. Variations within these families depend on the ability to control

these basic emotions, the object of the basic emotion and the spontaneity of the emotion. Basic emotion families can be distinguished by four characteristics: each basic emotion family has distinctive universal signals, occurs in the presence of other primates, has a distinctive physiology, follows distinctive universal events and coheres among response systems. All emotions have a brief duration of only a few seconds. Longer emotional experiences usually consist of multiple expressions of a single emotion. Different emotions can follow each other rapidly. The beginning of an emotion is easier to note than its ending. Emotions are often experienced as happening to a person instead of being deliberately chosen; they occur through automatic appraisal and often result in involuntary responses. Nevertheless, some responses are easier to control than others. (ibid.)

Ekman suggests that embarrassment, awe, and excitement could also be added to the basic emotions. Furthermore, he notes that in addition to the basic emotion of enjoyment, there are a number of other positive emotions such as amusement, relief, pleasure, pride, thrill, satisfaction, and contentment. What makes these positive emotions problematic is their lack of distinctive signals separating them from each other. Instead, they share a common smile where the expression extends from the lips to the eyes as well. (ibid.)

Although various sets of basic emotions have been introduced by other authors, evolutionary psychologists do agree that happiness, anger, sadness, fear and disgust are basic emotions. However, since people experience a considerably larger variety of emotions in their everyday life, some theorists list a considerably larger selection of basic emotions. (Sloboda & Juslin 2011.)

An alternative approach to this static view of basic emotions has been presented by Scherer (2001). Scherer describes emotion as a continuous mechanism that adapts to the environment. This mechanism separates stimulus and response, thus creating a latency time for optimizing the response. Scherer defines emotion as consisting of five different components: cognitive, subjective feeling, motivational, motor expression, and internal copies of the movement-producing signals. All five components affect the different interrelated organismic systems. Thus, emotion is defined as episodic changes where organismic subsystems react together, adapting to an external or internal stimulus central to the well-being of the whole individual. (Scherer 2001.)

Scherer (2001) challenges the model by Ekman (1992) by denying the existence of a limited number of hard-wired affect programs, such as basic emotions. Indeed, the emotion process fluctuates continuously, thus producing an extraordinarily large number of emotions. However, some major patterns of adaptation are more frequent than others, resulting in specific, recurring state changes. These states could be described as modal emotions and labeled with a short, single-word, verbal expression. Scherer proposes a set of modal emotions consisting of enjoyment/happiness, elation/joy, displeasure/disgust, contempt/scorn, sadness/dejection, anxiety/worry, irritation/cold anger, rage/hot anger, and boredom/indifference. (Scherer 2001.)

### 2.1.2 Dimensional model of emotion

The basic emotion model can be contrasted by the various dimensional models of emotion. Sloboda and Juslin (2011) present various models where emotions are conceptualized by placing them along affective dimensions. These models have been built around one dimension (arousal) or three dimensions (valence, activation, and power). However, the most influential is Russell's (1980) two-dimensional circumplex model (valence, arousal), with valence indicating pleasantness–unpleasantness. This model captures two important aspects: that emotions vary in their degree of similarity and that some emotions are bipolar by nature. (Sloboda & Juslin 2011.)

Russell (1980) places emotions in a circle, situated in a two-dimensional bipolar space, with one dimension being pleasantness and the other arousal (Figure 4). Antonyms reside on the opposite sides of the circle. The middle of the circle displays moderate affective states, whereas strong emotions are further away. If the dimensional axis is rotated by 45 degrees, this would result in new bipolar axes ranging from excitement (high arousal and high pleasantness) to depression (low arousal and low pleasantness) and from distress (high arousal, low pleasantness) to contentment (low arousal, high pleasantness). The circular ordering of the variables complement rather than contradict the dimensional characterization. (Russell 1980.)

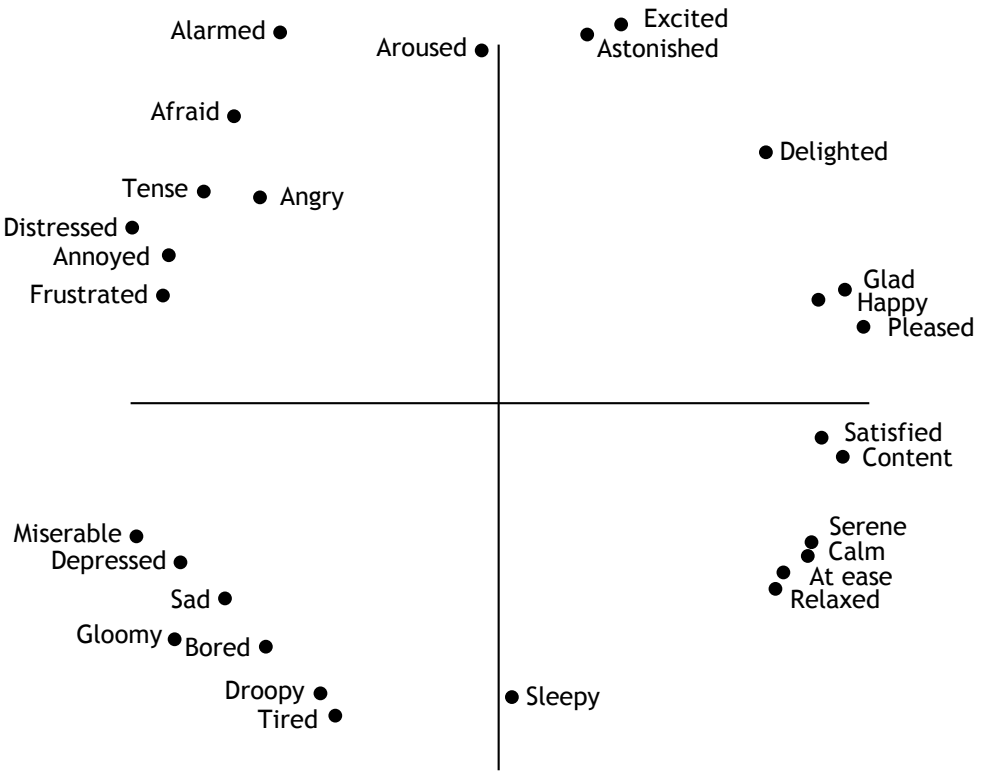


**Figure 4. The affective circumplex (Russell 1980). Affects situated among the valence and arousal dimensions.**

The affective circumplex is based on two types of evidence: a) how ordinary people conceptualize affective states and b) the analysis of self-reported affective states. People

need to interpret the moods of others, and anticipate or seek to modify their own emotional responses in everyday life. In order to do that, the emotions are summarized into a cognitive structure, shaping the perception and interpretation of events. These events can be verbal descriptions of emotion or nonverbal evidence of emotional states. Affect terms describing emotions are not synonymous with either the pleasantness or the arousal axes, but are rather placed in the two-dimensional space defined by these axes. Thus, any affect can be defined as a combination of the pleasantness and arousal components. (Russell 1980.)

Sloboda and Juslin (2011) note that the problem with the circumplex model is that people can experience simultaneously both positive and negative affect. Furthermore, essentially distinct emotions may be placed in the same position in the circular matrix. For example, angry and afraid are quite different emotions, yet they are both located high along the dimensions of arousal and unpleasantness. Their implication to the individual is significantly different. (Sloboda & Juslin 2011).

Another problematic issue concerning dimensional model rises from the model being built on common concepts of emotion. Russell (2003) criticizes later his own model by noting that the concepts of emotion inherit from folk theories. The intuitive ideas about psychological processes are not necessary wrong, but this intuition does not make them any more right. Folk concepts need to be analyzed in order to be scientifically useful. Even the concept of emotion is ambiguous, as it can be conceptualized as brain modes, actions or action tendencies, reflexes, instincts, attitudes, cognitive structures, motives, sensations, or feelings. Yet the usage of the everyday emotion words is essential in both common language and scientific discussion. (Russell 2003.)

Russel (2003) remarks that the dimensional model of emotion (Russell 1980) does not provide a sufficiently rich explanation of prototypical emotional episodes. As a solution, he suggests the integration of the dimensional perspective built on pleasantness and arousal with a categorical perspective using folk concepts for emotion. This integration takes into account the common emotion categories such as fear, anger and jealousy, and describes how these categories differ from each other. (Russell 2003.) Another approach could be to broaden the model to three dimensions (such as valence, activation, and power) (Sloboda and Juslin 2011).

Russell (2003) remarks that humans are amateur psychologists. A network of concepts has been developed over centuries to account for dramatic events that seem to be qualitatively different from everyday thoughts and actions. The concepts of basic emotions are based on tradition and everyday experience, and they shape the way people view themselves and others. Russell's analysis suggests that the concepts have empirical standing and provide understanding and prediction of common encounters and events. Russell concludes that emotional life consists of constantly changing and developing simple raw feelings, which depend on individual perception of affective qualities frequently attributed to single objects. All these components interact with perceptual, cognitive, and behavioral processes, occasionally forming emotional episodes matching closely with prototypes. (Russell 2003.)

## 2.2 Emotions in music

The basic emotion model and the dimensional model of emotions both have their own benefits and shortcomings. Most research on music and emotion is based on either one of these two models or their variations. This chapter focuses on emotions particularly related to music.

Davies (2011b) remarks that emotions in general do not constitute a homogenous class. Some emotions are primitive, automatic responses, such as disgust. Some have a more self-conscious, intellectual content, such as patriotism, envy, jealousy, regret, and shame. In practice it is useful to separate the emotions with sophisticated cognitive elements (e.g., hope and remorse) from emotions involving unconscious appraisals and automatic responses (e.g., lust and fear). Artworks might elicit either type of emotions. If narrative fiction is involved, the emotions elicited are most frequently cognitively sophisticated. (Davies 2011b.) Music can evoke almost any kind of emotions. However, extreme peak experiences are quite rare (Juslin et al. 2011).

Section 2.2.1 presents the different functions of listening to music, whether to regulate emotions or for social purposes. Section 2.2.2 introduces the Geneva Emotional Music Scale, a domain-specific emotion model especially suited for analyzing emotions evoked by music. Section 2.2.3 discusses the difference between emotions perceived in music and the emotions evoked by music, and their varying relationships. Section 2.2.4 presents the different psychological mechanisms evoking emotions. Finally, Section 2.2.5 discusses musical preference and its effect on evoked emotions.

### 2.2.1 The functions of listening to music

Music is most commonly listened to influence emotions. Music is used to change and to release emotions, to match current emotion, for enjoyment or for comfort, or for stress relief. Explaining these evoked emotions is increasingly important, as this emotional aspect of music is applied in film music and marketing. (Juslin & Sloboda 2011.)

Music is used for different functions in everyday life; distracting for reducing boredom, energizing for focusing attention on task, maintaining arousal and enhancing meaning. In the case of meaning enhancement, music is used to strengthen the emotional significance of an event or activity: to accompany a social ritual (wedding, funeral) or to reminisce valued past experiences. In all these cases the listener decides to obtain a strong emotional effect from the music stimulus. (Sloboda & Juslin 2011.) Music can act as a tool for self-management and self-regulation. Music can be used to emphasize everyday actions, such as listening to slow and easy music while trying to relax. Additionally, music can be used to accomplish emotional work, to manipulate feelings and energy levels and to motivate towards an external task. Music can structure social events, and serve as a soundtrack cueing other events. (Batt-Rawden & Denora 2005.)

The roles of emotions in everyday musical experiences differ between different cultures and when comparing musicians to non-musicians. Everyday music could be songs from the radio, themes for TV programs, music in elevators and shopping centers. This music is heard in situations combined with multiple experiences and the main focus is directed elsewhere. When listening to everyday music, the emotional

responses consist of rather basic than complex emotions. In everyday experiences, the emotional message is primarily designed to be read from the surface. People do experience complex emotions in their everyday life, but those are more likely the result from the context itself and its non-musical aspects. (Sloboda 2011.)

People do feel real emotions when listening to music. They are not simply just observing emotions or inferring them. There are specific features of the music that can cause certain emotions. However, a certain feature of a musical stimuli cannot be mapped unambiguously with a certain emotion. Nor can the emotional response of a person be predicted based on only the musical content. The person and the whole context play a key role in emotions evoked. (Sloboda & Juslin 2011.)

### 2.2.2 The Geneva Emotional Music Scale

The emotions evoked by music may somewhat differ from everyday emotions. Zentner, Grandjean and Scherer (2008) state that neither the basic emotion theory nor the affective circumplex capture the essence of musically evoked emotions. The emotions in music represent a more nuanced range than the labels imply. Basic or discrete emotion theories are more suited for coarse than refined emotions. Additionally, the affective circumplex does not add to the understanding on what makes the emotional effects of music emotionally rewarding. (Zentner et al. 2008.) As a summary on previous research, most common emotions evoked by music are suggested to be happiness, calm, love, sadness, excitement, and nostalgia. Fear, shame, and jealousy are quite rarely felt. A vast majority of self-reported felt emotions belong to the positive category of happy–elated. This category is followed by sad–melancholic, calm–content, and nostalgic–longing. (Juslin et al. 2011.)

The special qualities of music-related emotions require a domain-specific representation. The Geneva Emotional Music Scale (GEMS) groups music-related emotions together as a taxonomy (Table 1). The GEMS presents nine main musical emotion factors (Wonder, Transcendence, Tenderness, Nostalgia, Peacefulness, Power, Joyful activation, Tension, and Sadness), together with associated feeling terms to reduce interpretation errors. The meanings of different emotion names vary within different languages even when the translation aims to be exact. There are two different versions of the GEMS; a broader version, including a broader version of musical genres, and a more concise version conducted with only classical music. (Zentner et al. 2008.) In the version presented here, the clear duplicates from the associated feeling terms (such as Wonder – filled with wonder) have been removed to make the list of feeling terms more concise and easy for the users to read. Furthermore, some terms from the broader version have been selected for a better compatibility with a broader range of musical genres.

**Table 1. The Geneva Emotional Music Scale (GEMS) adapted from (Zentner et al. 2008).**

| Musical emotion factor | Associated feeling terms |
|---|---|
| Wonder | Allured, moved, admiring, amazed |
| Transcendence | Fascinated, overwhelmed, thrilled, inspired |
| Tenderness | Mellowed, affectionate, in love, sensual |
| Nostalgia | Sentimental, dreamy, melancholic |
| Peacefulness | Calm, relaxed, soothed, meditative |
| Power | Energetic, triumphant, strong, heroic |
| Joyful activation | Animated, bouncy, amused, feel like dancing |
| Tension | Agitated, irritated, nervous, impatient |
| Sadness | Tearful, sorrowful |

Zentner et al. (2008) noted in their empirical research that the most important states were feeling moved, enchanted, filled with wonder, nostalgic, dreamy, tender, and relaxed. Tenderness relates to feelings of love, affection, and tenderness, whereas wonder relates to the qualities of music: feeling enchanted, charmed, dazzled, and amazed. Peacefulness and relaxation emphasize the detachment of the listener from the real world. The researchers added the term joyful activation or 'to feel like dancing' to the scale, even though it did not seem to refer to an emotional state. However, it is an action tendency, which is a defining criteria for an emotion. Body entrainment is one of the most fundamental reactions to music. Joy evoked by music implies an action tendency to dance, differing from the common meaning for joy. In the GEMS scale, general happiness takes either the form of bliss or enchantment, as in wonder, or combines joy with the special affordance of music, dancing. (Zentner et al. 2008.)

Musical sadness is not exactly the same as basic meaning of sadness, because the aspects of feeling gloomy, depressed, or unhappy, are rarely reported as responses to music. Musical sadness can perhaps be better described as melancholic. Thus, it is not a feeling that people wish to avoid in general. The characteristics of sadness can be peacefully savored and examined in music, as it is void from contextual, real-world implications. (ibid.)

Davies (2011b) highlights a philosophical problem on responding with sadness to music perceived as sad. The listener does not believe that there is something unfortunate about the music, nor responds with compassion as he/she would when encountering a sad person. The listener mirrors the emotions perceived in music with subjective feelings. As only a few feelings are distinct from each other, music can arouse only rather general feelings, leading to a limited range of emotions. For the listener, the response

for a sad music can feel like sadness or pity, but as it is not directed towards a concrete object, there is not a strong tendency to act. This presents also another interesting dilemma. In general people do try to avoid unpleasant things, yet people voluntarily listen to sad music making them feel sad. The explanation may lie in the other qualities in the musical piece, such as the beauty of the piece. Furthermore, negative aspects of life are essential components of everyday life, so they must be faced. (Davies 2011b.)

While listening to music, people felt rarely negative emotional states, such as angry, indifferent, depressed, and anxious. In everyday life, negative emotions aid coping with threats for physical or psychological integrity. However, when listening to music, self-interest or threats from the real world are not relevant anymore, so negative emotions lose their scope. An irritation or anger reaction to music arises most likely when people are exposed to music they do not understand or like. Fear is not a part of the GEMS scale, as fearful reactions to the sound tracks in thrillers usually come from learned association. (Zentner et al. 2008.)

The emotions of the GEMS scale usually appear in combined, so many of the emotions correlate with each other as well. Wonder, Transcendence, Tenderness, Nostalgia and Peacefulness can be grouped together under Sublimity, Power and Joyful Activation under Vitality and Tension and Sadness under Unease. (ibid.)

### 2.2.3 Perceived and evoked emotions

Acknowledging the difference between emotions perceived in music and emotions evoked by music is essential in research. These emotions may be related in many different ways. This thesis uses mainly the term evoked emotions, other term used in literature are induced emotions (with an emphasis on the music instead of the listener) and felt emotions (a common word used in questionnaires for test participants).

Gabrielsson (2002) notes that perceiving emotional expression is a cognitive process, which should be distinguished from the emotional response of the listener to the music. The distinction of perceived and evoked emotion is typically unclear in everyday discussion as well as in scientific papers. The two alternatives can be thought of as the opposite ends of a continuum, where one extreme is the emotion-free, intellectual perception and the other one the intense emotional reaction. In practice, most situations are located somewhere in between, with emotions both perceived and evoked. Emotional responses and intellectual responses tend to occur separately, where musically experienced listeners most likely focus on intellectual features, and less musically experienced listeners tend to focus on emotional properties. (Gabrielsson 2002.) The listener might note that a musical piece is in a minor key, thus expressing sadness. However, a poorly performed piece merely irritates the listener instead of evoking sadness.

The relationship between perceived and evoked emotion can be Positive, Negative, have No systematic relationship or No relationship at all (Figure 5). In a Positive relationship the emotional response agrees with the emotional expression in the music. An example of a positive relationship is musical mood induction, where people use music to change, intensify, or release existing emotions. Background music in shops and restaurants relies on this positive relationship as well. However, several background fac-

tors need to be taken into account, such as age, gender, familiarity and attitude, physical and psychological state of the person, the degree of involvement and the concept of musical fit. (Gabrielsson 2002.) Positive background music might evoke negative emotions if it is considered unsuitable for the occasion, too unfamiliar for the listener or if the listener is in a bad mood.

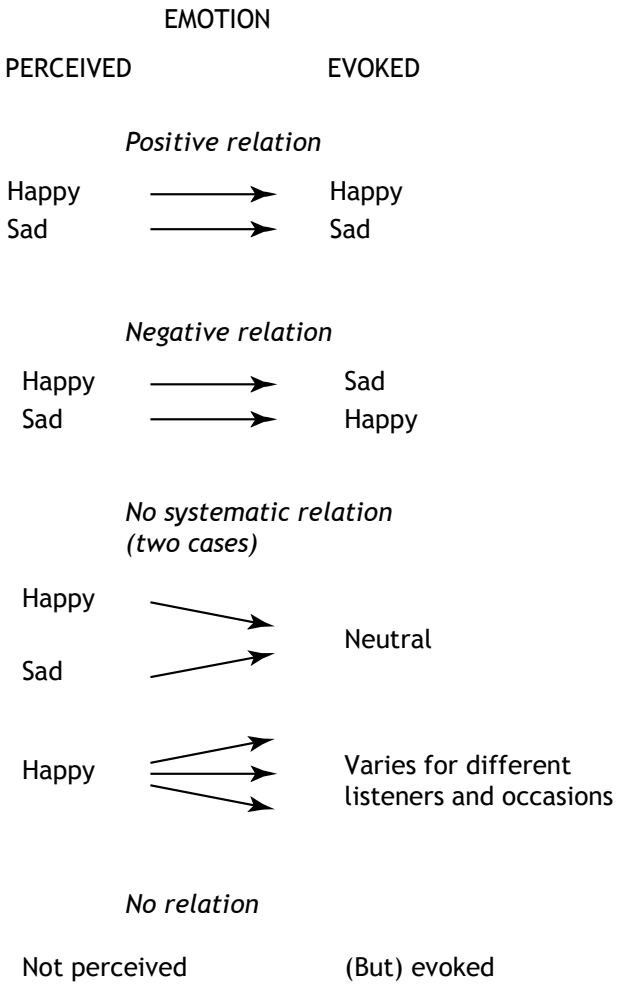


**Figure 5. Four types of relationships between perceived and evoked emotion. Happy and sad are used as examples and may be replaced by any other emotions. (Gabrielsson 2002).**

A Negative relationship between perceived and evoked emotion (Figure 5) occurs when the listener responds to the emotional expression of the musical piece in an opposite way. This may result from associating a certain musical piece with an event of the opposite emotional quality. One example is aggressive music that makes the listener feel calm and safe. In this case the music is familiar, associates with the identity of the listener and creates a sense of belonging in a certain cultural group. The expressive quality of a musical piece can influence the emotions of the listener disregarding the emotional content of the piece. Previous attitudes towards a musical piece, or using this musical piece in a certain, inappropriate context may cause negative emotions. (Gabrielsson 2002.) Additionally, music with perceived negative emotions, such as fearful or sad, can still arouse positive emotions. (Zentner et al. 2008)

No systematic relationship (Figure 5) may be a result of analytical, neutral listening by musically experienced listeners, theorists and critics. A critic might be listening to a musical piece, note the expression of sadness, but have no personal emotional response to this piece. Another example is a piece of music evoking different emotional responses in different listeners, or in the same listener on different occasions. The last relationship is No relationship between perceived and evoked emotion, as some emotions have no counterparts in musical expression. Overall, most evoked emotions depend on the background of the listener and of the situation. Emotion induction in a musical context is not limited to musical induction. (Gabrielsson 2002.)

Emotions evoked by music and emotions perceived in music differ significantly. All in all, more emotions are perceived than evoked, especially in the case of negative emotions. Music can symbolically mimic a broad range of emotional expressions, including negative behaviors. However, these perceived negative emotions do not inevitably translate into evoked negative emotions, as the listener in most situations is safely removed from any threats or dangers. (Zentner et al. 2008.) The basic emotions happiness, sadness and fear are among the easiest to recognize and communicate in music. As the basic emotions are explained by biology, they are recognized across various musical cultures. Basic emotions are recognized in a natural and effortless way, as members of the same culture are able to classify musical excerpts in remarkably short times from one second and less. (Peretz 2011.)

A contrasting view is offered by Davies (2011a), who claims that music expresses only some of the basic emotions, although it can evoke all of them. Music can be sad, happy, or angry. However, music cannot express surprise, disgust, or fear. It can evoke fear in listeners by building tension and suspense, but the music does not express fright itself. A symphony can startle the audience, but the music itself is not surprised. The expressiveness of music is based on dynamic patterns of tension and movement. Therefore, music has a dynamic character instead of a static one. As many emotions are displayed by static relative characters, such as those found in a facial expression, these emotions cannot be expressed by music. (Davies 2011a.)

Musical emotions rarely are directed towards the music; a listener is not sad about a classical piece or angry at a punk song. Some musical emotions take music as an object: the listener might be disgusted for the performance quality, admire the virtuosity of the composer or feel joy on the sequence of feelings during a musical piece. (Rozin & Rozin 2008.)

### 2.2.4 Psychological mechanisms evoking emotions

Psychological mechanisms refer to information processing leading to evoked emotions while listening to music (Juslin et al. 2011). There are six psychological mechanisms involved in evoking emotions: brain stem reflexes, evaluative conditioning, emotional contagion, visual imagery, episodic memory, and musical expectancy. These mechanisms are not exclusive but complement each other (Juslin & Västfjäll 2008.) Later on, a seventh mechanism of rhythmic entrainment has been added to this framework, referred to as the BRECVEM model. (Juslin et al. 2011).

Brain stem reflexes approach music as sound. The brain stem takes one or more acoustical characters from the music as a signal of something potentially important or urgent. These acoustical characters include sudden, loud, dissonant sounds or sounds with fast temporal patterns. These sounds can evoke arousal or feelings of unpleasantness. In general, listeners prefer music that evokes an optimum state of arousal: not too much but not too little. (Juslin & Västfjäll 2008.)

Evaluative conditioning refers to a piece of music repeatedly being paired with other positive or negative stimuli. Eventually, this music will produce the same emotion without the external stimuli. If a particular piece of music has been played repeatedly with a happy event (e.g. meeting with a friend), this music can eventually evoke happiness even without the friendly interaction. This can explain a piece of music evoking emotions for no apparent reason. Evaluative conditioning has not been considered relating strongly to music as such. However, it is a strong and frequent source of emotions evoked by music in everyday life. Evaluative conditioning evokes basic emotions very fast without depending on musical structure. (ibid.) Evaluative conditioning can occur even without awareness (Juslin et al. 2011.)

Emotional contagion refers to emotions first perceived in the music and then evoked in the listener. Emotional contagion evokes basic emotions in a very fast, unconscious way. This can occur through peripheral feedback from muscles or activation of relevant emotional representations in the brain. (Juslin & Västfjäll 2008.) Sadness in music can be expressed with by slow tempo, low sound level and soft timbre. The listener perceives this sadness and mimics the expression, leading to the same emotions evoked. (Juslin & Timmers 2011.) Music can feature acoustical patterns similar to emotional speech, and instruments can overemphasize these patterns, being free of the limitations of human voice (Juslin & Västfjäll 2008). Emotional contagion may not be an immediate mechanism, but rather increasing slowly while listening to pleasant music. Thus, it might result from a more complex mechanism. Furthermore, the researchers note that other musical information might associate to meaningful concepts, such as drum figures in African cultures, national anthems or wedding marches. Recognizing these concepts may lead to an emotional response. (Fritz & Koelsch 2008.) However, the relationship between perceived and evoked emotion may be either positive or negative, have no systematic relationship or no relationship at all (Gabrielsson 2002, Section 2.2.3.). Emotional contagion occurs only when this relationship is positive.

Visual imagery is a process where emotion is evoked due to the own imagination of the listener creating visual images while listening to music, for example a beautiful landscape. These emotions appear as a result of an interaction between the music and the images created. The musical structures may be mapped to concrete images, such as a melodic movement heard as "upward". Listeners respond to mental images similarly as they would to their counterparts in real world. In general the listeners may select and manipulate the images at will, thus influencing the emotions evoked. Visual imagery may evoke all possible emotions. (Juslin & Västfjäll 2008.) The emotions evoked by a particular piece of music are influenced by a written description on the context of the piece. When the emotional aspect of the contextual information was aligned with the emotional aspect of the musical piece, the evoked emotions were more intense. The

narrative descriptions promoted music-related visual imagery related to those descriptions. (Vuoskoski & Eerola 2015.)

Episodic memory refers to music evoking memories of special people and events. Music is also used to reminisce of valued events. The emotions evoked by episodic memory can be of any possible emotions. Episodic memories associated with music are particularly vivid when connected to music from young adulthood. At that time, music plays an important part in everyday life and the development of self-identity. This music is usually preferred the most. (Juslin & Västfjäll 2008.)

Musical expectancy refers to emotion evoked as the expectations for the musical structure are violated, delayed or confirmed. An unexpected outcome may leave the listener surprised. (ibid.) In Western music, a leading tone is a note with a strong tendency to move upwards or downwards. For example, the expectancy created by the seventh note B in a C major scale is confirmed by moving one semitone upwards to C, thus resolving the tension created by this leading tone. Juslin and Västfjäll (2008) continue that musical expectancy depends strongly on cultural learning as young children view it very differently. It is difficult to test, as musical expectancies can be formed on various hierarchical levels. Furthermore, expectancies vary for different listeners. Musical expectancy evokes surprise, awe, pleasure, "thrills", disappointment, hope, and anxiety. It is highly dependent on musical structure. (Juslin & Västfjäll 2008.)

Listeners constantly form expectations on how the music will proceed. They experience various degrees of tension and relaxation depending on the relationship between these expectations and the actual outcome. Tension might not necessarily be negative, just as the feeling of resolution might not be positive. These expectations can depend on general musical knowledge on melody, harmony, and rhythm, which non-musicians obtain by listening to music. Listeners may have expectations of how an individual piece of music will proceed, if a certain theme will reoccur later. Finally, general rules of perception create expectations. Listeners generally expect small changes in pitch, and are surprised with large jumps. (Krumhansl & Agres 2008.)

Rhythmic entrainment evokes emotion when a powerful, external rhythm of the music interacts with an internal body rhythm of the listener, such as heart rate or the rhythm of breathing. The bodily rhythm adjusts towards the rhythm of the music and eventually stabilizes on it. This adjusted rhythm may spread to other components of emotion, thus leading to increased arousal. The rhythm of the music can also aid motor coordination when performing physical work tasks. Rhythmic entrainment is a considerably slower induction process than for example brain stem reflex. (Juslin et al. 2011.)

Overall in the BRECVEM framework, the emotions evoked depend on the functions of the music – whether it is used to relaxation or evoking memories. The same piece of music may evoke different emotions in a different context. The difference between music and other stimuli for emotions in everyday life is that music is intentionally designed to evoke emotions. (Juslin & Västfjäll 2008.) Evaluative conditioning and episodic memory focus on real-life situations. In films, pairing of music with narrative content impacts the emotional experiences of the narrative. Music can foreshadow nar-

rative content, change the perception of the emotional state of a character and prepare the viewer for what is likely to occur in the narrative. (Bezdek & Gerrig 2008.)

In addition to single emotions, music can also evoke mixed emotions, such as the bitter-sweet feeling of simultaneous happiness and sadness. This can result from different mechanisms activating at the same time. Musical emotions become more complex as the listener matures and develops their musical skills. During this development, these mixed emotions also occur more frequently. (Juslin & Västfjäll 2008.)

The BRECVEM framework suggested by Juslin & Västfjäll (2008, 2011) is not sufficient for studying musical emotions in general. Researchers should specify the mechanism involved in each study. Several mechanisms determine together emotional outcomes depending on the precise conditions of the listening context. Gathering data on the emotional reactions of the listener is not enough; this data needs to be interpreted using the BRECVEM framework. Emotions do not have a simple relationship with cognitive appraisal. (Juslin & Västfjäll 2008.) Cognitive appraisal is defined as comparing music with aesthetic goals or standards. Emotions are caused by a process of appraisal, where music is first evaluated on its relevancy concerning the goals of the listener; will the music help the listener achieve their goals, does something need to be done about the music, and who is playing the music. These evaluations then determine the quality of the emotion that follows. (Moors & Kuppens 2008.)

### 2.2.5 The effect of musical preference on emotions

The musical preferences of a person affect the emotions evoked by a particular piece of music. The term preference indicates longer-term affective evaluations of objects or persons with low intensity, e.g. liking a particular type of music (Juslin & Sloboda 2011). There are essentially two types of musical emotions. The first type involves an appreciation of music; whether it is liked or disliked. Thus, the presence or absence of liked/disliked music may elicit emotions itself. The second type of emotions notes the content of music: whether the music represents certain emotions (sadness, happiness, anger) or emotion-eliciting events, such as hurricanes or carnivals. The emotions evoked by this type of music can be a reaction towards the perceived emotion or the events portrayed in the music. (Moors & Kuppens 2008.)

A number of studies between 1960s and the early 1980s present evidence of an inverted-U type of relationship between liking and objectively determined complexity of music. Music with intermediate complexity was liked most, and this degree of liking gradually declined towards both extremes of complexity. Parallel to the studies concerning objective complexity, studies of the relationship of familiarity and musical preference have been conducted. The more the listeners heard something, the more they liked it. This also followed the inverted-U curve, showing first an increase on the popularity of pop songs repeatedly heard on radio, followed by decreasing popularity at a later stage. The findings of complexity and familiarity can be combined together to form an understanding on how the listener perceives the complexity of the music. If this perceived complexity level lower than optimum, repetition will shift liking of the piece further down. If the complexity is higher than the optimum, liking should show an increase with repetition. (Hargreaves & North 2011.)

Another, much researched approach is the preference for prototypes. Everyday experiences are classified and compared with prototypes developed for those kinds of experiences. Repeated exposure enables learning, thus developing the prototypes further. These prototypes depend on individual listening history but also on the cultural expectations on how a particular piece might progress. (ibid.)

Apart from the musical structure, the use of music influences the preferences of a listener. Music can be used as a mean to achieve certain emotional states. People may choose musical stimuli to reduce high arousal levels (e.g. relaxing at home after a stressful work week) or to increase low levels to neutral (e.g. avoid boredom by listening to loud, fast music on long car journeys). In a broader perspective, people choose music to match a particular listening situation and the arousal-state goals of that situation. They may already have high arousal levels but wish to achieve an even higher level, for example selecting stimulating music while exercising. (ibid.)

In addition to the context, stylistic preferences of music may be influenced by the characteristics of the individual, e.g., age, social class, gender, musical training, and personality. The effects of age are the most prominent. Specific musical likes and dislikes in late adolescence and early adulthood have a strong influence on the musical taste developed later in life. Other research concerning social class, gender, musical training, and personality, is scattered and diverse. People from higher socioeconomic groups are more likely to prefer serious music than lower groups, although most of this research is outdated. (ibid.) Some more recent studies indicate that social status is a better indicator of musical tastes than social class. Other studies have shown that individuals in urban environments prefer jazz, classical, and contemporary rock music. In rural and suburban areas, classic rock, country, folk, and oldies are more popular. (Rentfrow & McDonald 2011.) Gender has been the topic of various studies indicating that young girls generally have more positive attitude towards music than boys. Furthermore, girls express liking for a wider range of styles. High level of musical training and ability may result preferring more complex music than people with low levels of training or ability. (Hargreaves & North 2011.)

Musical preferences may either reflect or compensate the personality style by lowering or increasing arousal. More evidence supports the claim of music reflecting the personality. (ibid.) As a summary on previous research, personality and musical preference can be connected by two means. Firstly, individuals prefer certain styles of music as the psychological qualities of that music resonate with their own self-image. Secondly, specific musical attributes, such as fast tempo, dissonant harmony, or richness of melodic themes, may determine the preferences of individuals. Overall, research illustrates a clear structure underlying musical preferences. Preferences for certain styles (e.g. classical) have a consistent relationship to preferences for other styles of music (e.g. jazz, blues, and folk.) This structure emerges across different samples, countries, and methods used. (Rentfrow & McDonald 2011.)

The musical preference of an individual relates strongly with emotions evoked by music. However, also the evoked emotions direct musical preferences. Schubert (2007) outlines that one of the strongest attractions of music is the ability to evoke and express

emotion. Nevertheless, the evoked emotion is a more important predictor of musical preference than expressed emotion. Pleasantness evoked by music correlates strongly with musical preference. People seek music that will evoke emotions. Furthermore, these evoked emotions need to match with the expressed emotions. If a music tries to express a strong emotion but fails to evoke it in the listener, the piece or performance has failed in some way. Listeners may also repress expressed emotions from being evoked, if they assume that their peers dislike the style of music listened. (Schubert 2007). On the other hand, preference for a musical genre enhances both the intensity and specificity of the emotions evoked by that music (Kreutz et al. 2008).

Pleasant emotions can be disliked and unpleasant emotions liked. (Ritossa and Rickard 2004). Negative emotions can be evoked when listening to either liked or disliked music. With music that is liked, the negative emotions are of an aesthetic, contemplative kind, and they are most commonly reported as sadness. These emotions do not activate real-life actions, such as avoidance behavior. With disliked music, the negative emotions are real, fully-fledged, and evaluative. These emotions are mostly related to annoyance and anger and may elicit avoidance. If a music piece is happy or evokes happiness, this emotion does not necessarily connect to liking. (Schubert 2013.)

## 2.3 Musical structures expressing emotion

Emotions perceived in music can be traced to certain musical structures. Emotional connotations vary with each structure, including intensity, tempo, pitch height, timbre, sensory dissonance, rhythmic complexity, and harmony. Each emotion correlates with various changes in musical structures. As many changes are moderate or weak, emotions are not determined by individual features. The full set of musical structures must be evaluated in a probabilistic manner, where different features are weighted according to their association with each emotion. (Thompson & Balkwill 2011.)

Balkwill, Thompson and Matsunaga (2004) discovered in their cross-cultural study that fast tempo with simple melody lead to high ratings of perceived joy. Consecutively, high ratings of sadness were associated with slow tempo and a complex melody. The music samples were perceived as angry when there was high intensity (loudness) and a complex melody. (Balkwill et al. 2004., Table 2) Overall, the typical major–happy/minor–sad association may be modified when the tempo, loudness or pitch height is changed. A piece in minor may sound happy if the pitch is high, tempo is fast and/or chords are loud. (Gabrielsson & Lindström 2011).

The balance between consonance (harmonious) and dissonance (inharmonious) has influences the emotions perceived in music. In Western tonal music, consonant music appears as stable and positive, whereas dissonance is associated with tension, instability, and negative emotions. Musicologists have suggested that the recognition and interpretation of dissonance may vary between different musical traditions, cultures, styles, and time periods. However, consonance and dissonance are perceived and interpreted already by infants, and these interpretations may remain influential into adulthood, diminishing the effect of culture. (Thompson & Balkwill 2011, Table 2)

Gabrielsson and Juslin (2003) summarize a large amount of previous studies on how the most common emotions perceived in music are related to musical structure variables. Positive valence (pleasantness) and high arousal are associated with fast tempo, high loudness, high pitch level, large pitch variation, staccato articulation, bright or sharp timbre, and sharp envelopes. Positive valence relates to major mode, consonance and simple harmony, fluent rhythm and less complexity. High arousal can be expressed with either mode, it may be dissonant and contain more complex harmony, more complex rhythm and more formal complexity. (Gabrielsson & Juslin 2003.) Increases in tempo, loudness and timbre result in higher activation. Tempo and loudness are dominant over other factors. (Gabrielsson & Lindström 2011, Table 2.)

The combination of negative valence (unpleasantness) and low arousal results from slow tempo, soft loudness, low pitch level, small pitch variation, legato articulation, dark timbre and round envelopes. Negative valence alone is usually in minor mode, more dissonant and allows more formal complexity. Low arousal alone may be in either major or minor mode, and less dissonant and complex than negative valence. The uncertainties lie in the effects of timbre, intervals, melody, rhythm, harmony, and properties of musical form. Most of all there are uncertainties on the interactions between different musical structures. (Gabrielsson & Juslin 2003.) All of these perceived emotions together with associated musical structures are summarized in Table 2.

**Table 2. Perceived emotion and associated musical structures**

| Perceived emotion | Musical structures | Reference |
|---|---|---|
| Joy | Fast tempo & simple melody | (Balkwill et al. 2004) |
| Sadness | Slow tempo & complex melody | (Balkwill et al. 2004) |
| Pleasantness | Major mode, consonance, simple harmony, fluent rhythm, less complexity | (Gabrielsson & Juslin 2003) |
| Unpleasantness | Minor mode, more dissonant, more formal complexity. | (Gabrielsson & Juslin 2003) |
| High arousal | Dissonant, complex harmony, complex rhythm, more complexity | (Gabrielsson & Juslin 2003) |
| | Increase in tempo, loudness and timbre | (Gabrielsson & Lindström 2011.) |
| Low arousal | Consonant, simple | (Gabrielsson & Juslin 2003) |
| Pleasantness & High arousal | Fast tempo, high loudness, high pitch level, large pitch variation, stacccato | (Gabrielsson & Juslin 2003) |
| Pleasantness & Low arousal | Consonance | (Thompson & Balkwill 2011) |
| Unpleasantness & High arousal | Dissonance | (Thompson & Balkwill 2011) |
| Unpleasantness & Low arousal | Slow tempo, soft loudness, low pitch level, small pitch variation, legato articulation, dark timbre and round envelopes. | (Gabrielsson & Juslin 2003) |

Another way of approaching emotions and musical structures is to commence the analysis from the different composed musical structures and list the perceived emotions associated to them. Gabrielsson and Lindström (2011) summarize previous research on musical expression of emotion. The clearest results can be seen with the effects of tempo/speed, intensity/loudness, and timbre/spectrum.

- Increasing tempo, loudness and timbre result in higher activation. Tempo and loudness are dominant over other factors.
- Fast tempo is mostly associated with activity/excitement, happiness/pleasantness, potency, surprise, anger, and fear.
    - Other factors such as minor mode and descending seconds may overrule this tendency.
- Slow tempo may be associated with calmness, peace, sadness, tenderness, and boredom.
- Loud music is mostly associated with expressions of intensity/power, excitement, tension, anger, and joy.
- Softly played music is associated with peace, tenderness, sadness, and fear.
- Large variations in loudness may suggest fear, small variations happiness.
- Tones with more high harmonics (increase in timbre) may suggest high activation such as potency, anger, fear, activity or surprise.
- Tones with few, low harmonics can be associated with low activation, such as pleasantness, boredom, happiness, or sadness. (Gabrielsson & Lindström 2011.)

The effect of pitch is ambivalent; high pitch may be associated with either high or low activation. The effect of melodic intervals depends on tempo, interval direction (up/down) and the location of the interval in a rhythmic/melodic pattern. Melody has been mainly studied concerning the range and direction, not as much concerning specific sequences. Research on harmony has concentrated mainly on the effects of consonance and dissonance, leaving the effect of different chords, harmonic progressions and implied harmony unstudied. (ibid.)

Also the changes in instrumentation can add emotional value. For example in popular music used in commercials, the lack of a bass-line can provide a quality of remoteness to a single melodic phrase. When a rhythmic bass line is added, the music is given a sense of fullness and presence. (Cook 2000, 10–11.)

The expressive qualities of music may relate to changes over time, resulting in shifting, blending or conflicting emotions. These changes can indicate growth, decay, tension and release, crescendo–diminuendo (increasing–decreasing loudness), and accelerando–ritardando (increasing–decreasing tempo). These phenomena may require recording the experiences of a listener for a longer time period. (Gabrielsson & Juslin 2003.) Other effects of transitions are diatonicism versus chromaticism and thin to thick texture. Even with static states, most factors have been studied regarding two extreme levels, such as fast or slow tempo, high or low pitch, loud or soft sound, ascending or descending melody, legato or staccato articulation. (Gabrielsson and Lindström 2011.)

## 2.4 The effect of culture on music and emotion

The cultural background of the listeners affects the emotions perceived and evoked. Becker (2011) notes that Western scholars and scientists studying music and emotion frequently presume that the person listening to music is a Western, middle-class individual. This person concentrates quietly to the music and the emotions evoked belong only to the individual, not to a particular situation or relationships with other people. However, these ideologies and presumptions do not apply for most of the world. Other cultures present situations, where music and emotion may not be individual and interior, but public, demonstrated by dancing or ecstatic movement. These emotions depend on the situation and are constituted by the surrounding culture. Furthermore, the musical expressions triggering these emotions may be determined by history, and inflected culturally within the musicians and listeners. (Becker 2011.)

In cross-cultural research, the researcher needs to be aware of their own cultural perspectives and how they can bias all phases of the research, including the questions being asked, the chosen methodology and analysis strategy, as well as the interpretation of observations. Consulting with members of the cultures under investigation may increase awareness of these biases. (Thompson & Balkwill 2011.)

Chinese listeners listening to Western music distinguished the perceived emotions happy and sad similarly to Western listeners. Therefore, the existence of an underlying universal bias is suggested, on which own cultural variants are being built and new culture variants are assimilated. (Peretz 2011.)

Most cross-cultural similarities result from cultures diffusing and interacting with each other. Presently, it is difficult to find individuals who have not been exposed to a large range of musical styles and tuning systems particular for a wide range of cultures and subcultures. (Thompson & Balkwill 2011.) Most modern non-Westerners are bicultural, already exposed to Western music. On the other hand, most Western participants are monocultural, unaccustomed to non-Western music. Therefore, most studies comparing Western and non-Western music are not fully cross-cultural as they lack the two-directionality required for satisfactory results. (Davies 2011a.)

Hindustani ragas have been discovered to evoke joy, sadness, and anger, but not peacefulness in Western listeners unfamiliar with Hindustani music. The ratings of psychophysical dimensions such as tempo, rhythmic complexity, melodic complexity, and pitch range, predicted their judgments of emotions. The timbre of music did not correlate with ratings of emotions. (Balkwill & Thompson 1999.)

In another study, the subjects were Japanese listeners, who were already exposed to both Western and Japanese music. As a comparison, Hindustani music was used to represent an unfamiliar musical system. The researchers concluded that acoustic (or psychophysical) cues are significant in other acoustic signals such as speech and animal calls. When speech prosody and music evoke the same emotion, they share several same acoustic cues. However, acoustic cues do not directly signify emotional meaning but suggest a rather complex mapping with emotional meaning. Anger in Western music was associated with increases in tempo, but in Japanese and Hindustani music it was associated with decreases in tempo. When acoustic cues are considered on their

own, they provided ambiguous information. Perceived complexity was associated with perceived anger as well as perceived sadness. Thus, a combination of cues must be used to evaluate perceived emotion. (Balkwill et al. 2004.)

The role of music listening across cultures varies as well. The participants from Germany mentioned the emotional reasons for listening everyday music significantly more than Anglophone (New Zealand, the US), South-American and Asian (Hong Kong, the Philippines, and Singapore) participants, when inquired about the different reasons for listening to music. On the other hand, emotions were identified more frequently by South Americans as a cultural function. (Boer & Fischer 2012.)

In this cross-cultural research, the individualism–collectivism dimension was considered for two reasons. First, if psychological research focuses predominantly on individual perspectives of musical experience, it neglects the collective aspect. This results most likely from the individualistic cultural background of Western researchers. Second, within the individualism–collectivism dimension, individuals from different ends of the dimension use music differently. (ibid.) Furthermore, relevant cross-cultural comparisons should be made across musical divides, instead of comparing Western cultures with each other (French vs. German, Finns vs. British). These cultures do not differ from each other significantly enough. Musicological boundaries do not equal political boundaries. (Davies 2011a.)

More research should be done in social bonding over shared musical experiences within and across cultures. Sharing a musical experience with friends is accompanied by emotional experiences. These experiences are exchanged within a cultural context. When these shared musical and emotional experiences are combined, they become shared memories bonding people together. (Boer & Fischer 2012.)

In the cue-redundancy model presented by Balkwill and Thompson (1999), emotions in music can be expressed through both culture-specific and perceptual cues. The culture-specific cues may involve music theory aspects, such as in the Hindustani classical theory, where traditional relationships are outlined between the ragas and their corresponding moods. The cultural cues of different tonal systems may not overlap with each other. The basic perceptual cues consist of the psychophysical dimensions of music, such as tempo and complexity. These psychophysical cues are independent of musical experience, knowledge or enculturation, and are present in all tonal systems. Together the cultural and perceptual cues provide an overlap of information, as illustrated in Figure 6. This overlap facilitates cross-cultural recognition of musically expressed emotions, enabling the listeners to perceive musically expressed emotion even in an unfamiliar tonal system. (Balkwill & Thompson 1999.)

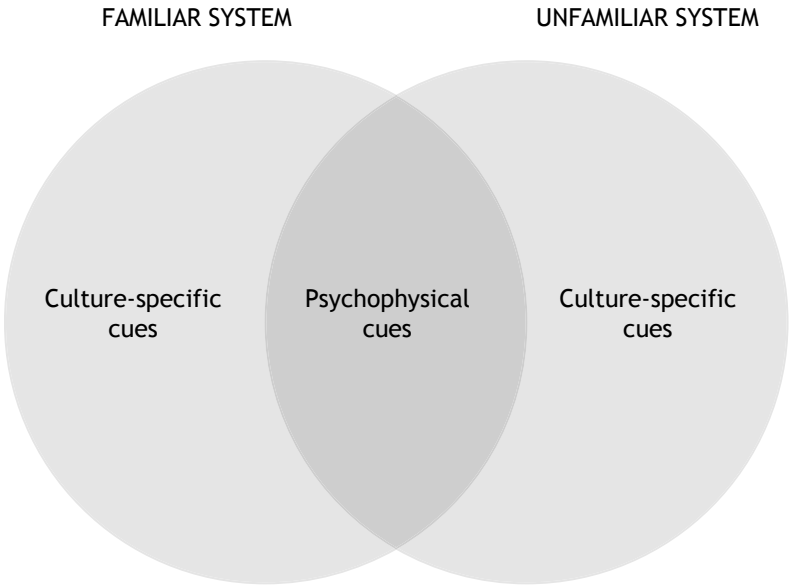


**Figure 6. The cue-redundancy model (Balkwill & Thompson 1999, Thompson & Balkwill 2011)**

Several candidates have been proposed for musical universals, providing a common understanding across different cultures and leading to influence emotions evoked by music. These musical universals are grounded on evolutionary biology and are not subject to learning.

- Music is processed easily when built on discrete, unevenly spaced pitch levels forming a scale
- People are more sensitive to shapes in pitch than to exact intervals
- Pitches separated by an octave are perceived as similar
- Relative differences in pitch are recognized better than absolute pitch values
- The difference between consonance and dissonance is well recognized
- Pitch sequences close to each other belong to the same group
- Music containing regular rhythmical and accent patterns is processed easily
- One pitch class usually acts as a point of reference for others. Thus, some pitches perceived as more stable than others. (Thompson & Balkwill 2011.)

Musical expressions frequently reflect mixed emotions. Decoding these mixed emotions in a cross-cultural environment is an even greater challenge. (ibid.)

Certain attributes of high arousal music are likely to occur across cultures, emerging indirectly from biophysical constraints. For example, music expressing high-arousal emotions may feature attributes reflecting increased oxygen requirements, which in turn correspond with high-arousal emotional states. As the connection between increased oxygen consumption and arousal state is recognized across different cultures, these musical attributes can also be independent of culture. Other psychophysical cues are sound intensity, rate, melodic complexity, melodic contour, pitch range, rhythmic complexity, dynamics, and timbre. (ibid.)

## 2.5 Measuring music and emotion

When researching music and emotions, there are various methods of measurement. The research of emotions in everyday music mostly involve field rather than laboratory studies, self-report methodologies, and other rich, user-drive en forms of data. Preferred methods are based on interviews and questionnaires. Furthermore, with self-report methods, the participant guides the interpretation of emotions. (Sloboda 2011.) In empirical studies it is necessary to have the subjects observe the distinction between expressed and evoked emotions, as they may differ significantly. (Gabrielsson 2002, Zentner et al. 2008.)

Section 2.5.1 discusses measures relating to different emotion models, as both the basic emotion model and the dimensional model have been used in music-related research. A comparison is made between these models and the domain-specific GEMS model. Section 2.5.2 focuses on special considerations concerning self-report questionnaires used to measure subjective feelings.

### 2.5.1 Measures relating to different emotion models

Self-report instruments typically derive from a certain theory or model of emotion, such as the basic emotion model or the dimensional model of emotions (Zentner & Eerola 2011).

Approximately one third of self-report studies related to music and emotion and conducted within 1990–2010 have utilized the popular basic (or discrete) emotion model (Section 2.1.1). Furthermore, the basic emotion model has been proven especially suitable for testing the perceived emotions in music. When using the basic emotion model, traditional emotion categories can be modified by replacing disgust and surprise with more musically fitting categories such as tenderness or peacefulness. The basic emotion model focuses on the negative emotions, so it does not function well with emotions evoked by music. Music can reflect human behavior in general in a broad range, including also various negative emotions. However, these perceived emotions do not translate into evoked negative emotions, as the listener is distanced from the dangers, threats and losses that the music describes. (ibid.)

The main alternative for the basic emotion model has been the dimensional model of emotion (Section 2.1.2.) Another third of self-report music and emotion studies conducted within 1990–2010 have utilized this model. Typically participants rate pleasantness and arousal independently on bipolar (negative to positive) scales. Nevertheless, the categories of basic emotions have been present in these studies, either in the stimuli representing the basic emotions or using basic emotion terms in the rating scales (specifying the bipolar extreme of pleasantness as happy). However, the two-dimensional model does not account for all music-mediated emotions. Basic emotions commonly classified rather distant (anger and fear) can be placed quite close to each other in the affective space (unpleasant and highly active). A three-dimensional model divides arousal to energy and tension arousal and could be applicable to music, as tension is a particularly appropriate concept to music. (ibid.).

The basic emotions and the three-dimensional model can both be simultaneously used. In this combination, the core affects and the underlying mechanisms can be best described by the dimensional model (a location along the energy–tension axis), with people interpreting these dimensions in conceptual categories (e.g., sadness, fear, or tenderness). Furthermore, this separates the affect mechanism from the cultural interpretation. (ibid.).

A third alternative model for measuring music and emotion is the domain-specific Geneva Emotional Music Scale (GEMS) developed by Zentner et al. (2008) (Section 2.2.2). The researchers compared the GEMS with the basic emotion model and the dimensional emotion model. The validation was made with classical music and concentrated on emotions evoked by music. The listeners preferred the domain-specific emotion model to describe their music-related emotions. Furthermore, the emotions selected by the participants were better aligned within the GEMS model than with other models. Finally, the GEMS terms distinguished the emotions of different musical excerpts better from each other. The GEMS model is useful to all professionals evaluating emotional effects of music, among them film industry professionals evaluating the emotional atmosphere evoked by various pieces of music. However, with more subtle distinctions, it is difficult to achieve reliable results, as the emotions occur most of the time in a blended manner. (Zentner et al. 2008.)

### 2.5.2 Considerations on self-report questionnaires

Self-reports provide information on the subjectively experienced component of an emotion, usually referred to as feeling. The other aspects of emotions such as action tendencies, physiological arousal, cognitive appraisals and expressive motor behavior are not measured. However, as music rarely causes overt expressions or actions, the researchers conclude that self-report is a viable method for researching musical emotions. (Zentner & Eerola 2011.)

Verbal self-reports have long been the only way of accessing the subjective emotional experience. Nonetheless, verbal report is a biased method due to individual differences in language use. Furthermore, listeners may confuse perceived emotion with felt emotions. As emotional and intellectual responses tend not to occur together, reporting on emotional reactions may interfere with the reactions itself. (Gabrielsson 2002.) Self-report is vulnerable to deception and demand effects as not all emotions are experienced consciously. Self-report can be complemented by measuring heart rate, skin conductance, and facial expressions, but all these measurements have their own limitations. Specific emotions can also be identified on the basis of systematic neural activation patterns. This method could complement other techniques. (Kassam et al. 2013.)

In questionnaires, the questions can be of either open or closed form. Open responses are more motivating for the participants, enabling a deeper reflection on experiences. However, the choice of words, differences in vocabulary and culture make the comparison difficult. (Sloboda 2011.) Free responses are not compliant to systematic data treatment and analysis. Furthermore, listeners may lack interest or the necessary vocabulary to verbalize their emotional experiences accurately, which may lead to underreporting. (Zentner & Eerola 2011.) However, free descriptions identify variable, multi-

faceted and subtle emotions that might escape the choice among given adjectives or rating along simple scales (Gabrielsson & Lindström 2011).

In closed-form questions, choosing emotions from a predefined list aids analysis and comparison. The disadvantage is that this might only present the nearest fit to the emotion instead of the true response (Sloboda 2011). Results are quantified easily but some important aspects of the phenomena might be overlooked and the predetermined choices might influence the responses of the participants (Zentner & Eerola 2011). To maximize the advantages and minimize the disadvantages of each approach, open-ended and closed questions should be combined. This enables also discoveries that are incompatible with the current model. (Zentner et al. 2008.)

When constructing closed-form questions, unipolar scales (e.g., "How happy did you feel?" on a Likert scale ranging from 1–5) are less prone to interpretation errors than bipolar scales (ranging from sadness to happiness). (Zentner & Eerola 2011.)

Participants who are not that interested in music might be unaccustomed to talk and think precisely about music. They may have few authentic comments even when asked to focus their attention on music. Any detailed reflection might be directed more towards their own psychological states than the emotional aspect of the music (Sloboda 2011). Nevertheless, musical listening, musical reflection, and musical narrative may create a sense of empowerment for the participants. The conscious listening of music may increase the self-reflection and help control emotional reactions. Furthermore, even musically unexperienced participants have become increasingly conscious towards the emotions that music evokes. (Batt-Rawden & Denora 2005.)

From a philosophical point of view, even musicians claim that the power of music goes beyond words. Language cannot be used to fully understand musical experiences. Nonetheless, describing, understanding and explaining the phenomena is certainly possible. (Zentner & Eerola 2011.)

# 3 APPLICATIONS OF MUSIC

Sound expresses and arouses emotions more easily than visual stimuli. (Gabrielsson & Juslin 2003.) In cinema, words and images supply the most evident emotional identifications. The role of music is to structure and evoke that emotion, while defining passage through time. In commercials, music already has some latent meaning by itself, but it is also ready to accommodate meaning together with words. The meaning of words and the meaning of music have a common intersection between their emotional attributes. In this way, a piece of music can offer a wide range of emotional expression. (Cook 2000, 95–96.)

The practical applications of music are plentiful, and there are various contexts relevant for this study. As Suunto Movie is created from an outdoor sport exercise, Section 3.1 presents the different uses of music in sports, starting from music listened by athletes and continuing on towards music used in sporting events, television and video games. In a basic interpretation, the Suunto Movie combines music and visuals. Therefore, Section 3.2 discusses matching music with visual content and the effects of synchronization. As the simple relation of music and visuals is taken further, Section 3.3 discusses film music as a source of emotion and information. Essentially, one of the aims of the Suunto Movie is to create brand awareness. Therefore, Section 3.4 examines music and emotion from the viewpoint of marketing and introduces the concept of musical fit. Finally, Section 3.5 combines all this knowledge in the relatively new field of sonic branding.

## 3.1 Music in sports

Music has been used in athletics and exercise as an enhancing supplement to the activity, underscoring something of the expressive act of exercise. Furthermore, music can be used to organize exercise. (McLeod 2011, p. 53). An individual athlete can use music in three main ways. First, asynchronous music can be played in the background to make the environment more pleasurable. Second, synchronous music can be used by athletes synchronizing their movement patterns to the rhythmic or temporal aspects of music. Third, the athletes can listen to pre-task music to arouse, relax or regulate their mood. This pre-task music can be used to manipulate the activation states by arousal control, to facilitate task-relevant mental rehearsal, to promote flow and to enhance perceptions of self-confidence. (Karageorghis & Terry 2008.) Music used during exercise should be fairly familiar to the listener and reflect their personal preferences. (Karageorghis et al. 2012.) Apart from the psychological effects, music also has considerable physiological effects. Music can modify or extend perceived body capacity by enhancing our feelings of strength, endurance or enhancing coordination (Batt-Rawden & Denora 2005).

Music played at sporting events most frequently represent a specific ‘sports rock’ genre. This music is often especially compiled and distributed by companies specializing in the genre. The idea for the compilations came from realizing that same music (e.g. Gary Glitter: Rock and Roll Part 2; Queen: We Will Rock You) is played at different venues for different sports. (McLeod 2011, p. 87) Apart from sporting events, music has an important role in sports films, where musical soundtracks are used to convey and

reinforce social identities and messages. The powerful images in cinema, television and internet build powerful associations for the music accompanying these images. Combining sports, film, and music has produced memorable representations for defining social identities. (ibid., pp. 185–186.)

Music is used in television sports to underscore sports highlights in the news, theme music in sports shows and televised sporting events. The majority of music in television sports is based on the commodification of networks and sporting leagues. The music is most frequently coded aggressive, with notions of masculine aggression and heroism (ibid., p. 215, 218). The music composed for the cinema carries often similar connotations. In American sports films, composers can use musical motifs and gestures to emphasize the mythological stature of the sports heroes. These gestures are used as musical cues, to guide the audience's interpretation of a certain moment in film. These musical gestures are drawn from classical music, especially of the post-Romantic era, light classical music or classical Hollywood scores. They may underline heroic individualism as an American virtue, triumph over odds, hard work and teamwork as constructing success and success as a tool to regenerate and reintegrate communities. (Scheurer 2005.)

Sports film soundtracks are a very high profile example of interactions between sports and music. However, the use of music in video games has become one of the most important and innovative arenas for new music generation. The use of music in sports video games has evolved from an introductory background to music heard in sporting events during half-time and in between plays. Influential bands such as Barenaked Ladies and Aerosmith have provided music to popular games by the sports game manufacturer EA Sports. (McLeod 2011, p. 212)

According to Dave Warfield, a producer of NHL franchise games at EA Sports, music in games is used for emotion and recognition. He continues that the aim is to recreate the experience of fans at sporting events by using hit songs already on the charts or songs that the gamers already own in their record collections. For the bands, this is another opportunity of promoting singles before an album release. (Traiman 2001.) Music is used to enhance the overall experience of a sporting game. Music will evoke an emotion that will be remembered and associated later with a particular brand. Presently, music is used as a passive, although influential, background to the activities in the game. However, interactive or participatory music simulation video games have become popular, with music at the focus of the experience. (McLeod 2011, p. 213)

## 3.2 Matching music with visual content

There are overall implications when playing music together with moving visual imagery. Words and images dealing with the specific and the objective, whilst music deals primarily with responses — values, emotions, and attitudes. Music can generate meaning beyond things that are explicitly said, yet interacting with words and images. (Cook 2000, 22–23.)

Chion (1994) uses the term synchresis as a combination of synchronism and synthesis. Synchresis is a connection between simultaneous auditory and visual phenomena, of-

ten beyond rational logic. This enables dubbing, postsynchronization and sound-effects mixing. Not all events connect as synchresis. Events that set up precise expectations, such as walking, are especially easy to combine with virtually any sounds, ranging from actual human footsteps to ping-pong balls and glass objects used by Jacques Tati. (Chion 1994, 63–64.)

When music is played together with a moving image, any similarity beyond a certain level is bound to make the music and movement synchronize. This synchronization can occur even with quite different tempi, making the spectator see the rhythmic qualities of the music also in the movement. (Cook 2000, 78.) Sound in conjunction with a moving image directs the attention to a particular visual trajectory, for example kung fu movements punctuated with rapid auditory effects. Furthermore, sound can create a rapid movement which does not even exist in the image. In science fiction movies, consecutive images of a closed and an open diamond-shaped door, accompanied with a dynamic and convincing sound, make the spectator think that they actually see the door slide open. (Chion 1994, 11.) Mickeymousing is following the visual action in synchrony with musical trajectories, such as ascending musical figures accompanying the climbing of a hill, and instrumental punctuation of specific actions including blows, falls, and doors closing. Sound increases the understanding of rapid visual sensations and aids memorizing them. However, the extensive use of mickeymousing leads to redundancy. (ibid., 121–122.)

By embodying motion, music embodies emotion. This can occur in three different ways. First, kinesis can result from rhythm, harmony, dynamics, and other musical elements. Second, the kinesis can be built within the genre, for example, the conventional dance types of classical music. This kinesis does not need to synchronize with actual movement on screen. Third, there is the kinesis of structure in large-scale patterns of musical analysis. This could present itself by imperfect cadences resolved bars later on in the composition, counterpoint between melody and bass and ascent to a common cadence in the end of a composition. (Cook 2000, 78–80.)

Music videos are typically characterized with horizontal freedom, where parallel image and sound tracks rarely have precise relation. The image is completely liberated from the linearity normally imposed by sound, using widespread nonsynchronization. This is contrasted with precise and pronounced points of synchronization occurring throughout the video. (Chion 1994, 37, 167.) In general, there can be a vast amount of synchronized points, but only certain ones are important. These primary points are crucial for meaning and dynamics. (ibid., 190.)

Multimedia has an inherently dialogic nature. It is mostly a work of more than one author, which needs to be recognized when analyzing it. Cook defines three basic models of multimedia: conformance, complementation and contest. These models reflect the way that the different elements of multimedia (in this case sound and images) relate to each other. Conformance means that sound and images are consistent with each other, variants of the same expression. The components of each element relate directly to each other. The full opposite of conformance is contest, where each different media attempts to impose their characteristics on the other. Contest is dynamic and

contextual and it is seen especially clearly in examples where a new medium is added to an existing production. It radically deconstructs the component media and generates its own meaning. The third model, complementation, represents a mid-point between these two extremes. Images and music each have their own properties. The conflict of these different properties can be avoided by one media filling in the gaps that the other media is leaving; for example, music complementing the words and images. (Cook 2000; 98–106, 128.)

## 3.3 Music in film

As music and visuals are combined together to create a narrative, the relationship is analyzed further in the topic of film music. Music is one of the strongest sources of emotion in film (Cohen 2011). Chion (1994) characterizes cinema as not really being an art of the image, but rather an art form, where image and sound are combined to create something new that is not there when observed with only one sense. This audiovisual illusion is located in the heart of the relationship between sound and image. The sound enriches the image to provide a certain impression that is already embedded in the image, creating added value. This added value gives the impression that sound only duplicates the meaning of the image, when in fact at times the sound provides the meaning to the picture and dictates the rhythm and unity to a film sequence. The audiovisual relationship is a symbolic contract where the audio-viewer agrees that the sound and the image form a single entity. In practice, visual and auditory perception mutually influence each other by contamination and projection. (Chion 1994, 4–5, 9.)

Sound influences the perception of time of an image. It can impose a sense of succession for two static shots, and it can dramatize shots and orient them toward a future goal. This temporalization depends on different factors of the sound: A smooth and continuous sound animates the image less than a fluttering one. A predictable sound with steady rhythm creates less temporal animation than an irregular, unpredictable sound. This regularity is further combined together with the tempo of the soundtrack to effect the temporal animation; an unstable rhythm with moderate speed is perceived more animate than a rapid speed with regular rhythm. (ibid., 13–15.)

Music in film belongs to the objective world of the audience, unless it is actually played by the characters in the film. Therefore, the attendance of the audience is selective, and is directed to only that part of the music that is logical according to the narrative. They may extract the emotional information, failing to pay attention to the acoustic properties of the music. The emotions evoked by music are automatically attached to the visual focus of attention or the main topic of the narrative. Therefore, the film content provides an object for emotion and controls it. The composer for the film music is coding music to match the visual and emotional information of the narrative. (Cohen 2011.)

Chion (1994) describes an experiment of forced marriage, where one film sequence is played in conjunction with various pieces of music. Even with randomly chosen pieces, there typically are a few that create surprising or moving points of synchronization different from the points in the original sound. (Chion 1994, 188–189.)

Emotional expression in music directs considerably the perception of an ambiguous film. A melodrama soundtrack leads to the film being classified as sad and sentimental. Consecutively, thriller soundtracks result in thrilling judgments of the film. In general, film music polarizes the emotional atmosphere of the film. Furthermore, the soundtrack influences the perceptions that the viewers have of the reasons and intentions of the characters. Additionally, the soundtrack directs the presumed end of the film. (Bullerjahn & Güldenring 1994.)

Music can transport information that meets the goals of a film director and a film composer in the minds of the audience. The audience aims to make sense of the whole film presentation, using all available information. In the entertainment context, there is also the aim to create the best possible story. Even though the focus of the audience might be on the visual scene, the emotional meaning of the music can be directed to the auditory scene, where it can aid in interpreting the visual level. The structure of music may suggest the structure of the narrative; with musical closure suggesting closure in the storyline or raising expectancies on the outcome of an episode in film. (Cohen 2011.)

A film composer has multiple goals that need to be fulfilled: provide continuation, direct attention, induce mood, communicate meaning, cue memory, create a sense of reality, and contribute to the aesthetic experience. Real life portrays multiple emotions both simultaneously and in succession. The possibility of expressing these complex emotions in music can be accomplished by presenting multiple emotional information in harmony, rhythm, melody, timbre, and tonality. (ibid.)

## 3.4 Music in marketing and musical fit

The object of film music is to evoke emotion and communicate meaning for the sake of art or entertainment. When the objective of the film is to sell products, services or create brand awareness, the perspective changes to music in marketing. North and Hargreaves (2011) list five uses of music in film: to attract attention, prime memory, convey a message, overcome language barriers and appeal to different age groups. Academic research on music and marketing has focused on classical conditioning of emotional responses, the use of information associated with the music to affect the perceptions on a particular product and sonic branding. (North & Hargreaves 2011.)

Music in commercials associates various qualities and attributes to the product advertised. However, the significance of these qualities emerges from the interaction with the storyline, the voiceover and the images. Musical meaning is constructed within the commercial; it is not an attribute that the music has, but it is rather something the music does within that given context. (Cook 2000, 8–9.) The music can tie the commercial together in a convincing manner, bringing associations and values to the story and interpreting the words and images. (ibid., 22–23) A musical cue aligned with the company logo emphasizes the message of the commercial. In a way, music is not just used to highlight the product name, but also to assert the fundamental, unspoken message of the commercial: this company is a solution to all your problems. (ibid., 16.)

One classical conditioning approach is the Elaboration Likelihood Model, presenting two routes to persuasion, leading to high and low involvement with the advertise-

ments. In the central route to persuasion, the subjects consider carefully information relevant to object, thus forming an attitude towards it. The elaboration likelihood is high, meaning that the person has the motivation, opportunity, and ability to process brand information. This leads to high involvement with the advertisement. In the peripheral route, the subjects do not think actively about the object and its attributes. They form attitudes by associating the object with positive or negative cues by some form of conditioning mechanism, such as liked or disliked music. The elaboration likelihood is low, thus leading to low involvement with the advertisement. This type of processing is more influenced with conditioning, as simpler cues and heuristics may be invoked when forming the attitude towards the brand. (North et al. 2004.)

Classical conditioning effects of music may occur when customers are in a low-involvement state. As the customers are not actively processing the information of the advertisement, the emotional aspects of music affect more. In the high involvement state, the customers are actively considering the claims made in the advertisement, so their preference of the music should be irrelevant to these logical attempts. However, even in high involvement state the music can have a positive impact if there is a good musical fit. (North & Hargreaves 2011.)

Musical fit has music guiding the way the consumers evaluate the product, so that the musical characteristics fit the brand characteristics. Music might be used in an explicit way with lyrics stating the message of the advertisement, or in a more subtle way that utilizes the knowledge of the consumer and stereotypes about the music. Dynamic, energetic, youthful dance music may promote the same values as a sports drink. Consecutively, old-fashioned, conservative, classical music may promote the same values as a bank. The music affects the perceptions of the products that are advertised. If the music fits the products, they are remembered better. This suggests music having a direct impact of the processing of information. (ibid.)

Musical fit leads to a greater ability to recall the advertisements. The musical content activates related mental concepts and is effective in promoting broad associations. The level of musical fit influences recall of the message of the advertisement, but also leads to more emotional responses to the advertisement. Musical fit may have beneficial effects in advertising with listeners of both low and high level involvement. For the low-involvement listeners, musical fit increases their liking of the advertisement. For high-involvement listeners, the salience of certain brand attributes is increased. The effect on excessive congruency remains unclear. If the musical fit is too good, it may make the brand sound like a cliché, leading to dislike. Another model suggests that it should just increase the liking monotonically with category activation. (North et al. 2004.)

There are four significant problems when researching music and advertising. First, most of the research is conducted in laboratory conditions. Thus, the research of long-term impact of music in advertising is not possible. Second, the current theories are complex, produce conflicting predictions but can explain almost all findings. For example, there are theories explaining product recall on adverts featuring congruous music, incongruous music, and no music at all. Third, research suggests that audiences create a connection between any combination of music and visuals, no matter how in-

congruous this connection is intended to be. Fourth, the concept of musical fit has not been defined well enough. As consumers have their own interpretations of music, this leads to advertisers employing only the most unambiguous and crass connotations of music; anything played with the distorted electric guitar is considered youthful and rebellious. In practice it is not clear, which aspects of the music should correspond with which aspects of the product. If cars are portrayed generally as exciting, but a particular car is advertised as safe or fuel-efficient, it is hard to have a logical decision on which aspects should be highlighted with music. This is where the findings of music psychology should be combined with research on music and marketing. In particular, research findings on musical preference and listening context could be used to find appropriate music for particular listening situations. (North & Hargreaves 2011.)

## 3.5 Sonic branding

Music in marketing mostly analyzes single cases of commercials and the music in them. When the scope is broadened from a single commercial, sonic branding discusses the use of music from the perspective of the whole brand in all available contexts. Gustafsson (2015) remarks that the presence of music in consumer society and especially its use in marketing can be described by the labels sonic branding, audio branding, acoustic branding, sound studies and sonic design, among others. However, she recommends using sonic branding as the common term, as it incorporates music as well as other sounds. Furthermore, it makes an explicit connection to brands and branding. (Gustafsson 2015.) Sonic branding is defined as music or other sound used for brand recognition, while relating to the key aspects of the brand. Many arguments of musical fit may apply to sonic branding as well. (North & Hargreaves 2011.) One example of a powerful sonic brand is the Intel sonic logo, a short tune designed to be easily remembered. A successful sonic logo is distinct and recognizable, interrupts the listener from performing other tasks and directs their attention to the commercial following the sonic logo. As a result, the actual information can be effectively provided to the now conscious listener. (Jackson 2003, 3, 9, 30.) A credible sonic brand supports the total sensory perception of the brand identity. (Kusatz 2007.)

Sonic branding strives to express emotions of individual brands through music, and generate belief among the stakeholders of a brand (Jackson 2003; 44, 97). Music has the potential to trigger an emotion-based reaction, hopefully leading to increased brand loyalty (Fulberg 2003). Sonic branding derives from the traditions of film music; both aim to enhance the experience and add believability and memorability to the action. Even now, the process of sonic branding frequently commences with a selection of appropriate film soundtracks, as they have the ability to portray every emotion imaginable. (Jackson 2003, 16, 22, 116)

The voice of the brand needs to be heard in the musical expression. This is achieved by collaboration between the brand owner, the creative agency and the composer. (ibid., 97, 121.) Sonic branding needs to be distinct, memorable, flexible and honest. Distinct sonic branding is most frequently achieved by creation of own music that reflects the uniqueness of the brand. Memorability follows closely the distinct characteristics of a brand. However, as all memories are formed from unique perspectives, it is difficult to

agree on which characteristics make a certain sonic brand memorable. Flexibility needs to be balanced with consistency. A sonic brand needs to be consistent in order to be recognized, yet flexible to maintain a fresh approach and cater the needs of different audiences. If the melody is kept intact, flexibility can be achieved by updating the instrumentation, changing the attitude and coloring to suit different contexts. (ibid., 87, 90–94.) Music can be a simple and effective way of creating cultural diversity for global, multinational companies. It can serve both as a creator of consistency for the global brand as well as demonstrate the desire to fit into a culture. (Fulberg 2003.) The final requirement for sonic branding, honesty, is hard to define as it is judged emotionally. Honest branding provides an emotional and aesthetical fit with every component, brand association, and for every stakeholder. (Jackson 2003; 95.)

In general, sonic branding is built on three elements: voice, ambience, and music. (Jackson 2003, 38; Kusatz 2007.) Voice can be human utterances, singing or spoken words. Singing can effectively express emotion with the melody and rational information through the words, which makes it a powerful mean of communicating. Also in spoken word the vocal qualities of a consistent brand voice can positively impact the brand identity and experience. Ambience can be created with weather sounds, machine sounds and any other sounds not made by human voice or a recognizable musical instrument. Ambient sounds can be a part of the sonic logo, short sound effects or generate an overall emotional and/or contextual background. Music is a fundamental element of sound and it can incorporate any and all sounds described before. In sonic branding, the role of music is to express the emotions of the brand in an even more accurate way. (Jackson 2003, 38–44)

When choosing music for the brand, the customers are the real end users (Jackson et al. 2013, 12–13). The customers can further be divided to actual users and the respective target group, which depend on one another. (Kusatz 2007.) A brand should be associated with the type of music most popular with its customers. After all, the success of a brand is evaluated by the value brought to the customers. This value can then translate to recall, awareness, affinity, loyalty and even love. (Jackson et al. 2013, 12–13.)

The sonic brand can reach the stakeholders through a multitude of opportunities. In addition to advertising in TV, cinema, radio, and websites, the brand can communicate through sound in offices, stores, company events, conferences, corporate films, call centers or even sound-enabled product packaging. All these opportunities and interactions need sound, which should be used in a consistent manner. (Jackson 2003; 5–6, 47.) However, Gustafsson (2015) questions the emphasis on consistency and points out that it easily leads to excessive repetitiveness. Fulberg (2013) proposes that music and ambient sound in stores can create an immersive and appealing experience to the customer together with other factors such as the interior design, staff behavior and visual imagery. Kusatz (2007) remarks that in-store music can also serve to protect the privacy of the consumer, eliminating the fear of being overheard.

Gustafsson (2015) has reviewed the current sonic branding literature from a critical, consumer-oriented perspective. She argues that the research on sonic branding should be looking for a common denominator between corporate strategy and the everyday

lives of the consumer. Instead, sonic branding research has been focusing on the effect or outcome of the use of music. However, the viewpoint of the consumer is crucial in music research. Consumers are no longer passive targets of music; instead, they are actively using music to create and recreate themselves. (Gustafsson 2015.)

There is a lack of objective, academic empirical studies providing recommendations for the managers. Most current research, along with most managerial recommendations, is based on the own experiences of the writers, who are managers in sonic branding agencies. Furthermore, there is no common approach to the consumer nor a shared agreement on the outcome of sonic branding across the different involved disciplines (sound studies, music sociology, strategic brand management, consumer culture theory and consumer behavior). Consumers may perceive sonic branding as manipulative. Therefore, the industry needs to reclaim the use of music and sound as a shared interest that benefits both consumer and brand. This could be done by using consumer panels to study the own ways that the consumers use music for motivational purposes. This consumer-oriented approach to sonic branding could stand out and receive goodwill as the majority of businesses are not yet inviting their consumers to contribute. (ibid.)

# 4 USER EXPERIENCE

The previous chapter discussed the different applications of music, concluding on the topic of sonic branding for companies. In this chapter the focus is moved towards the product and services developed by these companies. Instead of listeners of music, this chapter discusses the users of these products and services and their experiences. Furthermore, music and sound are approached as a part of this experience.

Since the late 1980's beauty, enjoyment and fun have been incorporated into human-computer interaction. Different approaches have three things in common: a subjective approach, such as user perceptions and experiences; the positive aspects of using products instead of avoiding problems in the use of products, and the human needs as a whole. (Hassenzahl 2004.)

Section 4.1 introduces the definitions of user experience, both from the ISO standard and the perspectives of user experience practitioners. Section 4.2 focuses on sound design and evaluation as a part of user experience. Finally, Section 4.3 presents a method for measuring overall user experience, the semantic differential tool AttrakDiff.

## 4.1 Defining user experience

Pleasure of use and usability (ease of use) need not conflict with each other. Moreover, pleasurable products seem to work better, are easier to learn and the result of their use is more harmonious. Pleasant assessment of the environment aids creative problem-solving as it broadens the thought processes. In pleasant situations, people tolerate more easily minor difficulties and problems in the design of a product. With a pleasing design that looks and feels good, the behavior seems smooth and easy. However, a beautiful product needs to fulfill a useful function, work well, and be easy to use and to understand. Only then it is truly beautiful and pleasurable. (Norman 2002.)

In product development, the perspective has expanded from usability to the pleasure of using things. User experience (UX) has been defined in ISO 9241-210 (2010).

> *User experience: person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service.*
>
> *Note 1. User experience includes all the users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviours and accomplishments that occur before, during and after use. (ISO 9241-210:2010)*

User experience results from brand image and presentation. Context of use, system functionality, performance, interactive behavior and assistance all affect user experience. After these overall qualities, the personal perspective of the user affects as well; the internal and physical state of the user resulting from prior experiences, attitudes, skills and personality. (ibid.)

In an online survey, UX professionals agreed that UX is dynamic, context-dependent and subjective. Some pointed out the need for investigating UX both during and after the interaction. Companies are typically interested in the long-term user experience, as the overall product experience diminishes the significance of temporary feelings. As

the ISO definition includes anticipated use as well as actual use, studying UX of anticipated use is essential. For this purpose, expressive scenarios of future use in real context are needed. (Law et al. 2009.)

In a broader sense, brand experience is about expanding the scope of interaction from the branded products to the entire company, along with its products and services. Information from the company, media, and from other people affect the brand experience. The brand experience in turn affects the user experience; for a loved brand, flaws in the product are forgiven. Consumers can have brand experience even without using the products of the brand. However, the user experience from interacting with the product also affects the brand experience. (ibid.)

## 4.2 Sound design and user experience

Traditionally, user experience has focused on the visual senses. Currently, modern technology has enabled sound to take a more central role in applications than before (Csapó and Wersényi 2013). However, the cognitive functions of sound remain largely unexplored (Carvalho and Pereira 2015). The omnidirectional nature of hearing, the physical nature of sound and the lack of aural training in the Western culture makes it selective listening difficult. This typically provides sound an overwhelming and surprising quality, affecting and interfering with the perception. (Chion 1994, 33.)

Sound can be approached as reinforcing a visual message, ensuring that the user receives the information. Furthermore, the aesthetics of sound affect the impression of an application. Sound design in games can enhance the enjoyment of the game and impact the amount of tension. Concentrating on both aesthetic and informative qualities of the sounds enables them to be more powerful. The major disadvantages in using sound are annoyance and lack of privacy. The user can be annoyed by obtrusive sounds representing unimportant issues. Sound cannot be directed at a single user unless they are using headphones. An auditory interface displays publicly the actions of the user, which can at times be undesirable. (Peres et al. 2008.)

Sounds should be designed compelling, inventive, and coherent. They should tell a story and be easily recognized. Emotional context can be conveyed with music or musical idioms. Visual events can be intuitively mapped to sound attacks. However, sound production issues need to be considered. Technical aspects, such as specifying audio sources and processing requirements, can have substantial implications for the computational architecture of an application. Finally, candidate sounds need to be tested with actual users to demonstrate the efficacy of the design. (ibid.)

Sound has historically been only a by-product of technology instead of a driving force (Rocchesso et al. 2008). This has resulted in an acoustically polluted world ever since the industrial revolution (Carvalho & Pereira 2015). Sonic interactions are usually limited to alert sounds added as an afterthought (Aaen-Stockdale 2014). Sound needs to be seen as a potential source of information instead of a potential source of noise. The most basic use of sound is to signal or alert the user to an event, process, or state. Furthermore, sound can also create or reveal new functionalities in a product and shape the sonic appearance of an artifact. Finally, sound can be used to provide feedback to

aid the performance of the user or control an interface, tool, device or physical activity. (Rocchesso et al. 2008.) Sounds contribute to the overall appreciation of an object. Sonic Interaction Design shapes the relation between humans and objects by utilizing sound. In a broad sense, sound can be used to convey information, meaning, aesthetic, and emotional qualities. (Rocchesso & Serafin 2009.)

Individual sounds can be chosen from various contexts, including versions of human speech (unaltered or slightly altered), music, or environmental sounds (natural or human made). Concentrating on non-speech sounds (music-based and environmental sounds), they can be entertaining and include dramatized and emotional content. However, non-speech sounds do not easily convey information. With musical sounds, the listener needs to learn abstract mappings between sound and information. With environmental sound, the existence of prior connotations limits creating free associations. Good auditory representations are mostly combinations of environmental sounds with musical and speech-based aspects. Current display of non-speech sounds can be categorized to the conceptual and the interactive paradigm. In the conceptual paradigm, audio interface provides fixed answers for any questions the user may have. The goal of the system is to provide the user with clear and concise information. The interactive paradigm approaches information in a less structured, less task oriented form. The information provided reflects the actions of the user by creating a basic sound model and emphasizing different ways the user can interact with the model. In practice, these two paradigms present the two opposite extremes of a continuum. As some applications are characteristically conceptual and some interactive, both approaches are relevant. (Csapó & Wersényi 2013.)

Sounds need to be designed and applied to the interface in a systematic way. The Dynamic Audio Application Guide (DAAG), presented by Carvalho and Pereira (2015), combines sound design concepts from the game industry with the user experience design approach. The aim of the DAAG is to systematize and simplify the process of creation, production and implementation of sounds in interfaces. Designing audio for interactive environments is a collaborative process between the composer and the programmer. In interactive environments, dynamic audio intensifies the user immersion as well as advances additional cognitive processes. When the sound amplifies the message of visuals, it makes the experience more complex and complete. The DAAG takes into account user needs and product objectives and guides the designers in considering sound already at the beginning of the interface project. The sounds used in the interface can be divided in dialogue, background music and sound effects. These sounds can fulfill structural, narrative, immersive, aesthetic and kinetic functions. Music and ambience tracks can connect two distinct interfaces, or indicate opening and closing content. Also the absence of sound can transmit information to the user. Sound can interrupt the user indicating a change in the interface. Furthermore, the continuous use of music can signal continuity of the same theme in different contents. In general, sound can function as an enabler of different emotional reactions and support the inner narrative of the interface. (Carvalho & Pereira 2015.)

In addition to designing informational and interesting sounds, the sounds require evaluation as well. The sonic interaction design process can be divided into two stages,

sound creation and sound analysis. First, the designer creates a new sound specifically tailored to the context. Second, the sound is examined to ensure suitability for use and consider the perspective of potential listeners. This is accomplished by using several methods to triangulate the results. This process prefers lightweight approaches to be used outside laboratory conditions. (Brazil & Fernström 2009.)

## 4.3 Measuring user experience, AttrakDiff

Overall user experience can be measured with various methods, one of which is the AttrakDiff which is by Hassenzahl et al. (2003). The term derives from the German word for attraction, *Attraktivität*, and *Differenzial* for the semantic differential form of the questionnaire. AttrakDiff measures the Pragmatic qualities and Hedonic qualities of a product, latter of which can be divided to Stimulation and Identity-related qualities. These are subjective qualities, as each user decides if the product satisfies them. The optimal case would be that the product would have both strong Pragmatic and Hedonic qualities, in which case it would be effective and efficient to use, the user will enjoy using the product and form a strong relationship with it. Based on the Pragmatic and Hedonic qualities, the user makes an overall estimate of the attractiveness of the product; whether it is good, sympathetic or motivating. There are products focusing on either Pragmatic or Hedonic qualities, and then there are products that aim to find a balance between both qualities. The desirable combination depends on the targeted market positioning. (Hassenzahl et al. 2003.)

The Pragmatic qualities of a product relate to fulfilling the needs of the users to achieve goals. These qualities derive from experience. Hedonic qualities derive from appearance, relate primarily to the user and can be divided further to Stimulation and Identification. Stimulation is a prerequisite of personal development together with novelty and challenge. Identification is about expressing oneself through products used and possessed. Both Pragmatic and Hedonic qualities can be separated from evaluation so that individuals may think that a quality of a product might be novelty but they still might make a negative evaluation of the product as not liking it. However, perceptions of Pragmatic or Hedonic qualities contribute to general appeal of products, thus potentially leading to positive evaluation of goodness and beauty. The evaluation of goodness is especially made after using a product. Beauty is mainly based on Hedonic qualities, and it is strongly related to Identification. It seems to imply outstanding quality while having a distinct social aspect. Beauty is shared and approved by others. However, what is beautiful is not necessary perceived as usable. (Hassenzahl 2004.)

The AttrakDiff 2 questionnaire consists of 21 opposite adjectives (Table 3) rated on a seven-point Likert scale. The Hedonic and Pragmatic qualities are independent. Hedonic qualities are further divided to Stimulation and Identity. All aspects are represented by several adjective pairs. (Hassenzahl et al. 2003.) Attractiveness describes a global value of the product based on the quality perception (AttrakDiff 2013).

**Table 3. AttrakDiff adjective pairs (AttrakDiff 2013)**

| Product dimensions | Adjective pairs |
|---|---|
| Pragmatic Qualities (PQ) | Technical – Human<br>Complicated – Simple<br>Impractical – Practical<br>Cumbersome – Straightforward<br>Unpredictable – Predictable<br>Confusing – Clearly structured<br>Unruly – Manageable |
| Hedonic Qualities – Identification (HQ–I) | Isolating – Connective<br>Unprofessional – Professional<br>Tacky – Stylish<br>Cheap – Premium<br>Alienating – Integrating<br>Separates me from people – Brings me closer to people<br>Unpresentable – Presentable |
| Hedonic Qualities – Stimulation (HQ–S) | Conventional – Inventive<br>Unimaginative – Creative<br>Cautious – Bold<br>Conservative – Innovative<br>Dull – Captivating<br>Undemanding – Challenging<br>Ordinary – Novel |
| Attractiveness (ATT) | Unpleasant – Pleasant<br>Ugly – Attractive<br>Disagreeable – Likeable<br>Rejecting – Inviting<br>Bad – Good<br>Repelling – Appealing<br>Discouraging – Motivating |

The mean values of the adjective pairs are grouped by product qualities (PQ, HQ–I, HQ–S, ATT) and can be visualized with a graph. The extreme values are of particular interest, as they show the critical or the well-resolved characteristics. (AttrakDiff 2013.) A visualization of mean product qualities may already provide a sufficient overall view of the different aspects of user experience and point out the development needs, especially if an abridged version of the questionnaire is used.

For further analysis, the Pragmatic Quality (PQ) and the Hedonic Quality (HQ) can also be combined to in a two-dimensional diagram, with the vertical axis representing Hedonic quality and the horizontal axis representing the Pragmatic quality. The product is placed in one or more character-regions, with a confidence rectangle illustrating the accuracy of the estimation. Products high on HQ and low on PQ are too self-oriented, when products high on PQ and low on HQ are too task-oriented. Simultaneous high HQ and PQ ratings indicate a desired product. (AttrakDiff 2013.)

# 5 CONCLUSIONS ON THE THEORY

The most common reason for listening to music is to influence emotions; to strengthen the importance of an event or reminisce on an event, to emphasize emotions accompanying everyday actions, or to manipulate feelings and energy levels towards a more desired, direction. Musical preference is strongly related to emotions evoked. Preferred music evokes more intense and refined emotions, but also evoked emotions may predict musical preferences. In general, music with an intermediate complexity is preferred by the listeners. The listening context also affects the preference; the same listener may prefer different music in different situations.

When researching music and emotion, it is important to distinguish the difference between emotions perceived in music and emotions evoked by music. The emotions evoked by music can be caused by seven different psychological mechanisms described in the BRECVEM framework: brain stem reflexes, rhythmic entrainment, evaluative conditioning, emotional contagion, visual imagery, episodic memory, and musical expectancy. The emotions perceived in music can result from various musical structures. However, when these structures are combined, their overall effect on emotions can be evaluated in a probabilistic manner at most.

The cultural background of the listeners affects both the evoked and the perceived emotions. In cross-cultural research, the researcher needs to be aware of their own cultural perspectives and of the bias these perspectives are forming. Emotions in music can be expressed by both culture-specific and psychophysical cues. These psychophysical cues are independent of musical training and the culture of the listener, thus forming a set of musical universals.

The emotions evoked by music can be measured with the domain-specific Geneva Emotional Music Scale (GEMS), concentrating on subjective feelings as a component of emotion. The GEMS presents nine main musical emotions; Wonder, Transcendence, Tenderness, Nostalgia, Peacefulness, Power, Joyful activation, Tension, and Sadness. The intensity of each emotions is rated on a Likert scale, thus enabling the expression of mixed emotions. The problems in using verbal report is the bias due to individual differences in language use and the possible confusion of perceived and evoked emotions. Open comments should be added to the GEMS scale to identify variable emotions escaping the choice of given adjectives and simple rating scales.

The practical applications of music relevant to the context of this thesis are the use of music in sports and marketing. In sports, music can be used by the athlete to create a pleasurable environment, synchronize movement and regulate mood. Furthermore, music is played in sporting events. Commonly, these musical pieces are so similar to each other that they form their own genre of sports rock.

The use of music in marketing derives from the traditions of film music. In commercials, musical accents can be synchronized with important visual elements to emphasize information. Overall, any similarity beyond a certain level is bound to make the music and movement synchronize in the mind of the viewer. Music also adds to the emotional content of the commercial. The music of a commercial is considered having

a good musical fit when the emotional qualities of the music match the qualities of the product. In a broader perspective, sonic branding is about expressing emotions of brands throughout various interactions between the brand and the consumer, e.g., sonic logos, commercials, and corporate events. Sonic branding delivers a consistent message through all these different channels.

User experience and sound design approach music and sound from the perspective of product development. User experience is defined as the perceptions and responses resulting from the user using a product, so it includes all the user's emotions before, during and after use. The benefit of creating good user experience is that pleasurable products appear easier to use as well. Sounds can be used to convey information, meaning, as well as enhancing the aesthetic and emotional qualities for products and services. Overall, user experience can be measured with various methods, one of which is the AttrakDiff semantic differential. The AttrakDiff measures the Pragmatic and Hedonic qualities of a product as well as its Attractiveness. These qualities are evaluated by rating opposite adjectives representing the different qualities on a Likert scale.

# 6 METHODS AND MATERIALS

The empirical part of this research studies six different music samples composed for the Suunto Movie. These samples were evaluated for their Musical fit, evoked Emotions and User Experience. The evoked emotions focused on subjective feelings as a component of emotion. The evaluations were performed as a self-report web questionnaire, with Movie Music samples played as embedded YouTube videos. This format was required by the Fluid survey tool used. The links to the Suunto Movie Music variations is included in Appendix A, and the entire questionnaire is included in Appendix B. The responses were gathered by two separate email requests sent to selected Movescount users, and one link published at the Movescount Facebook group, visible in Finland, USA, Canada, UK and Australia.

Section 6.1 discusses the selection criteria for the email respondents for the first two parts of the survey. Section 6.2 describes the Suunto Movie Music samples by first introducing the structure of the Suunto Movie, then describing the overall structure of all music samples and finally providing a brief musical description of all samples. Section 6.3 presents the pilot test and learnings from it, and finally, Section 6.4 introduces the questionnaire and explains the reasons on choosing the methodology and questions.

## 6.1 Selecting subjects

Multimodal interfaces are designed utilizing simultaneously various modalities such as light, sound, and pressure. These different user interfaces utilizing different modalities should be designed simultaneously to ensure the consistency among the user interfaces. However, in some cases, a new modality is added to an existing user interface. In this case, the users of the application are already available for testing the new user interface. These studies should use both existing users and new users with no previous knowledge of the application. The perspectives of both user groups need to be taken into account: as current users should not be alienated by the new design, new users should as well be attracted to the improved application. (Bangor & Miller 2008.)

The music for the Suunto Movie is an added modality affecting the whole user experience, so some of the test participants should be already familiar and others unfamiliar with the Suunto Movie. This knowledge was not available when choosing subjects, but the assumption was that only a few of them would be familiar with the Suunto Movie. Therefore, I informed them in advance that the study was about developing music for the Suunto Movie. Additionally, I explained what Suunto Movies are, and that the Movies could be created with the Suunto Movescount App for iPhone and Android phones. This information offered the test subjects the option to experiment with the Suunto Movie in advance if they had not already done so. In addition to this, the aim was to gather at least some subjects with previous experience of making their own Suunto Movies.

The email questionnaire was sent in total to 78 people from Finland, 78 people from China and a mixed group, consisting of 78 people from UK, US, Canada and Australia. The aim with the mixed group was to get a variable group of people from different Western countries, but with the common factor that all of them were native English

speakers, as the language might lead to some extra problems in a verbal self-report questionnaire. It is possible to specify the language used in Movescount, so especially for the Chinese group, we selected first people who had specified English as their preferred language.

The subjects were users of the Movescount.com web community, which has been launched in 2010. For random users of Movescount, we took the registering time 1.9.2014 as a starting point and chose the first 50 members from each country group, fitting the desired criteria, with registering times counting backwards from that point in time. This date was chosen around the issuing of the first Movescount App for iPhone (August 2014), hoping that some of the users would have used the Suunto Movie as well. Another criteria was that the users had been members of Movescount for almost a year, so in most cases they should have at least some experience of the Suunto products and services. The subjects had given a prior permission to be contacted by Suunto for research purposes. The second group consisted of the first 50 members from each country group descending from the registering date 1.3.2013. These two groups overlapped some, so this group was condensed to 28 members per each country (Finland, China, and mixed Anglo-Western group).

The usual variables, such as age and gender, should be considered when selecting test users. In addition to these, the experience in the audio field needs to be taken into consideration when testing auditory interfaces. Musical expertise needs to be taken into account, as users with musical training are better in discriminating variations of pitch and temporal aspects. (Peres et al. 2008.) Each three groups of nationalities consisted of 50% female and 50% male participants due to the Suunto equality principle, where all products and concepts should be tested with equal gender distribution, according to the target users of the products. This differs from the actual users of Movescount, who are mostly male. There were no prerequisites for age and musical background, they were mainly taken as they fall naturally.

The first group of 150 respondents (50 Finnish, 50 China and 50 mixed) received an informatory email one week before the actual questionnaire, telling them that they were selected to answer to a survey, in which they could influence the choice of music for the Suunto Movie. The questionnaire link was then emailed to them with one week allocated for replies. Two reminders were sent during this week for those, who had not answered the questionnaire yet or had left the questionnaire incomplete. As the response rate at this point was at 24% with 36 completed responses, another group of 84 respondents (28 Finnish, 28 China and 28 mixed) were invited to answer to the survey. All participants were told that by completing the questionnaire, they would participate in a raffle for one Suunto Ambit3 Sport (retail price 350€) and five Suunto Smart Sensors (retail price 80€), which are compatible with Ambit3 watches or the Suunto Movescount App. The two email questionnaires received 54 completed responses, reaching a response rate of 23%.

At this point it was clear that more users were still needed, but the directed email questionnaires would not result in more responses. Therefore, an open invitation to participate in the Survey for Suunto Movie Music was published at the Movescount Facebook

group website. This approach was similar to the online survey conducted by Law et al. (2009), who also commenced with a directed invite-only survey with a 37% answer rate, but later on opened the survey for all interested parties, thus receiving significantly more answers. This Facebook survey was published in Finland, USA, Canada, UK and Australia and it received 94 completed answers all in all. The response rate from Chinese users had been extremely low in the email questionnaires, so the country was left out from the countries where the Facebook survey was published. One Suunto Smart Sensor (retail price 80 €) was raffled between all Facebook respondents. First, the link to the survey including samples FED was published at 9.20 pm Finnish time, receiving 47 responses. The following morning at 8.20 am, the link was changed to another survey, featuring samples CBA and followed by a reminder link. One day later another reminder was sent to the Facebook group. Five days after changing the link, the survey for samples CBA was closed, having also received 47 responses.

## 6.2 Suunto Movie Music samples

Mapping an emotion with a certain musical structure would demand isolation from other factors. Even then, the mapping would not automatically predict the emotion of a person (Sloboda & Juslin 2011). With multiple musical structures occurring simultaneously, the whole emotion might change. For the purpose of this study it would also not be very interesting to separate each feature and test their emotional significance. Instead, the whole musical piece was listened and analyzed by approaching the user experience of the piece and using the AttrakDiff scale by Hassenzahl et al. (2003). Also in that case it is important that certain features remain the same, such as the visuals of the piece. Changing the Suunto Movie video clip would have affected the emotions felt by the user. The same composition played over a relaxed paddling trip would have created different emotional expectations than a long and hard cycling exercise in the mountains. Instead, the changing audio was the only factor modifying the user experience. Furthermore, this was in line with the experiments proposed by Chion (1994, 188–189) to illustrate the phenomena of added value that various pieces of music bring to a certain film sequence. Also Bullerjahn & Güldenring (1994) examined the effect that different soundtracks made to the emotional atmosphere of the same film.

The samples A, B, C, D, E, and F were distributed to two groups and the order was changed within the group. Compositions ABC consisted of samples and synthetic sounds; DEF had some recorded audio as well. Both included one peaceful and melancholic sample (A, D), one energetic sample (B, E) and one symphonic sample (C, F).

With the first two email questionnaires, there were four groups, listening to samples ABC, CBA, DEF, and FED. The first sample needed to change, because the evaluation of that would affect the later evaluations. The internal order of the samples should also change, because the previous sample would always affect the listening experience of the following sample. And finally, the last sample should change, as the last sample would be the one remaining most clear in the respondent's memory in the final evaluations. Therefore, middle sample remaining the same would have the least effect. With the final Facebook questionnaire, there were only two groups of respondents listening to samples CBA and FED, due to practical reasons.

The following sections provide a more detailed description of the Suunto Movie used in the evaluations, the common musical structure of the music samples, and a short description of samples A, B, C, D, E, and F. Links for the YouTube videos containing the musical samples can be found from Appendix A.

### 6.2.1 Description of the Suunto Movie

The Suunto Movie lasts for one minute and consists of three parts: intro, track and outro. The same movie was used for all samples.

The intro consists of beginning titles fading in rhythmically. While the titles are playing, the rendered 3D map appears in the background and the camera pans around from a bird-eye view. In the video used in this study, the titles are showing first a Movescount user name (MikkoMoi), then the location of the exercise (Vancouver, Canada), and finally the date and time of the exercise (August 6th 2014 17:53), and the type of the exercise (Running: 8.03 mi).

The actual exercise track is shown on the map as a yellow moving line, with the "current point" accentuated with two yellow filled circles. The camera follows the track, panning around it from the bird-eye view. During the track a highlight is shown (fastest mi 8'44 min/mi). When the track ends, the camera moves further away from the end point and the map fades slowly away in the background.

The outro consists of ending titles, including the duration of the exercise (Duration : 1 h 40 min), hashtag displaying the exercise once more (#SuuntoRun), the device with which the exercise was recorded (Made with Suunto Ambit3 Peak) and finally the Suunto logo, accompanied with the Suunto slogan (Conquer New Territory).

### 6.2.2 Description of the musical samples

All musical samples were structured similarly. The intro consisted of short loops with varying lengths, some of which had an ambient quality. These loops did not necessary have a strong beat of their own, thus enabling them to be played in a non-linear fashion, stretching for intros of varying lengths. The melody loops were placed to start on the beat, accentuating the beginning titles and thus emphasizing the informational content as described by Cook (2000, 16). The whole structure aimed to slowly increase the intensity towards the start of the track.

Once the track started moving, the drums and the bass started playing a beat emphasizing the forward movement. The lack of a bass-line in the intro gave a quality of remoteness; adding the rhythmic bass-line gave the music a sense of fullness and presence (ibid., 10–11.) An additional highlight sound was played in sync to emphasize the informational content (ibid., 16). During the track the music was linear and arranged to a more traditional structure that could be divided into separate bars forming sections. First the melody and the harmony played an A section in the melody, followed by a B section composed to respond to the A section. Some samples repeated section A once more. In the final product, the goal was that these A and B sections could be repeated to form different musical structures in case the Movie in question was longer than one minute. The rhythm of melodies A and B was not particularly synchronized with the

rhythm of the track, but some unintended synchronization was observed by the respondents as described by Cook (2000, 78).

In the outro, the rhythmical bass and drums ended, and the loops of varying length were played again, this time decreasing the intensity towards the end. The highlight sound was played once more in the end to emphasize the company logo (ibid., 16).

The structure of the compositions was mostly defined by myself, together with Mikko Ahlström from Suunto and Guy Dowsett, the composer of the tracks. Guy Dowsett created all tracks and played all instruments in them. The only exception was the electric violin, which I played for tracks D, E, and F. Links to the YouTube videos with musical samples A, B, C, D, E, and F can be found from Appendix A.

**Sample A**

Sample A is played with a tempo of 160 bpm (beats per minute) and the composition is in a minor key. Sounds are a mix of samples and synthesized sounds.

The intro starts with an accented melody played by a synthesized sound resembling a Spanish guitar with a delay effect. The melody is syncopated, and at parts interpreted rhythmically a bit behind the beat. Ambient, bell-like sounds without a clear accent and with reverb (echo) play in the background. Once the track starts, a drum set and an acoustic bass start playing in section A. The ambient synth chords continue in the background together with a subtle theme on the electric guitar. The highlight sound is played with a high ambient sound. The guitar continues on to section B and section A is repeated before returning to the outro loops.

**Sample B**

Sample B is played at 156 bpm and the composition is in a minor key. The sounds are a mix of samples and synthesized sounds.

The intro starts with synthesizer chords played with a chorus effect and a slight tremolo (rapid repetitions of the same note). The melody is played on top of these chords by a clear piano sound. When the track starts, a rapidly moving low walking-bass line is added, together with synth drums playing a trip-hop rhythm. The melody is played on the beat by a distorted electric guitar with a wah-wah effect, accompanied with distorted electric guitar chords in the background. The highlight sound is relatively quiet noise sound with a flanger effect (pitch sweeping up the frequency spectrum). The B section omits the wah-wah guitar and has some synthesizer chords with growing intensity. Section A is played once more before returning to the outro loops.

**Sample C**

Sample C is played at a tempo of 112 bpm and the meter is 3, resembling a waltz. The composition is in a minor key, with some touches from a diminished scale. The sounds are a mix of samples and synthesized sounds.

The intro starts with a melody of repetitive beats played by an electric guitar, accompanied with ambient sounds without clear accents and with reverb and delay effects. The synth chords start halfway throughout the intro, playing low quavers and increasing the intensity for the track. Only when the track starts with section A, the pulse

starts distinctly following the division to three with a heavy bass line. Synthesized rhythmical strings are playing the harmony, and the piano melody includes a lot of chromatic passages leading upwards. The highlight sound is played by some very small bells resembling icicles. Section B adds in a low, slow, distorted guitar theme, resolving to outro loops.

**Sample D**

The tempo of Sample D is 124 bpm and the composition is in a minor key. The sounds are recorded audio; percussion instruments, acoustic guitar and electric violin. A majority of the sounds have been processed and manipulated for effects and textures.

The intro starts with a soft, repetitive acoustic guitar melody, grouped with a repetitive soft synth sound. In the background synth chords are played with a tremolo and light percussion with a delay. All intro loops are four bars long. When the track starts, the bass is added and there is a bit more percussion. There is an accordion playing some long notes and various electronic, bubbling sounds playing in the background. A cymbal marks the transfer to section B. Section B is more intense, with a simple melody played by electric violin with some vibrato and slurs (short slides). An acoustic guitar is strumming in the background. The highlight sound is a bubbling percussion sound moving upward. After section B, the outro loops begin.

**Sample E**

Sample E is played at a 140 bpm tempo. The composition starts in a minor key but moves upwards and modulates to a major key. The sounds are a mix of synthesized sounds, drum samples and recorded audio. There are multiple layers, including accordion, electric violin, piano, and wurlitzer (electronic organ) among others.

The intro starts with low, distorted, repetitive synth sounds with crashes and tinkling bells. There is a fast repetitive sound resembling the rhythm of a helicopter, and some cymbal beats are played in the background. All intro loops are four bars long. When the track starts, the melody is played by long synth chords in the beginning of each bar. There are quiet strings playing in the background. The highlight sound is a high ambient sound without a distinct accent. In the B section the harmony moves upwards, modulating the composition to a major key. The intensity grows towards the end, up until the final bar of the section where the melody and harmony drop out, leaving only percussions and one high synth string note playing. Section A is played once more before short outro loops.

**Sample F**

Sample F has a tempo of 144 bpm and the composition is in a minor key. The sounds are mostly synthesized sounds with recorded electric violin and sampled drums, piano, and bass.

The intro starts with rapid synth string plucking sound playing a chord progression repetitively in a polyrhythmic manner (one rhythm played on top of another). The melody consists of long piano notes with reverb and delay. All intro loops are four bars long. The track starts with long synthetic bass sounds, and the harmony is played by

piano chords. There is also a high sound resembling a barrel organ. B section incorporates rhythmic strings recorded multiple times with one electric violin. The highlight sound resembles a pan flute chord, in the end it is an accented ambient sound. Outro begins after section B.

## 6.3 Pilot test

Before the actual pilot test, I had conducted a preliminary group testing session with 15 volunteer Suunto employees in November 2014. The duration of this test was one hour. In this test, the participants listened to a total of six samples, but answered less questions (Liking, Musical fit with the exercise and User Experience). Judging from the feedback from that test, the participants found it hard to concentrate for such a long time while analyzing several musical pieces. Furthermore, an online survey needed to be considerably shorter than a live testing session. This is why I decided that the participants in the online questionnaire would listen to only three samples per person.

An online pilot study was conducted in May 2015 to test the actual test setting before sending out the global questionnaire. Seven volunteers completed the test and were asked to observe and comment the test setting as well. The test was completed as a web survey using the Fluid survey tool. Individual invitations were sent by email to each test subject. Out of the test subjects, three were male and four female; two had English as their native language and the remaining five were Finnish. It would have been beneficial to have Chinese test subjects in the pilot as well, but this is what could be arranged at a short notice. Most of the pilot testers completed the test between 10–20 minutes, so for the invite of the actual test, I decided to use 15 minutes as an approximation for the pilot test length.

One of the test subjects commented that the choices of musical education presented (no formal musical training / music school / vocational school of music / professional school of music, according to Kallinen 2005) represented the modern Finnish education system and did not take into account other cultures, older population of Finland nor self-educated musicians, who are plenty in popular music and can be quite skilled. Also for my purposes, the differentiation between vocational (secondary school level) and professional (university / polytechnic) did not really matter.

Originally, I left the genre preference question out from the pilot study to shorten the questionnaire. However, from the results showed that liking the piece correlated very much with the emotions felt, just as Moors & Kuppens (2008) suggested. In some answers dislike for the piece was explained with a dislike towards the genre in general. If the test subject disliked the piece, they felt almost no emotions from the GEMS scale. Therefore, I decided to include the genre preferences after all. Furthermore, in sonic branding, the genre preferences of the target users typically need to be taken into consideration (Jackson 2013). Also Kreutz et al. (2008) recommend screening the preferences of the participants to maximize emotional responses.

One of the test subjects noted that they did not know enough about the Suunto Brand to evaluate the musical fit to the brand image. So, I changed the question from “fit with the Suunto Brand” to “fit with my impression of Suunto”. One subject was not sure if

they were allowed to replay the music after the first listening of each of the three tracks. Thus, I added the comment "you are welcome to listen to the music more than once". The phrasing and titles of the questionnaires were modified to make the results more readable. In the pilot questionnaire, I alternated between 5-point and 7-point Likert scales, using the same scales as the original researchers. From the results of the pilot study, it was difficult to analyze changing scales. Therefore, I decided to use a 5-point Likert scale in all answers for the actual study. One person had left the survey incomplete. To avoid unintentionally incomplete answers, I added a "Save and continue later" option for each page. Furthermore, I noted that the age categories (20–30, 30–40 etc.) needed to be categorized unambiguously (20–29, 30–39 etc.).

## 6.4 Questionnaire

In the empirical study, I concentrated on the subjectively experienced feeling of the emotion, similarly as Zentner et al. (2008), leaving out the cognitive processes, bodily changes, action tendencies, and facial and vocal expressions. These subjective feelings could be researched via self-report questionnaires and sent globally, broadening the scope from Finnish users to global target users.

Terms describing different emotions are not easily translated, as the emotion vocabularies vary across cultures. Cultural traditions of expressing emotions might affect self-report. Verbal labels could be replaced by pictures representing the emotions, or subjects could be asked to sort examples based on their similarity. (Zentner & Eerola 2011.) My personal view was that photographs can be quite unclear, the current available drawings are not of very high aesthetic quality and the amount of samples in this study (three per subject) was not enough to make classifications based on comparison. This is why I decided to use the GEMS adjectives by Zentner et al. (2008) to evaluate the emotions evoked by the samples. Furthermore, the GEMS adjectives focused on positive emotions with varied nuances. They seemed to be more suitable for testing in a product development environment than the basic emotions by Ekman (1992), which had a high emphasis on negative emotions. After all, the Suunto Movie wishes to evoke mainly positive, not negative emotions. Furthermore, the GEMS adjectives were most suitable for the musical context.

The AttrakDiff questionnaire was chosen for evaluating user experience. It was already familiar to me and it had been previously used for evaluations on Suunto products. Moreover, the method of rating adjectives fit together nicely with the GEMS adjectives. The whole questionnaire is included in Appendix B.

### 6.4.1 Background information

The test subjects were asked to select their age group (–19, 20–29, 30–39, 40–49, 50–59 or 60–) and their gender (female / male). The test subjects were asked what their native language was, as it is an important factor in verbal studies (Zentner et al. 2008, Walsh et al. 2013). They could select from the official languages of the test countries (Chinese, simplified; Chinese, traditional; English; Finnish; French; Swedish) or specify another native language. The country of origin was not asked from an individual test subject, but the location from where they were responding was recorded automatically by the

Fluid web survey tool. Their proficiency in English language was evaluated by inquiring how many years had they studied English at school (0–1 years, 1–4 years, 5–8 years, More than 8 years) (Walsh et al. 2013). This was relevant, as all participants answered the questionnaire in English.

The subjects specified how often they generally listened to music (never / sometimes / quite often / very often) (Kallinen 2005). The level of musical training of the users was asked (non-musician / doing music as a hobby (just for fun) / amateur (serious interest, but non-professional) / semi-professional / professional). This categorization was created by combining the categories presented by Kreutz (2008) and Vuoskoski & Eerola (2015), taking the definitions of hobbyists and amateurs from Kreutz (2008) and leaving the choice between semi-professional and professional for the subject themselves to decide instead of a definition based on monthly income.

The musical preferences of the participants were asked emphasizing the different genres of contemporary music, as the musical samples in this study covered a range of genres. The musical preference scales I used were modified from Ritossa & Rickard (2004) and Pieschl & Fegers (2015) with the addition of R&B, hip hop and latin. The subjects were asked to state their personal opinions on a 5-point Likert scale with verbal descriptions (don't like at all / dislike / neutral / like / like very much) concerning the following genres: Pop, R&B/Soul, Hip hop, Electronic, Jazz, Latin, Folk, Country, Rock, Hard rock/Metal, Alternative/Indie, and Classical.

Finally, the subjects described their experience as a Suunto user concerning Suunto products and services relevant for this study. The products and services were Ambit, Movescount, Movescount App and Suunto Movie and the degree of expertise was none / some / regular / expert.

### 6.4.2 Evaluating the musical samples

Before the subjects listened to the actual samples to be evaluated, they watched a short, 30s listening test with one of the other samples (sample A for groups DEF and FED, sample D for groups ABC and CBA) as music and a promotional picture from the Suunto Ambit3 material of a man running. Also Lykartsis et al. (2013) used a listening test for sound system setup, directing the users to adjust the volume to a suitable level, eliminate extra noise sources and get into a comfortable listening position. In addition to these instructions, I recommended that the subjects should use headphones or external speakers. In order to the subjects to familiarize themselves with rating the music, I also asked them to rate the overall impression of this listening test on a Likert scale from 1 (don't like at all) to 5 (like very much).

As the questionnaire was targeted to such a broad group of people, it was not possible to choose video clips from their own exercises. This would have been the most accurate representation of the final context of use. Instead, one generic video was chosen to be used with all samples. This was aligned with the recommendations of Chion (1994, 188–189), who experimented with one single film sequence grouped together with various pieces of music. The video clip that I chose represented running, which is a common sport and accessible for most people. The exercise track was recorded in Vancou-

ver, Canada, so there were mountains, a city view and seaside that formed a visually interesting landscape. However, the track itself consisted of only moderate altitude changes, nothing extreme. The 1:40 hour run featured in the video was itself a long run, but not a maximum performance. The duration of the video was 1:00 minutes. A more detailed description of the video is presented in Section 6.2.1.

All test subjects evaluated three musical samples. Each sample was evaluated with three different sets of questions, each located on their own page: Liking and Musical fit, Emotions, and User Experience. On the first page, the subjects were instructed to watch the entire Suunto Movie once through, concentrate on their own emotions and opinions. They were asked watch the entire video through before answering the first questions. The subjects rated the overall impression of the music on a scale from 1 (don't like at all) to 5 (like very much). In general, the appreciation of music is evaluated first, thus affecting the other emotions evoked (Moors & Kuppens 2008). After rating the liking, the subjects evaluated the musical fit with questions adapted from the study of Morris & Boone (1998). The sentences were modified to positive statements according to Suunto recommendations, and rated on a Likert scale from 1 (not at all) to 5 (very much): 'The music was predictable regarding to the Suunto Movie overall'; 'The music fit well with the start / end titles in the Suunto Movie'; 'The music fit well with the exercise track' and 'The music fit well with my impression of Suunto'. After these closed questions, an open question was provided with the title 'Comments on the musical fit'.

The GEMS adjectives by Zentner et al. (2008) and their descriptions listed in Section 2.2.2 were used to evaluate the evoked emotions of the music variations. The GEMS adjectives were rated on a 5-point Likert scale, from 1 (not at all) to 5 (very much). The subjects were asked to concentrate on the emotions that the music made them feel while listening to it. They were given an opportunity to watch the video again, listen to the music and answer the questions while listening. The subjects were also instructed not to spend too much time thinking about words, but rather give a spontaneous response. Also the subjects were told that if they did not understand a question, they could leave it unanswered. I was aware of the fact that this might lead to unintentional blank answers, but as some of the adjectives were quite difficult for non-native speakers, I preferred taking this risk than forcing people to rate something they did not quite understand. Additionally, the subjects were given a possibility to comment their answers or explain them further in an open question titled 'comments on your emotions'.

For evaluating the effect of music on user experience, I used the AttrakDiff method by Hassenzahl et al. (2003), described in Section 4.3. The original AttrakDiff method includes 21 adjective pairs (Table 3), out of which I chose two adjectives representing each dimension: pragmatic, hedonic–stimulation, hedonic–identity, and attractiveness (Table 4. AttrakDiff adjectives selected for this study.). The adjectives were selected to fit the context of sports and the evaluation of music. Furthermore, the adjective list needed to be shortened for this questionnaire, as AttrakDiff was not the only method used.

**Table 4. AttrakDiff adjectives selected for this study.**

| Product dimensions | Adjective pairs |
|---|---|
| Pragmatic Qualities | Complicated – Simple<br>Confusing – Clearly structured |
| Hedonic Qualities – Identification | Tacky – Stylish<br>Unpresentable – Presentable |
| Hedonic Qualities – Stimulation | Unimaginative – Creative<br>Dull – Captivating |
| Attractiveness | Discouraging – Motivating<br>Ugly – Beautiful |

The adjectives of different dimensions were presented in mixed order and every other adjective pair was presented in reverse order. The adjective pairs were rated on a 5-point Likert scale with one adjective on one, and the opposite adjective on the other end of the scale. This ensured the consistency of these scales with other evaluations. The subjects were asked to give a spontaneous response based on their own personal opinion, keeping in mind that there are no right or wrong answers. After answering the AttrakDiff questionnaire, the subjects could answer an open question titled 'comments on evaluating the music'.

### 6.4.3 Overall feedback

The final page of the questionnaire consisted of optional overall feedback. The test subjects were offered a possibility to give feedback on the music for Suunto Movies and feedback on this test, as it is common practice in user experience evaluations to give the users an opportunity for this as well. Finally, according to the Suunto recommendations, there was an optional field titled 'other feedback for the Suunto team'. Usually Suunto users have some other comments or ideas on Suunto products in general that they wish to give to the company. These comments were then summarized and sent forward inside the company.

# 7 RESULTS

This chapter presents the results of the Suunto Movie Music Questionnaire. The first section introduces the background of the respondents concerning their demographic background, their involvement with music and their experience with various Suunto products and services. The following sections present the findings on musical fit, emotions and user experience of the music samples used in this study. Finally, some overall observations are made on emerging themes from the open comments.

The six musical samples A, B, C, D, E, and F are described in Section 6.2 Suunto Movie Music samples. Additionally, the links to the YouTube videos watched by the respondents are listed in Appendix A.

## 7.1 Demographics of the respondents

The questionnaire received 148 responses; 54 responses from an email questionnaire sent to selected Movescount users and an additional 94 responses from an open invitation to the Movescount Facebook group. The age distribution of the respondents (Figure 7) was taken as falls naturally, leading to a relatively accurate representation of typical Suunto users.

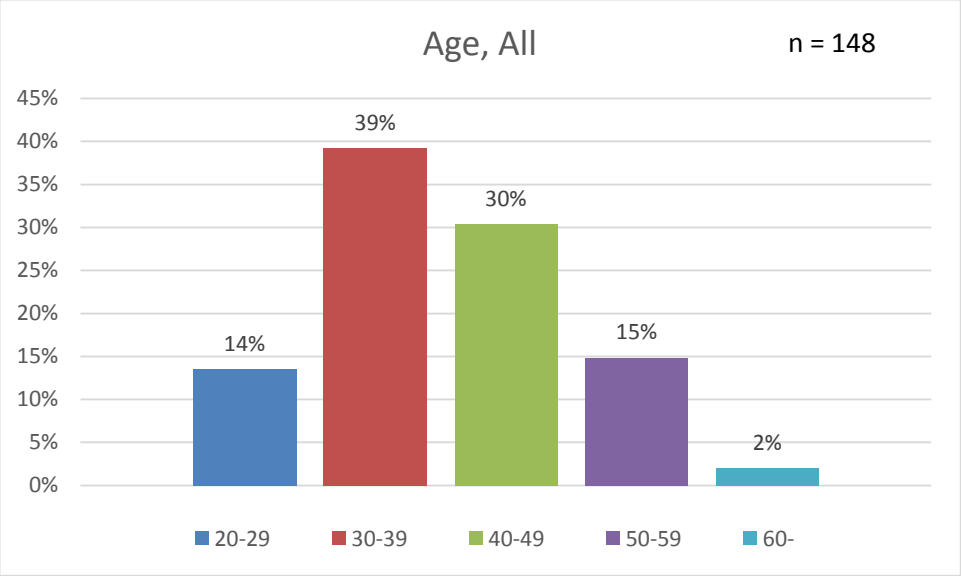


**Figure 7. Age distribution of all respondents**

The gender distribution was 16% responses from women, most of these received from the email questionnaire. The emails sent to Movescount users followed a gender distribution of 50% men and 50% women ratio, according to the Suunto equality principle. The email questionnaires received 33% responses from women, whereas the Facebook questionnaire answers were from only 6% women. However, the resulting 16% proportion of women was slightly better than what Suunto questionnaires normally receive. The survey link sent by email was sent first to 234 recipients. The survey received 54

completed responses and reached a response rate of 23%. The survey link posted on the Movescount Facebook pages received an additional 94 completed responses.

Most respondents spoke Finnish or English as their native language, which was what the study was aiming for (Figure 8). Additionally, there were some other European and a few Asian respondents. All in all, 52 respondents (35%) spoke English as a native language and 49 respondents (27%) Finnish. Other major categories consisted of French (8 respondents, 5%), Spanish (7 respondents, 5%), Swedish (6 respondents, 4%), Chinese (5 respondents, 3%), and German (5 respondents, 3%) speakers. The respondents who spoke Swedish, the second official language in Finland, and were located in Finland, were also considered as Finnish respondents when comparing Finnish respondents to other nationalities.

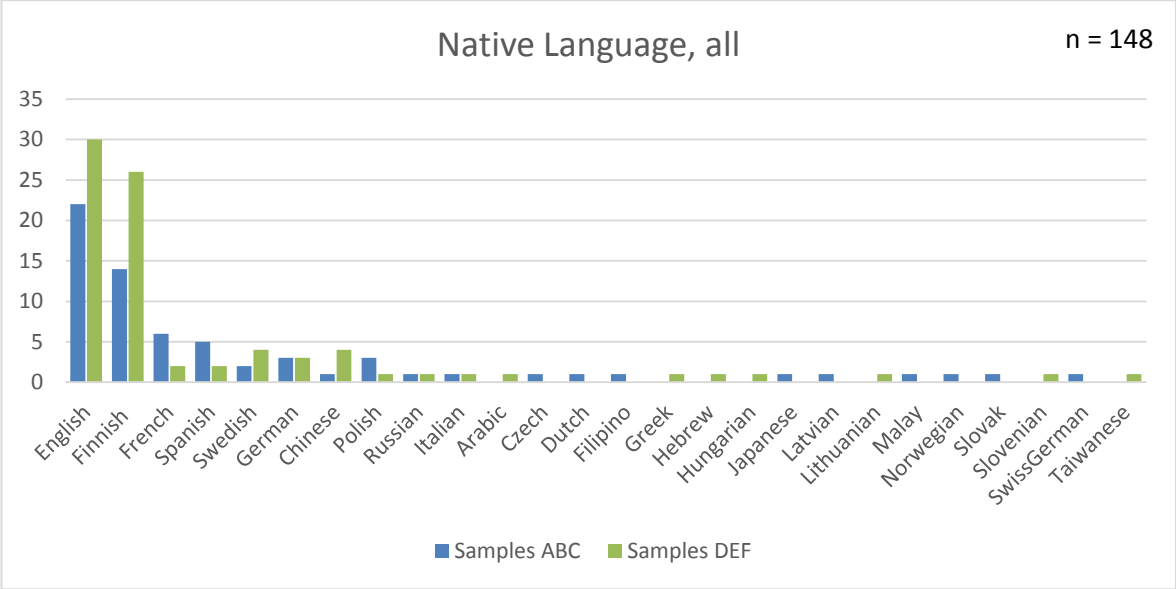


**Figure 8. The native language of all respondents.**

The two groups (respondents, who listened to samples ABC or CBA and respondents, who listened to samples DEF or FED) differed slightly from each other (Figure 8). Firstly, the email questionnaires for samples ABC received 20 answers, whereas the email questionnaires for samples DEF received 34 answers. The Facebook answers for both sample groups were the same (47 answers), so all in all samples DEF received 81 ratings and samples ABC received 67 ratings. This also led to a slightly different distribution concerning native languages between the two different sample groups. From the respondents who evaluated samples ABC, 33% were English and 21% Finnish, whereas samples DEF were rated by 37% English and 32% Finnish. Therefore, samples ABC received more evaluations from respondents with other native languages than English or Finnish (46%) than samples DEF (30%).

The native English speakers came from many different countries, so they were analyzed further by the location from where they answered (Figure 9). This was recorded by the survey tool. Four of these respondents did not allow the survey tool to track their location. Samples DEF received significantly more responses from Australia (12) than samples ABC (4). This may have been due to the time difference; the Facebook

questionnaire for samples FED was published 9.20 pm Finnish time, so the Australians noticed the link first thing on Friday morning. This may have led to more responses.

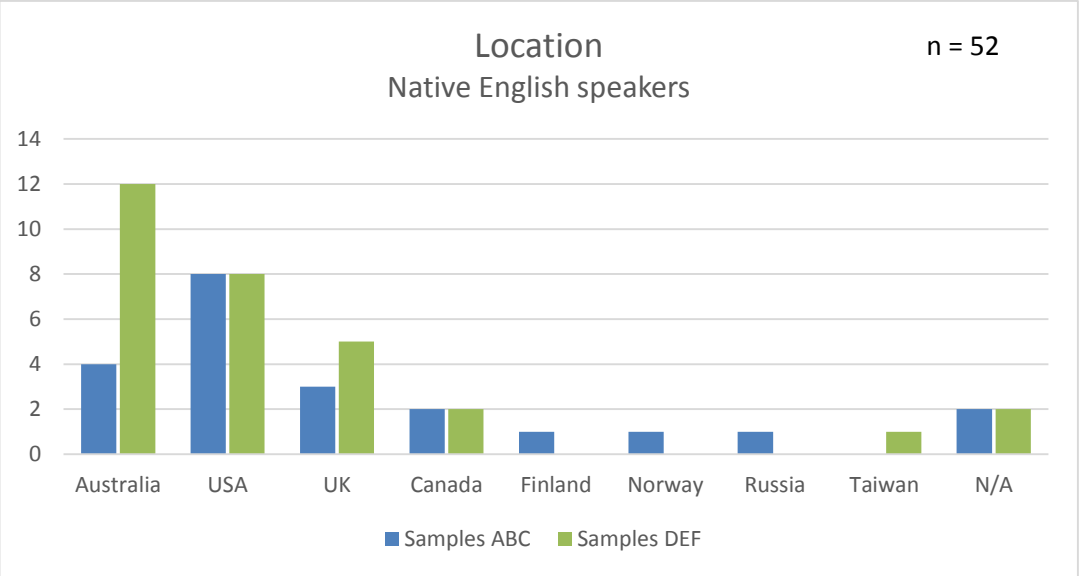


**Figure 9. The location from where the native English speakers answered the questionnaire. This data was gathered automatically.**

Figure 10 presents the respondents' proficiency in English, combining the native English speakers and the level of English studies of the other respondents. This was essential to know as the study was conducted in English. In addition to the 35% (52) of native English speakers, another 35% (52) of respondents had studied English for more than 8 years, and a further 23% (34) had studied English for 5–8 years. Therefore, as 93% (138) of the respondents had studied English for over 5 years or were native English speakers, the assumption can be made that a large majority of the respondents understood most of the words used in the verbal study.

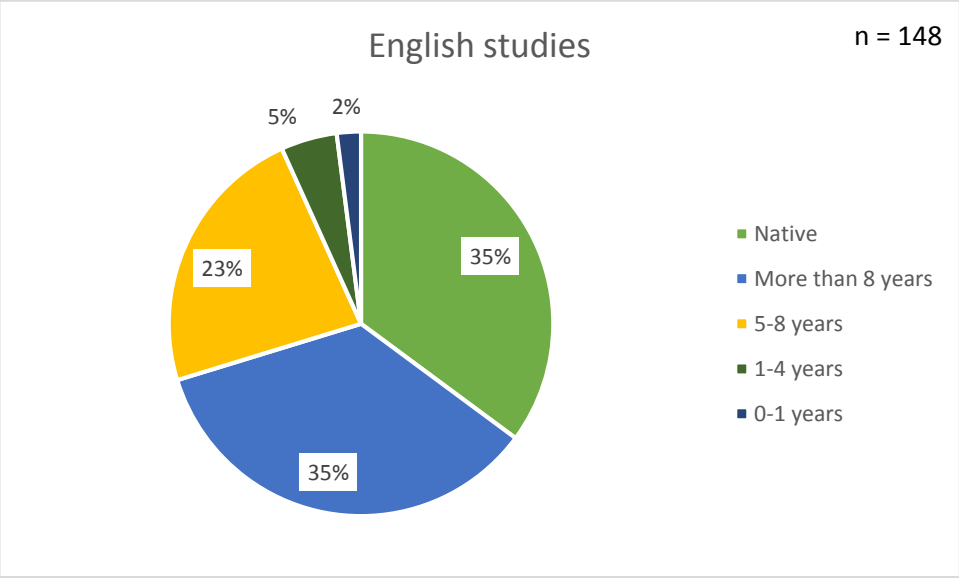


**Figure 10. The level of English studies of all respondents**

Figure 11 illustrates the fact that music is a part of everyday life for most respondents. 13% of respondents (19) listen to music at least sometimes, 43% of respondents (63) listen to music quite often and 45% respondents (65) very often.

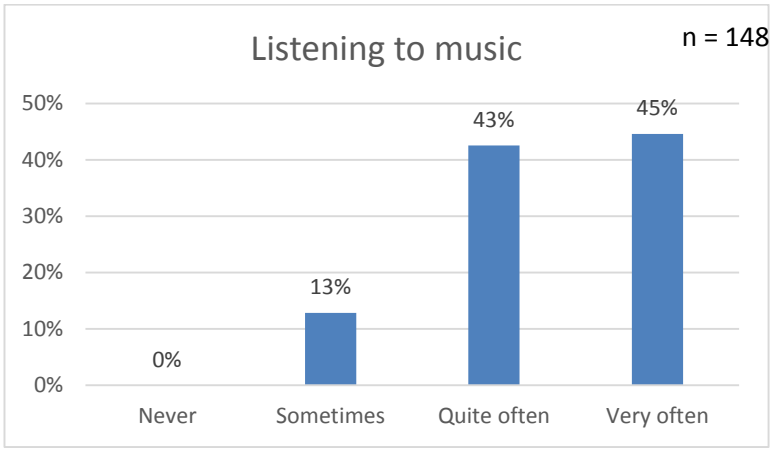


**Figure 11. Listening to music, all respondents**

The level of musical training (Figure 12) was distributed as expected, with 49% of the respondents (73) being non-musicians. However, a majority (51%) of the respondents were involved with music at least as a hobby. 31% of the respondents (46) practiced music as a hobby (just for fun), 18% of the respondents (27) considered themselves as amateurs (serious interest but non-professional) and 1% of the respondents (2) were semi-professional. No respondents identified themselves as professional musicians.

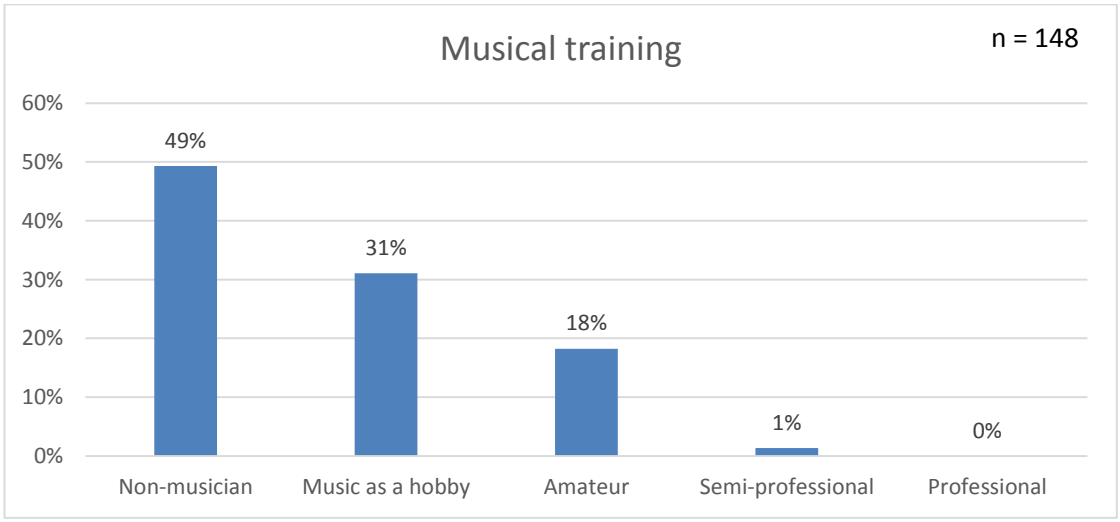


**Figure 12. Musical training of all respondents**

The respondents answered questions regarding their musical preferences on a 5-point Likert scale with verbal descriptions (don't like at all / dislike / neutral / like / like very much) concerning the following genres: Pop, R&B/Soul, Hip hop, Electronic, Jazz, Latin, Folk, Country, Rock, Hard rock/Metal, Alternative/Indie, Classical. The average values (AVG) and standard deviations (SD) were calculated from the answers (Table 5). The fairly high amount of Finnish responses (44) was separated from the other nationalities to analyze the potential effect on the results. Also, this was necessary for recognizing the researcher bias of the Finnish researcher. The categories Rock (4,3) and

Hard rock /Metal (3,5) were rated considerably high overall as anticipated. Furthermore, Rock received the lowest standard deviation (0,7) of all music genres, so the agreement on this preference was fairly high as well. Also Pop (3,8) was rated very high by all respondents. The Finnish respondents rated the category Hard rock/Metal slightly higher (3,8) than other nationalities (3,4). Moreover, Finns preferred Folk music significantly less (2,5) than other nationalities (3,1) with an average rating below the neutral response (3,0). The Alternative/Indie category was preferred less by Finnish respondents than other nationalities. However, the average rating remained positive. The musical genres Classical, Electronic, R&B/Soul were overall rated as positive. Finnish respondents had a slight dislike towards Jazz (2,9) and preferred Hip hop (3,2) just a bit more than other nationalities, who had a neutral liking to it (3,0).

**Table 5. The musical preferences of all respondents, divided into preferences of Finns and preferences of other respondents. AVG = average, SD = standard deviation.**

| | All | | Finns (n = 41) | | Other (n = 107) | |
|---|---|---|---|---|---|---|
| Genre | AVG | SD | AVG | SD | AVG | SD |
| Rock | **4,3** | 0,7 | **4,2** | 0,7 | **4,4** | 0,7 |
| Pop | **3,8** | 0,8 | **3,9** | 0,7 | **3,8** | 0,8 |
| Hard rock/Metal | **3,5** | 1,2 | **3,8** | 0,9 | 3,4 | 1,2 |
| Alternative/Indie | **3,5** | 1,1 | 3,2 | 1,1 | **3,6** | 1,1 |
| Classical | 3,4 | 0,9 | 3,3 | 0,8 | 3,4 | 1,0 |
| Electronic | 3,3 | 1,1 | 3,2 | 1,1 | 3,3 | 1,1 |
| R&B/Soul | 3,3 | 0,9 | 3,4 | 0,9 | 3,2 | 0,9 |
| Jazz | 3,2 | 1,1 | 2,9 | 1,1 | 3,3 | 1,0 |
| Hip hop | 3,1 | 1,0 | 3,2 | 0,9 | 3,0 | 1,1 |
| Country | 2,9 | 1,1 | 2,9 | 0,9 | 3,0 | 1,2 |
| Folk | 2,9 | 1,0 | **2,5** | 0,8 | 3,1 | 1,0 |
| Latin | 2,9 | 1,0 | 3,0 | 1,0 | 2,8 | 1,0 |

Figure 13 illustrates the experience of the respondents with Suunto products and services. A large majority of them were regular or expert users of the Suunto Ambit family (88%, 130 respondents) and the Suunto Movescount web service (89%, 132 respondents). The Movescount App was also mostly familiar, as 63% of the respondents (94) were regular or expert users. Their previous experience with Suunto Movie was roughly divided in half, with 46% of the respondents (68) having not used the Suunto Movie at all, 21% (31 respondents) had some experience, 22% (33 respondents) were regular users and 11% (16 respondents) considered themselves experts concerning the Suunto Movie. Overall, a large majority of the respondents were highly familiar with the Suunto products and services overall.

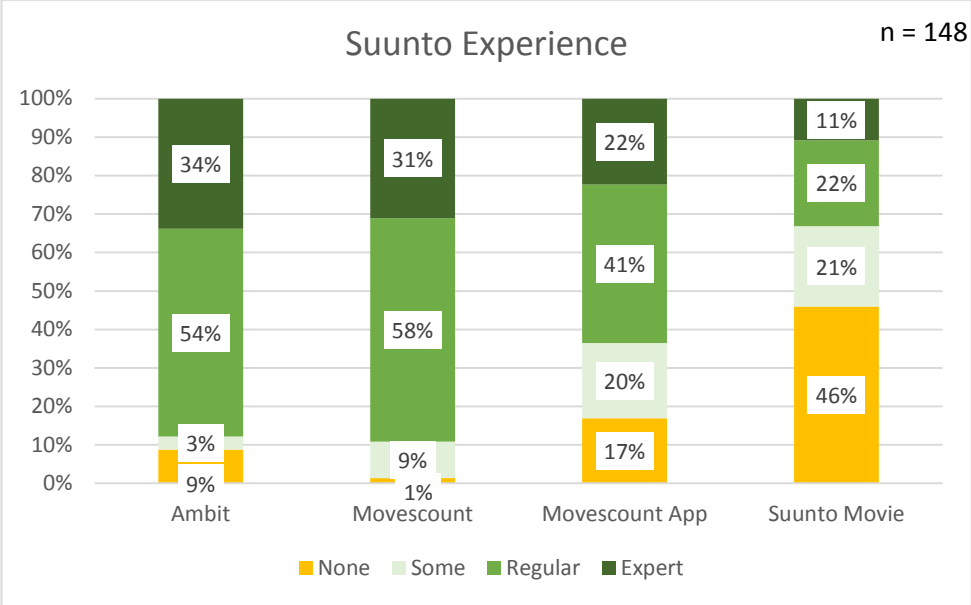


**Figure 13. The Experience of using Suunto products and services**

## 7.2 Musical fit of the samples

The respondents were asked to evaluate different aspects of musical fit for individual samples. The concept of musical fit involves musical characters fitting the brand characteristics (North & Hargreaves 2011). In the questionnaire, the respondents were first asked to rate the overall impression of the samples on a Likert scale from 1 (don't like at all) to 5 (like very much). Later in this chapter, this is referred to as Liking. Then, the respondents were asked whether the music was predictable regarding to the Suunto Movie overall (referred to as Overall Musical fit later on in this chapter) and after this, whether the music fit well with the different aspects of the Movie: the titles appearing rhythmically one after the other in the beginning and the end, or the track that moves in the 3D rendered map of the terrain. The statements were rated on a Likert scale from 1 (not at all) to 5 (very much). Figure 14 presents the average ratings for these aspects. Samples ABC were evaluated by 67 respondents, whereas samples DEF were evaluated by 81 respondents.

All values of Musical fit are average answers from all respondents. These average values were fairly neutral overall, ranging from 2,6 (Sample A / Musical fit with Suunto) to 3,6 (Sample F / Musical fit with titles). When comparing the results of different samples, it can be seen that Sample B scored overall high, Sample F had some relatively high ratings and D and E were located in the middle. Sample A scored overall low on the different aspects of Musical fit, and sample C was rated only slightly more fitting.

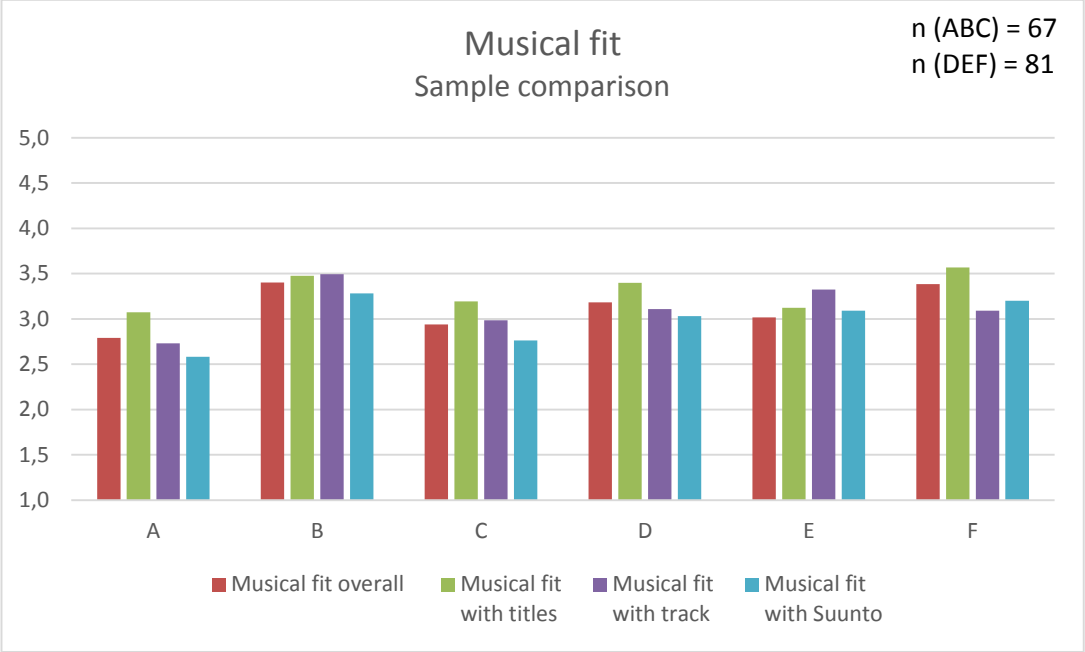


**Figure 14. The Musical fit of samples compared to each other**

The only positive rating of musical fit on Sample A was the Musical fit with titles (3,1), but the musical fit with Suunto was relatively low (2,6). Furthermore, the rest of the values remained under 3,0, thus resulting in negative evaluations. Sample B scored overall relatively high values ranging from Musical fit with Suunto (3,3) to Musical fit with titles and track (3,5). Sample C received slightly negative ratings on Musical fit overall (2,9) as well as with Suunto (2,8), whereas the rest of the values were slightly positive. Sample D fitted fairly well with the titles (3,4) and also the other ratings remained on either the neutral or positive side. Sample E fitted relatively well with the track (3,3). Sample F had the best Musical fit with titles (3,6) and a fairly good fit with the track (3,1).

Table 6 displays the values Liking and the various ratings of Musical fit for all samples. From this comparison, Samples B and F are highlighted when regarding Liking (3,5 for sample B and 3,3 for sample F) and different ratings of Musical fit. B and F were clearly the two most liked (3,5 for B and 3,3 for F) samples, with the best overall Musical fit (3,4 for B and 3,4 for F), best fit with titles (3,5 for B and 3,6 for F) and best fit with Suunto (3,3 for B and 3,2 for F). However, sample E rises above sample F with the second best Musical fit with track (3,3) although it does not receive otherwise high ratings. Table 6 presents also the standard deviations of different evaluations of Musical fit. From these values, it can be seen that the Musical fit with Suunto elicits fairly varied opinions, as the standard deviation receives higher values, especially with samples B (Musical fit with Suunto 3,3, standard deviation 1,3) and C (Musical fit with Suunto 2,8, standard deviation 1,3). The respondents were slightly more unanimous in their ratings of musical fit overall and titles, these receiving mostly standard deviation values of 1,0 and 1,1.

**Table 6. The Liking and the various ratings of Musical fit for all samples.**

| | A | | B | | C | | D | | E | | F | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AVG | SD | AVG | SD | AVG | SD | AVG | SD | AVG | SD | AVG | SD |
| Liking | 2,9 | 1,2 | **3,5** | 1,2 | 3,1 | 1,0 | 3,1 | 1,0 | 3,1 | 1,1 | 3,3 | 1,1 |
| Musical fit overall | 2,8 | 1,2 | 3,4 | 1,1 | 2,9 | 1,1 | 3,2 | 1,0 | 3,0 | 1,1 | 3,4 | 1,0 |
| Musical fit with titles | 3,1 | 1,2 | **3,5** | 1,1 | 3,2 | 1,1 | 3,4 | 1,0 | 3,1 | 1,1 | **3,6** | 1,0 |
| Musical fit with track | **2,7** | **1,3** | **3,5** | 1,1 | 3,0 | 1,2 | 3,1 | 1,1 | 3,3 | 1,1 | 3,1 | 1,2 |
| Musical fit with Suunto | **2,6** | 1,2 | 3,3 | **1,3** | 2,8 | **1,3** | 3,0 | 1,1 | 3,1 | 1,2 | 3,2 | 1,2 |
| Musical fit (AVG) | 2,8 | | 3,4 | | 3,0 | | 3,2 | | 3,1 | | 3,3 | |

The average Musical fit is calculated from all the different ratings of Musical fit, similarly to the study of Morris & Boone (1998). The samples ordered according to their average Musical fit are Sample B (3,4), Sample F (3,3), Sample D (3,2), Sample E (3,1), Sample C (3,0) and Sample A (2,8).

Sample B received the highest Liking (3,5) and the highest average Musical fit (3,4).

> *[Sample B] "Music was happy, up beat, something I could image the runner listening to whilst on his/her run." Male, age 20–29.*

Sample F had an average Musical fit of 3,3 and a Liking of 3,3. Out of all the samples, F had the best fit with titles (3,6) but only a mildly positive fit with the track (3,1).

> *[Sample F] "The beginning was great. I was excited about the feel of the track. I didn't like the synth that entered at about :29 and I felt it got a bit over-dramatic at :42, which was the end of the run. Ideally, I feel the song should climax during the workout, not the end credits." Male, age 30–39.*

> *[Sample F] "Never went anywhere, when the run started the music built to a drop, however what followed was mellow and made the movie feel like the run was nothing special, distinctly average." Male, age 20–29.*

Sample D had an almost as good average Musical fit (3,2) as sample F. It was fairly well liked (3,1), but it fitted with the titles even better (3,4).

> *[Sample D] "The piece is out of sync as a run, however, as a piece to review the move, it fits well, and the musical highlights fit well with the annotations (fastest mile, duration, etc) in the movie." Male, age 30–39.*

*[Sample D] "As a whole best fit with all the elements in the piece so far." [Listened to samples FED] Male, age 30–39.*

Sample E had an average Musical fit of 3,1 and a Liking of 3,1. It fitted relatively well with the track (3,3).

*"The 2nd video [Sample E] is more powerful and motivation for the sports" Male, age 20–29.*

Sample C had a neutral average Musical fit of 3,0. It was considered a slightly poor fit with Suunto (2,8) but it received better ratings of Liking (3,1).

*[Sample C] "In my mind, the rhythm of this music is fit well with the track, but the mucis sounds a little mysterious which fits not so well with the happiness when I am doing sports." Female, age 30–39.*

*[Sample C] "The music has internal power, and it is do not irritate, but for example my personal memories of moves are more rhythmical" Male, age 40–49.*

A received the lowest rating of average Musical fit (2,8). It was not necessarily well liked (2,9), however it fitted a bit better with the titles (3,1). The Musical fit with Suunto (2,6) of Sample A was even lower than Liking.

*[Sample A] "The rhythm doesn't fit with the track given in the movie" Female, age 30–39.*

The effect of the respondents' background concerning Musical training and previous experience on Suunto Movies did not appear to have any consistent relation to the ratings of Liking nor Musical fit.

## 7.3 Emotions evoked by the samples

The respondents rated their emotions on individual samples on a Likert scale 1 (not at all) to 5 (very much). Samples ABC were evaluated by 67 respondents, whereas samples DEF were evaluated by 81 respondents. Overall, most the average values ranked somewhere in the middle between 2,0 and 3,3. The standard deviation of these average values typically ranged between 1,0–1,3 with only a few values of 0,8 and 0,9. The following graphs present the emotional profile of each sample. Samples A, B, and C were listened by one group of respondents, and Samples D, E, and F by another. Therefore, these samples are grouped together in Figure 15 and Figure 16.

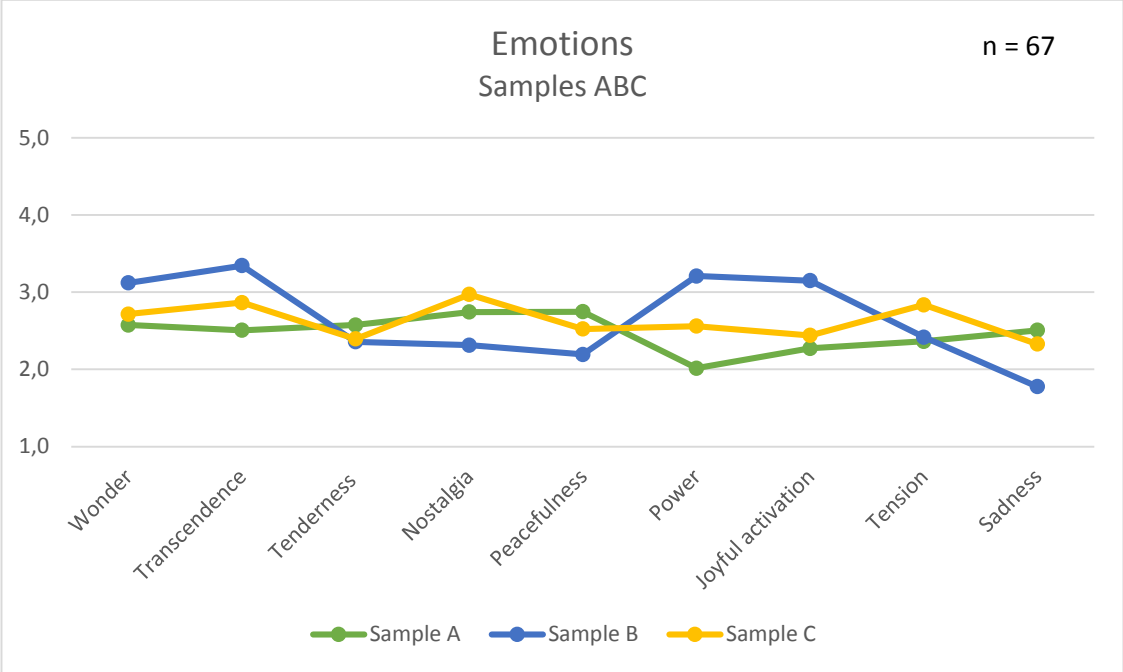


**Figure 15. Emotions evoked by Samples A, B, and C**

Sample A did not evoke strong emotions on any of the GEMS adjective scales (Figure 15). The highest values rated were Nostalgia (2,7) and Peacefulness (2,7) with a significantly low rating on Power (2,0). Sadness was fairly high (2,5) as it reached nearly the same level with all other emotions. In the open comments a few respondents remarked that they liked the melody, but the sample would have needed more power. Others considered the sample dull or boring.

> *[Sample A] "Music is not bad may be if add some bass it could have more internal power (like first melody [C] do)" Male, age 40–49.*

Sample B received a more versatile emotional profile with a significantly high rating on Transcendence (3,3), Power (3,2), Wonder (3,1), and Joyful activation (3,1). Sadness (1,8) received the lowest rating (Figure 15). In the open comments some respondents characterized the melody as happy, upbeat, funny or positive.

> *[Sample B] "When I listen to this music, my coming trekking in east face of Mt. Everest jump into my mind, and I'm very excited." Female, age 30–39.*

Sample C received overall fairly low emotional ratings, resembling Sample A. Only Nostalgia (3,0) reached even the neutral level, Transcendence (2,9) and Tension (2,8) were rated quite close. For Sample C, the lowest ratings were Tenderness (2,4), Joyful activation (2,4), and Sadness (2,3). (Figure 15.) The respondents commented that the music did not match their feelings and that it was a bit sad or mysterious. However, one person liked the mysteriousness, but would have preferred feelings of force and achievement in the sporting context.

> *[Sample C] "A bit sad, lazy." Male, age 30–39.*

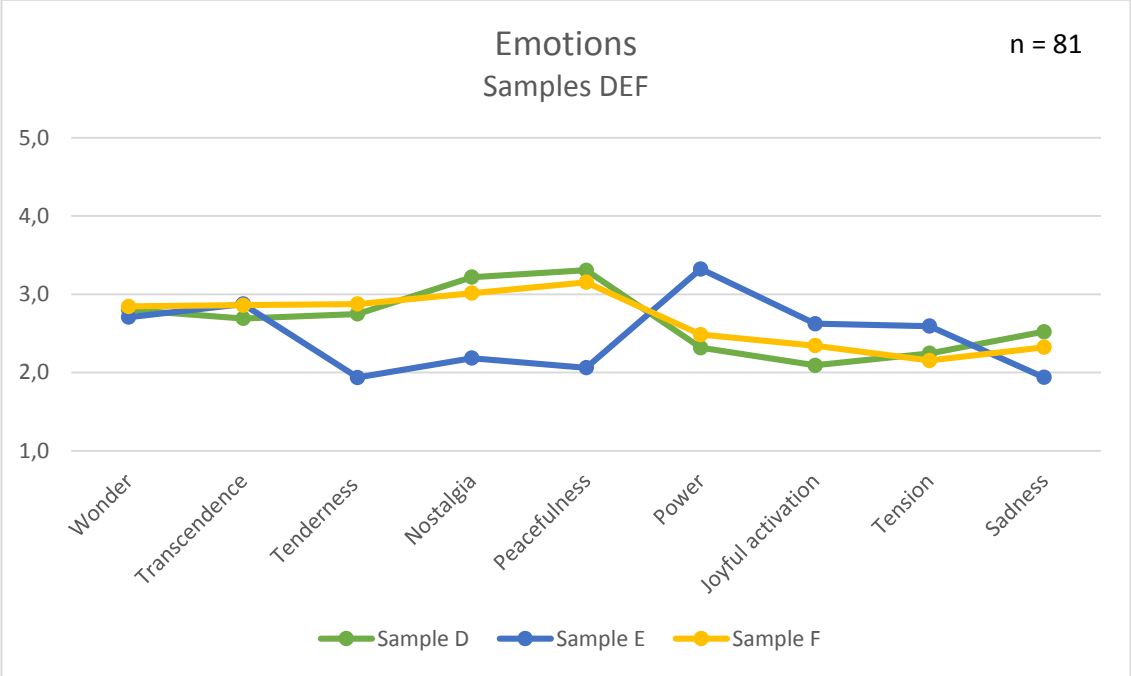


**Figure 16. Emotions evoked by Samples D, E, and F.**

The emotional profile of Sample D (Figure 16) resembled the profile of Sample A but with more emotional intensity. Peacefulness (3,3) and Nostalgia (3,2) were rated as positive. Joyful activation (2,1) and Tension (2,2) received lower ratings, whereas Sadness (2,5) received a relatively high rating. Some respondents remarked Sample D evoking the right kind of emotions with them; soothing, nostalgic or longing. Others would have preferred more upbeat or powerful music and found the sample boring.

> *[Sample D] "Had a feeling of nostalgia, which fits well with watching something of the past." Male, age 40–49.*

> *[Sample D] "The emotions felt are more awe and longing. The longing touches a bit of sadness." Male, age 30–39.*

The emotional profile of Sample E (Figure 16) resembled the profile of Sample B but with slightly lower average emotional ratings and more contrast within the profile. Power (3,3) was the most dominant emotion, with evoking least Tenderness (1,9), Peacefulness (2,1) and Sadness (1,9). In the open comments Sample E was described as energetic, captivating or inspiring. As some persons considered it to be too aggressive, others were hoping that the music would be even more uplifting.

> *[Sample E] "-- this music feels like I'm watching a gopro commercial. The music itself is inspiring." Male, age 30–39.*

Finally, the emotional profile of sample F (Figure 16) resembled the emotional profiles of Samples D and A, with the emotional intensity resembling the intensity of sample D. The emotions evoked most by Sample F were Peacefulness (3,1) and Nostalgia (3,0). Tension (2,2) was evoked the least. In the open comments some remarked that Sample

F made them happy or inspired, whereas in others it evoked desperation or depression. The sample was also described as mellow, relaxed or boring.

> *[Sample F] "The track did bring out some inspiration. Just a little dramatic for me. I absolutely LOVE the movies, but my workouts were fun, jubilant, certainly not melancholic." Male, age 30–39.*

> *[Sample F] "doesn't energize me much. It is more nostalgic/sad" Male, age 30–39.*

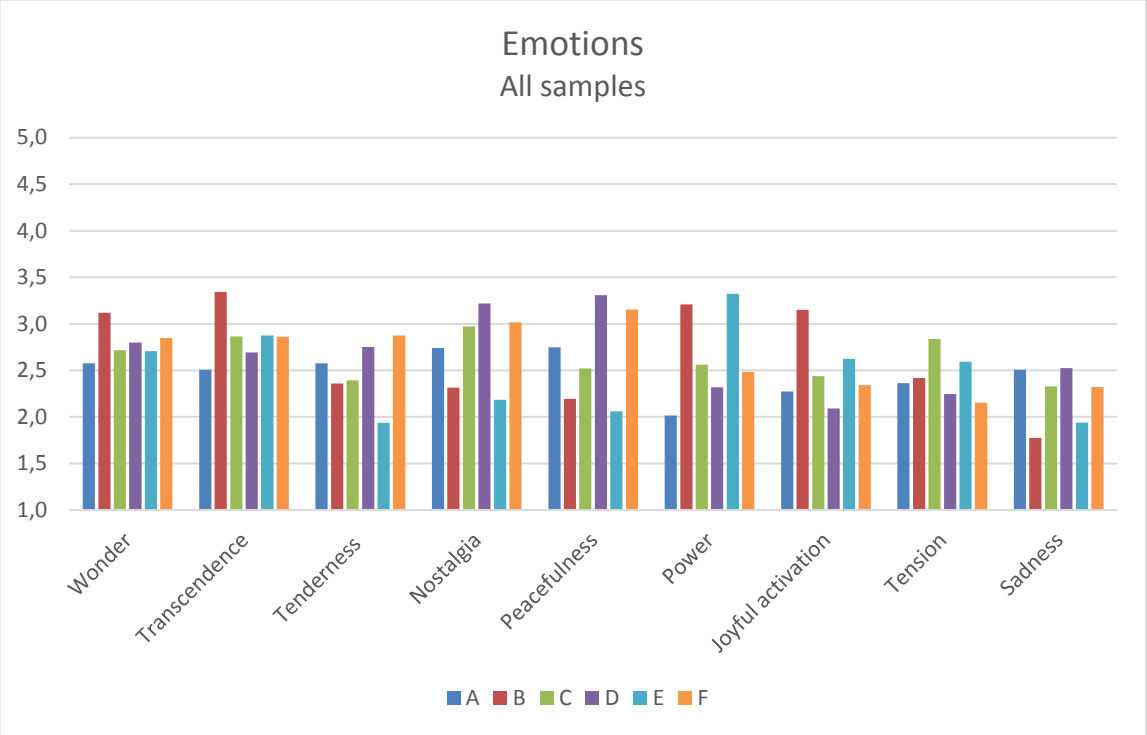


**Figure 17. Emotion comparison of all samples**

Figure 17 presents all samples grouped by individual emotions. From this figure, the extreme values are the most interesting. When discussing the average values, no average value reaches considerably high above the middle value (3,0). Compared within these samples, sample B ranks relatively high on both Wonder (3,1) and Transcendence (3,3). Tenderness is felt the most with samples D (2,8) and F (2,9), with Sample D evoking also the most Nostalgia (3,2). Peacefulness was evoked most by samples D (3,3) and F(3,2), and Power was evoked most by samples B (3,2) and E (3,3). Sample B was noticeable with the most Joyful activation (3,1) from all samples.

Sample E ranks considerably low on Tenderness (1,9), Nostalgia (2,2) Peacefulness (2,1) and Sadness (1,9). Out of the more negative emotions representing Unease, Tension scored overall relatively low, but sample C was rated the highest (2,8) and D and F the lowest (2,2). Sadness was even lower overall with highest ratings on samples A (2,5) and D (2,5) and lowest ratings with sample B (1,8) and E (1,9).

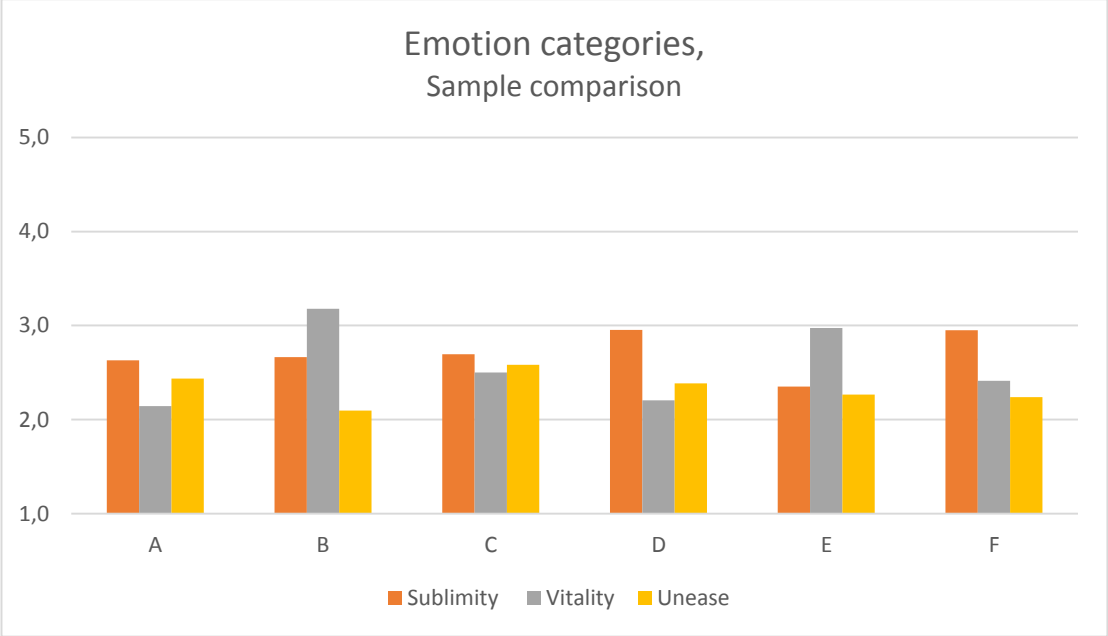


**Figure 18. Emotion categories, comparison of samples**

When the emotions are combined into categories, the similarities between different samples can be visualized more clearly (Figure 18). The emotion category Sublimity consists of an average of the values Wonder, Transcendence, Tenderness, Nostalgia, and Peacefulness. Vitality averages Power and Joyful activation and Unease is formed from Tension and Sadness. (Zentner et al. 2008.) Sample B evoked the highest rating of Vitality (3,2) and the lowest of Unease (2,1) with Sublimity remaining in the middle (2,7). Sample E forms a similar pattern of emotion categories with a relatively high rating of Vitality (3,0), low rating of Unease (2,3) and Sublimity barely over it (2,4).

Sample F differed from these with an emphasis on Sublimity (3,0), low rating of Unease (2,2) and Vitality (2,4) in between. Sample D resembled F closely with an emphasis on Sublimity (2,7) and lower values of Vitality (2,2) and Unease (2,4). Sample A followed the same pattern of D and F but with lower overall values of Sublimity (2,6) and lowest of all on Vitality (2,1), scoring slightly higher on Unease (2,4). However, sample C evoked even more Unease (2,6), averaging on Sublimity (2,7) and Vitality (2,5).

## 7.4 The effect of music on User Experience

The AttrakDiff questionnaire on User Experience consisted of adjective pairs representing various categories of User Experience: Pragmatic Qualities (PQ), Hedonic Qualities – Identification (HQ–I), Hedonic Qualities – Stimulation (HQ–S), and Attractiveness (ATT) (Hassenzahl et al. 2003.). In the results, the adjectives range from negative (1,0) to positive (5,0). However, the adjectives Simple–Complicated do not readily translate to positive and negative in the musical context. Overall, the AttrakDiff adjective pairs averaged around neutral (3,0) values, ranging from 2,6 to 3,6. Samples ABC were evaluated by 67 respondents, whereas samples DEF were evaluated by 81 respondents.

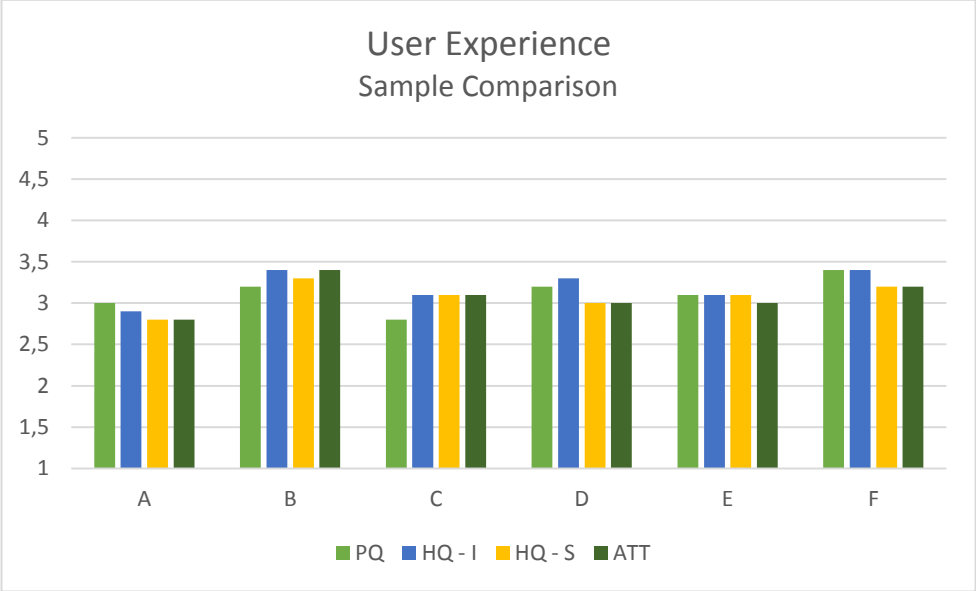


**Figure 19. User Experience, sample comparison**

Figure 19 compares the User Experience of samples categorized to Pragmatic Qualities (PQ, average of adjective pairs Confusing–Clearly structured and Complicated–Simple), Hedonic Qualities –Identification (HQ – I, Unpresentable–Presentable and Tacky–Stylish) Hedonic Qualities – Stimulation (HQ – S, Dull–Captivating and Unimaginative–Creative) and Attractiveness (ATT, Ugly–Beautiful, Discouraging–Motivating) (Section 4.3). The average values of User Experience categories should rate between 4 and 5 for HQ–I, HQ–S and ATT according to the Suunto guidelines. When looking at these values, it appears that all samples require further development before meeting the qualities of an end product.

*[Samples CBA] "You can do better." Male, age 30–39*

When comparing the samples with each other, samples B and F rate slightly better than others, with all categories of User Experience reaching above the neutral level. Sample B scores high on ATT (3,4), whereas Sample F scores high on PQ (3,4). Both Samples B and F are rated high on HQ–I (3,4). The lowest component of B is P (3,2) and the lowest component of F are HQ–S and ATT (3,2). Samples D and E are the next best options with one or two qualities at neutral level and the rest ranking positive. Samples A and C rate the lowest, with the pragmatic qualities of A at the neutral level (3,0) and everything else rated as negative. Sample C scores mildly positive on other qualities, but negative on PQ (2,8). Overall, all samples are fairly neutral and no sample emerges as having a significantly better User Experience than the others. However, the samples can be ordered according to highest ratings of User Experience among different categories: Sample B, Sample F, Sample D, Sample E, Sample C, and Sample A. Interestingly, this order resembles the order according to the average Musical fit.

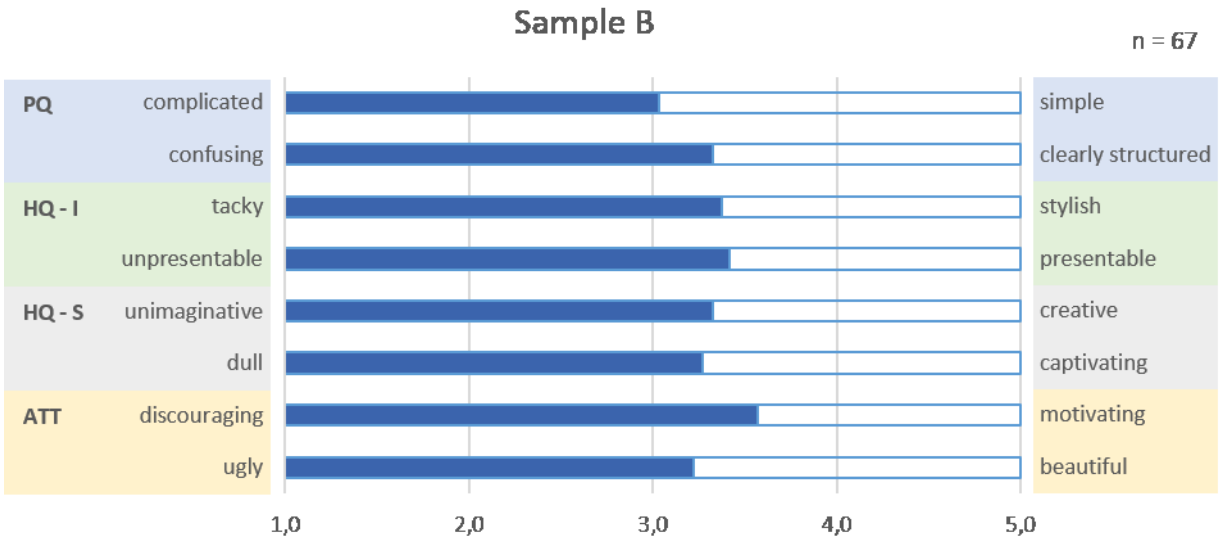


**Figure 20 .User Experience of Sample B**

Sample B (Figure 20) received mostly positive ratings with only Simple (3,0) remaining neutral. The highest ratings were Motivating (3,6), Presentable (3,4) and Stylish (3,4).

> *"I like 2nd Suunto music [Sample B] the most, it's motivational and beautiful." Female, age 30–39*

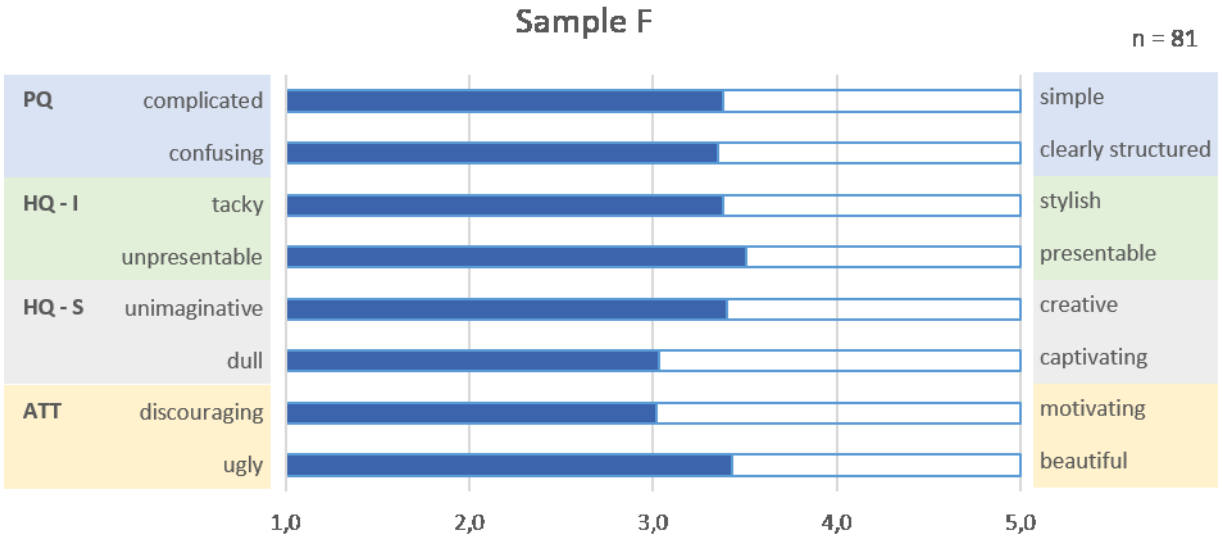


**Figure 21. User Experience of Sample F.**

Similar to sample B, sample F also scored only neutral to positive evaluations (Figure 21). The values ranged from neutral scores on Motivating (3,0) and Captivating (3,0) and peaked with Presentable (3,5).

> *[Samples FED] "Again, really liked the simple structured first track of the series [Sample F] best with the third [Sample D] in second place. It was "clean" and pleasant to listen to. It matched the moves and tempo well and was very upbeat." Male, age 60–*

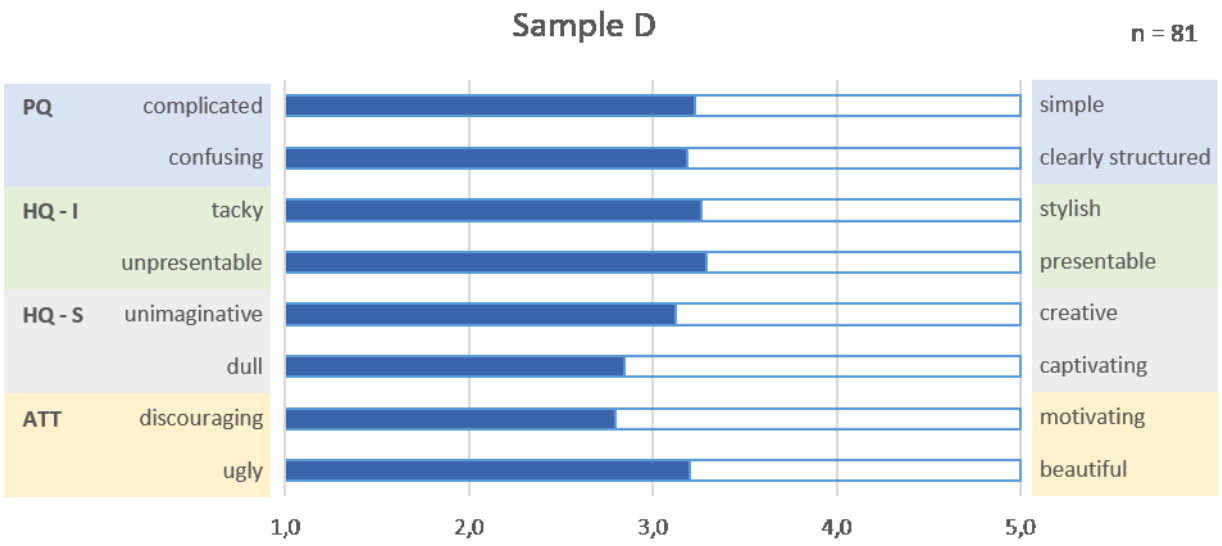


**Figure 22. User Experience of Sample D.**

Sample D (Figure 22) was regarded mostly positive with emphasis on Presentable (3,3) and Stylish (3,3). However, it was considered slightly Discouraging (2,8) and Dull (2,8).

> *[Samples FED] "The third example [Sample D] presented the quality image and feeling of Suunto best without overwhelming the actual point which is the excercise. It's a great idea to add music to the SuuntoMovies." Male, age 40–49.*

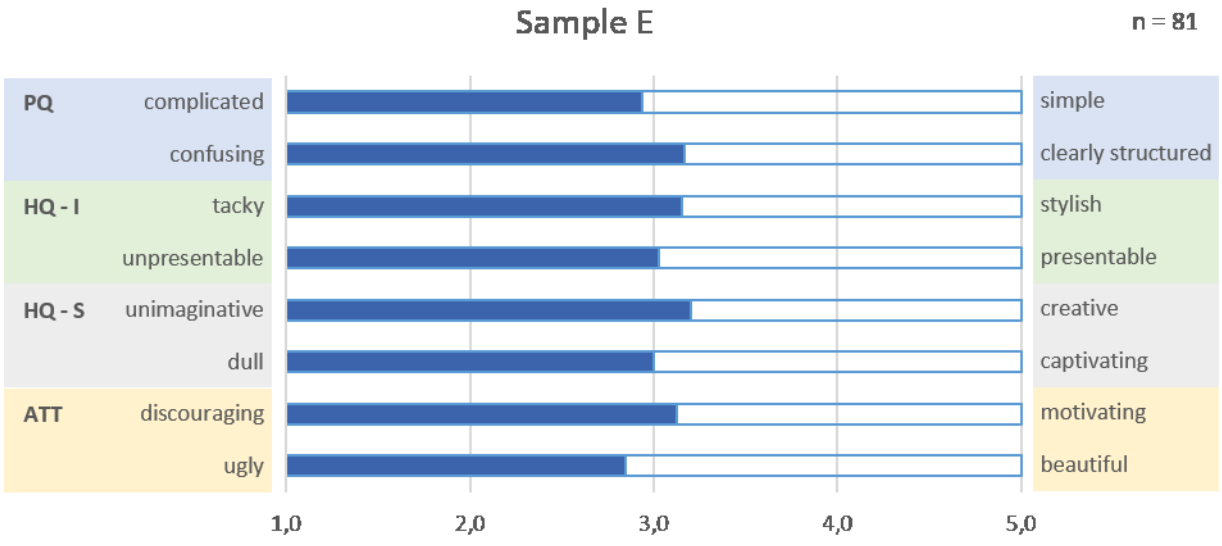


**Figure 23. User Experience of Sample E.**

Sample E also received mostly positive evaluations (Figure 23), and it was considered somewhat Imaginative (3,2), Stylish (3,2) and Clearly structured (3,2). However, it was considered slightly Ugly (2,8) and Complicated (2,9).

> *[Sample E] "Inspiring track" Male, age 30–39*

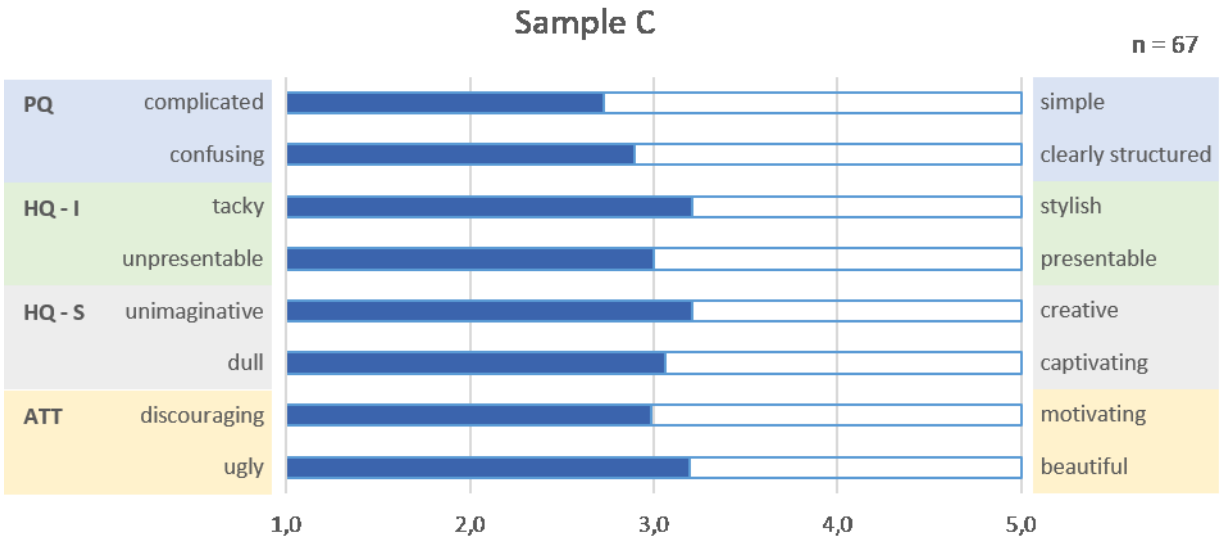


**Figure 24. User Experience of Sample C.**

Sample C received both positive and negative evaluations (Figure 24). It was considered fairly Beautiful (3,2), Imaginative (3,2) and Stylish (3,2), but also rather Complicated (2,7) and Confusing (2,9).

> *"First track [Sample C] was the one that fits suunto movie. But, it is too theatrical." Male, age 30–39*

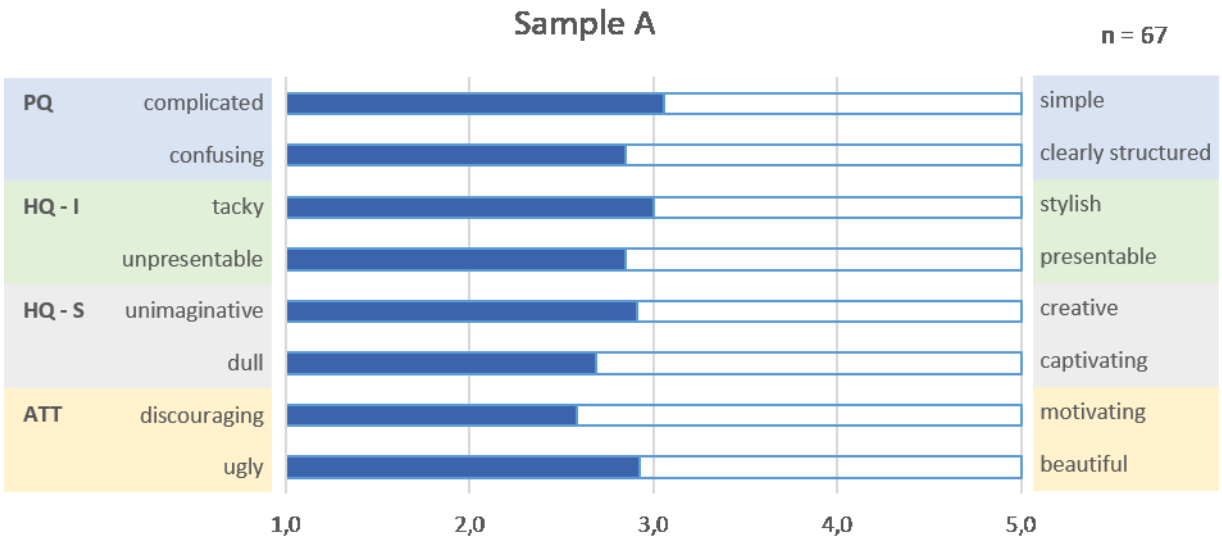


**Figure 25. User Experience of Sample A**

Sample A received mostly slightly negative evaluations with only Stylish (3,0) and Simple (3,1) reaching to neutral or slightly positive. On the other extreme, it was considered slightly Dull (2,7) and even more Discouraging (2,6). (Figure 25.)

> *[Sample A] "music neutral, typical, boring, did not impress" Male, age 50–59.*

## 7.5 Overall comments on music

The respondents were eager to give overall feedback. Even though the open comments fields were optional, 67% of the respondents answered to the open comments regarding the music, the test and overall feedback to Suunto. The large response rate, the length of the answers and the amount of details showed that the respondents were interested in the Suunto products, the Suunto Movie and its music. They expressed both strong positive and strong negative opinions.


**Figure 26. Word cloud on the overall comments on Suunto Movie Music**

The Suunto Movies music received 101 comments on a general, optional question "Feedback on the music for Suunto Movies". These comments are visualized in a word cloud (Figure 26). Word cloud visualizes important themes to the respondents, not so much the actual impression of the present situation; if respondents state that they like or that they do not like the current samples, both of these will highlight the word Like in the word cloud. Therefore, this cloud does not emphasize the high liking for these samples, as much as the importance that the respondents find that liking is important. Other relevant themes concerning music are Motivating, Upbeat and Powerful. Overall, respondents had lot of Ideas and the word Want shows that they wished to express their ideas. Also the evaluative samples are showing in the word cloud by adjectives Good, Better and Best. The high emphasis of the word Suunto shows that the company is important to the respondents and they feel passionate about it. This is one reason for the considerably high response rate on optional open comments.

> *[Samples FED] "All three samples summed up well what Suunto represents, while providing motivation." Male, age 40–49*

The main reason for so many open comments is that the Suunto users form an active community of people who feel really passionate about the brand. From the open comments it was clearly seen that the users appreciated this chance to give feedback and to influence the decisions in product development overall.

> *"Great idea! Involving users this way in R&D is a very nice way of listening to the end-user's voice." Male, age 30–39*

The 101 open comments concerning the Suunto Movie Music were first classified according to main themes to obtain an overall view. Then, more detailed emerging themes were searched from within these main classifications. The classifications were evaluation, positive comments, negative comments, and suggestions on the music. 12 respondents wished to conclude the test by once more evaluating the samples and putting them in preference order. 23 open comments were positive and complimented on the samples, 15 comments were negative but did not offer any clear suggestions. 51 comments had suggestions on how to improve the samples, whether it concerned the amount of samples, uploading your own music, the content or genre of music, improving the sound quality or generating music based of the exercise track. Positive comments considered the idea of music in this context interesting, the respondents liked the samples and appreciated the constant improvements on the product. The samples were described as motivational and beautiful.

> *"I haven't used Suunto movies yet but this survey has peaked my interest." Male, age 40–49.*

> *"I'm excited that you're looking at bringing music in. I love the movies and this is something that could enhance them even more." Male, age 30–39.*

However, in the negative comments the music samples were considered too simple or respondents simply stated that they did not like them. Many commented on the electronic sounds, hoping for a more versatile instrumentation. Four respondents commented that the sound quality should have been better, as the music sounded too computer-made for their taste. Three of these respondents described their level of musical training as Amateurs (serious interest but non-professional). It has been suggested, that more experienced listeners focus more on technical and motor aspects of the performance than the emotions evoked by music (Kreutz et al. 2008). Many respondents wished that instead of Suunto providing the music, the users could choose their own music from iTunes, MP3 files, Spotify or free online music.

> *"It owns to each of us to use the music of our choice that suits best the feeling we had during the effort." Male, age 40–49.*

Some respondents wished that they could choose a style of music themselves to match their own mood and feelings. Others suggested that the style should be based on the sport profile.

> *"A Movie for an "epic" (tougher) run or mountain biking should be decorated with some powerful music, while a relaxing walk should be played*

*with some relaxing atmospheric music to bring out the correct mood. An algorithm for analyzing the Move and choosing a suitable score should be developed if one does not already exist." Male, age 30–39.*

Many respondents described what the music for Suunto Movie should be from their perspective: the adjectives uplifting, motivating, energetic, and upbeat were frequently used. A few respondents mentioned rock music to make them feel the effort, others remarked that classical music could express relaxation or transcendence. Sonification, i.e. generating music based on the exercise track, was also suggested by many respondents. The topic of sonification is discussed more in detail in Section 9.4 Discussion and further research.

# 8 ANALYSIS

This chapter presents the further analysis of the results, while comparing the findings with the existing literature. The first section discusses the relationship between Liking and Musical fit, the second proceeds with the relationship between Liking and the strength of Emotions. The third section compares the Emotions of selected samples to the Suunto Emotional Profile. User Experience is discussed in the fourth section, concentrating on musical complexity, Motivation and overall musical quality. Finally, emerging themes from the open comments are introduced.

The six musical samples A, B, C, D, E, and F are described in Section 6.2 Suunto Movie Music. Additionally, the links to the YouTube videos watched by the respondents are listed in Appendix A.

## 8.1 Liking and Musical fit

Section 7.2 Musical fit of the samples presented the results of the various ratings for the Musical fit for each sample. The overall impression of the samples, Liking, related closely with the ratings of Musical fit. As the average Musical fit for a sample was calculated from the various ratings of Musical fit, the relationship was even more evident.

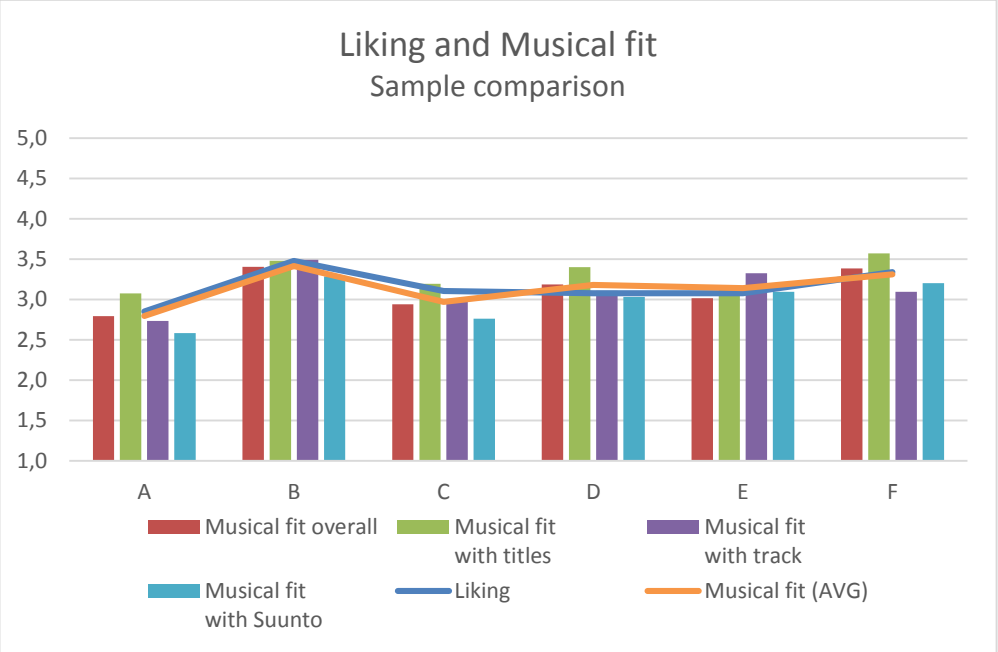


**Figure 27. Liking and Musical fit, sample comparison**

Figure 27 presents the different aspects of Musical fit for each sample and compares them with the rating of Liking and the calculated average Musical fit. With all samples the ratings of liking correlated with the different aspects of musical fit. Table 7 presents the average values and the standard deviation for Liking and the average Musical fit. As musical preferences are context-dependent (Hargreaves & North 2011), the context of a sports animation affects already both the Liking and the rating of the Musical fit. On the other hand, North et al. (2004) discovered that musical fit increased the liking of

the advertisements where music was used. Even though the Suunto Movie is not an advertisement, this could apply also in this context.

> *[Sample F]"I really liked the music and I thought it blended well with the exercise track. Very upbeat and "catchy" Male, age 60–.*

> *[Samples CBA] "All samples sound like licence free music to me what isn't the kind of music i like to hear in this content" Male, age 20–29.*

**Table 7. Liking and Musical fit for all samples**

| | Liking (AVG) | Liking (SD) | Musical fit (AVG) |
|---|---|---|---|
| Sample A | 2,9 | 1,2 | 2,8 |
| Sample B | 3,5 | 1,2 | 3,4 |
| Sample C | 3,1 | 1,0 | 3,0 |
| Sample D | 3,1 | 1,0 | 3,2 |
| Sample E | 3,1 | 1,1 | 3,1 |
| Sample F | 3,3 | 1,1 | 3,3 |

The Pearson correlation coefficient of Liking and Average Musical fit for all samples (n = 445) is 0,79. With a confidence interval of 95%, the p-value is 0,0000. Therefore, the assumption can be made that Liking correlates strongly with Average Musical fit.

Sample F was considered fitting best (3,6) with the titles. Musically, the piano melody featured accents well synchronized with the beginning titles. The strings in the background were mixed lower. Sample B received the second highest rating (3,5). B had a prominent piano melody, which somewhat synchronized with the start titles. The lowest fit with the titles was Sample A (3,1), which had an accented synth melody. However, this melody did not synchronize with the titles as clearly as the other two samples. The Musical fit with the titles is relevant, because the beginning titles display the key information of the featured exercise. The alignment of information with musical cues emphasizes the message (Cook 2000, 16). As most of the music in the Suunto Movie is not synchronized, the selected points of synchronization are relevant for meaning and dynamics (Chion 1994, 190). In the final implementation of the Suunto Movie, the length of the individual sections of the Movie can be adjusted so that the highlights and the beginning / ending titles coincide with the beats of the accompanying music.

Sample B was rated as best musical fit with the track (3,5). The most prominent musical structure at the beginning of the exercise track is the walking bass line played at 156 beats per minute, resembling the sound and pace of a person running. This kind of music can be used during sports as it can be synchronized to an athlete's movements (Karageorghis & Terry 2008). An overall tempo recommendation for stimulative, synchronous music is >120 bpm (Karageorghis & Priest 2012). A more detailed comparison of running pace and speed has been gathered by a commercial site, ranging from 150 bpm (slow jog, 10min/km) to 171 bpm (high intensity run, 4min/km). The results vary for different runners, depending on their technique, stride length and fitness. (run2rhythm 2007.) Another distinctive character of Sample B is the melody played by

a distorted electric guitar with a wah-wah effect, the distorted guitar sound essentially referring to rock music. Rock music is frequently played at sporting events, thus creating a separate "sports rock" genre (McLeod 2011, 87). Although a composition is in a minor key, it may express happiness with fast tempo and loud chords (Gabrielsson & Lindström 2011). The happiness expressed by Sample B fits with the happiness that the respondents assumed the runner was feeling.

Sample E was rated as second best Musical fit with the track (3,3). During the exercise track, Sample E moves upwards and modulates to a major key. This occurs during section B, which is played towards the end of the track. Major mode, less complexity, consonance and fluent rhythm express pleasantness (Gabrielsson & Juslin 2003). Expressed pleasantness may also evoke emotions of pleasantness in the listener through emotional contagion (Juslin & Västfjäll 2008). Some respondents mentioned that the track was inspiring, energizing and uplifting, thus fitting better with the pace of the activity. The tempo of Sample E was 140 bpm. The rhythm of the sample is interpreted by a driving synthesizer rhythm in intro and section A and a driving drum beat in section B. The tempo recommendation for motivational music during repetitive, aerobic exercise is within 125-140 beats per minute, when music is not used to synchronize movements (Karageorghis et al. 2012). This may possibly amount to better ratings of musical fit in the sports context. In the overall open comments, the contrary could be noticed. If a sample did not synchronize with the related sports, it was considered a poor fit.

> *[Sample F] "The tempo of the music is not related by the activity i.e. running/higher intensity" Male, age 30–39.*

On the other hand, the tempo of Sample F (144 bpm) did not considerably vary from the tempo of Sample E (140 bpm). Instead, the bass line was paced more slowly and the whole rhythm of the sample was not as driving as sample E. Furthermore, the drums are not playing the beat, only some relatively silent cymbal effects. This may have led to the listener's perception of a slower tempo. Karageorghis et al. (2012) remark that music used during exercise should have prominent rhythmic qualities and percussion.

## 8.2 Liking and Emotions

Section 7.3 Emotions evoked by the samples presented the results concerning the emotions felt by the respondents. Preference to a particular piece of music predicts the strength of emotions felt (Moors & Kuppens 2008). Moreover, preference for a musical genre enhances both the intensity and specificity of the emotions evoked by music (Kreutz et al. 2008). The specificity refers to more detailed and refined emotions; e.g. Wonder, Transcendence, and Joyful activation instead of a general emotion of Happiness. On the other hand, evoked emotion is an important predictor of musical preference (Schubert 2007). When comparing the individual emotions of the samples with Liking, the most intensively felt positive emotion related to the rating of Liking.

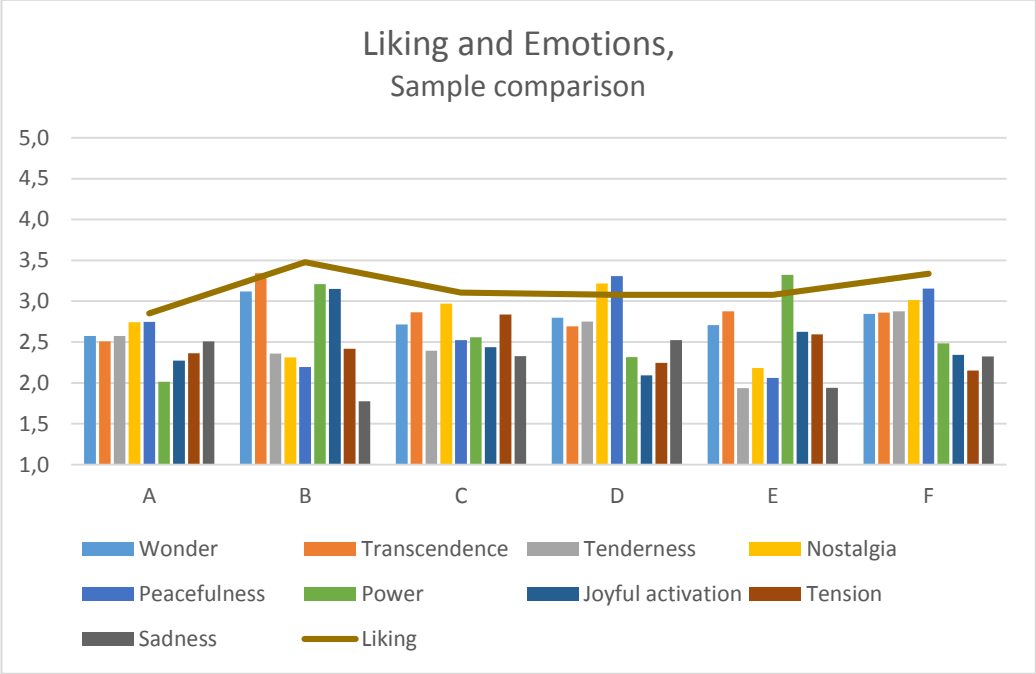


**Figure 28. Liking compared to the Strength of Emotions**

Figure 28 and Table 8 compare the Liking to individual emotions. Sample B was clearly liked the most (3,5), and it evoked most Transcendence (3,3). Sample F was liked second best (3,3) and the most powerful emotion was Peacefulness (3,2). Samples D, E and C all rated a lower Liking of 3,1. The emotion most evoked by D was Peacefulness (3,3), with Nostalgia (3,2) following closely. Sample C also evoked most Nostalgia (3,0), but the emotion was of lower intensity than with Sample D. Sample E was considerably different and evoked the most Power (3,3) of all samples. Sample A scored lowest on Liking (2,9) and overall did not evoke very intense emotions. The highest ratings were Nostalgia and Peacefulness (2,7). Overall, the strongest positive emotions (Wonder, Transcendence, Tenderness, Nostalgia, Peacefulness, Power, and Joyful activation) evoked by all samples were fairly close to the ratings of Liking.

**Table 8. Emotions and Liking**

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Wonder | 2,6 | 3,1 | 2,7 | 2,8 | 2,7 | 2,8 |
| Transcendence | 2,5 | 3,3 | 2,9 | 2,7 | 2,9 | 2,9 |
| Tenderness | 2,6 | 2,4 | 2,4 | 2,8 | 1,9 | 2,9 |
| Nostalgia | 2,7 | 2,3 | 3,0 | 3,2 | 2,2 | 3,0 |
| Peacefulness | 2,7 | 2,2 | 2,5 | 3,3 | 2,1 | 3,2 |
| Power | 2,0 | 3,2 | 2,6 | 2,3 | 3,3 | 2,5 |
| Joyful activation | 2,3 | 3,1 | 2,4 | 2,1 | 2,6 | 2,3 |
| Tension | 2,4 | 2,4 | 2,8 | 2,2 | 2,6 | 2,2 |
| Sadness | 2,5 | 1,8 | 2,3 | 2,5 | 1,9 | 2,3 |
| Liking | 2,9 | 3,5 | 3,1 | 3,1 | 3,1 | 3,3 |

The correlation of Liking and strongest positive emotion for all samples is 0,59. With a confidence interval of 95%, the p-value is 0,0000. Therefore, the assumption can be made that Liking correlates with the strongest positive emotion. However, the correlation between Liking and average Musical fit is even stronger.

## 8.3 The Suunto Emotional Profile

From the results, it was evident that the samples evoked different emotions, thus resulting to various emotional profiles for each sample. Some emotions were more desirable than others in the context of Suunto products, services or the whole brand.

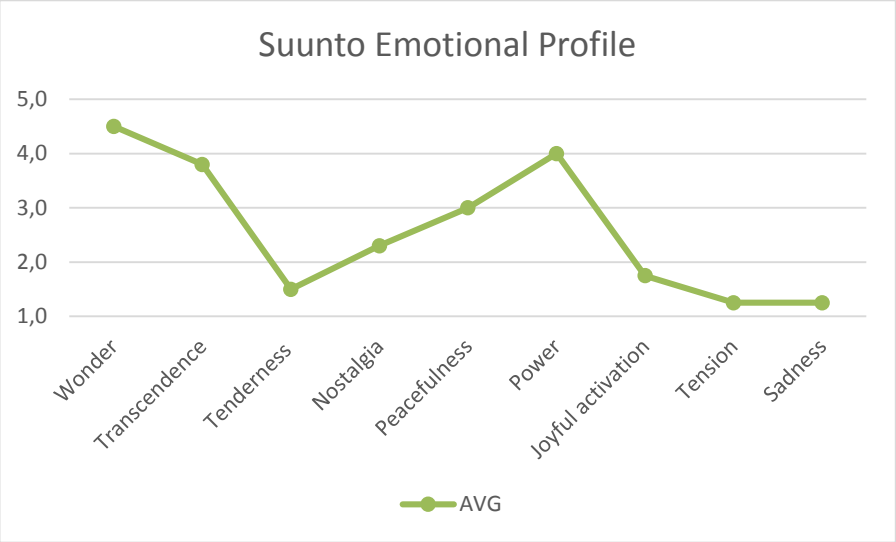


**Figure 29. The Suunto Emotional Profile**

In order to analyze the emotional profiles further, I conducted a small survey with representatives of the Suunto Strategy (1 respondent) and Brand & Marketing (3 respondents). The aim was to find out, which emotional qualities of music should be related to the Suunto products, services or the whole brand. An emotional profile for Suunto was constructed from these answers (Figure 29) with high emphasis on Wonder (4,5), Transcendence (3,8), and Power (4,0). The values Tenderness, Tension, and Sadness received the lowest ratings between 1,3 and 1,5. The Suunto respondents had fairly similar views concerning the emotions, only opinions on Transcendence were dispersed with the answers ranging from 2 to 5.

> *"Suunto, on brand level, is about powerful, emotional, inspiring and strong (but not too high beat) music that is having those "epic" qualities and strong enough to be paired with the awesome visuals that we have." Brand & Marketing*

The essence of the Suunto brand is authentic, confident, and inspiring. The Suunto Emotions curve (Figure 29) followed this fairly well. An interesting notion of the curve is, that unlike the emotional curves of the actual samples, there are remarkable differences also within the major emotional categories. Wonder (4,5) and Transcendence (3,8) differ considerably from Tenderness (1,5) and Nostalgia (2,3), with only Peacefulness (3,0) scoring relatively neutral. All of these emotions belong to the Sublimity category.

Moreover, within the category of Vitality, Power (4,0) and Joyful activation (1,8) differ from each other significantly. However, Tension (1,3) and Sadness (1,3) remain exactly the same, while both belonging to the Unease category. Therefore, the comparisons need to be made on the whole emotional profile, instead of the emotional categories.

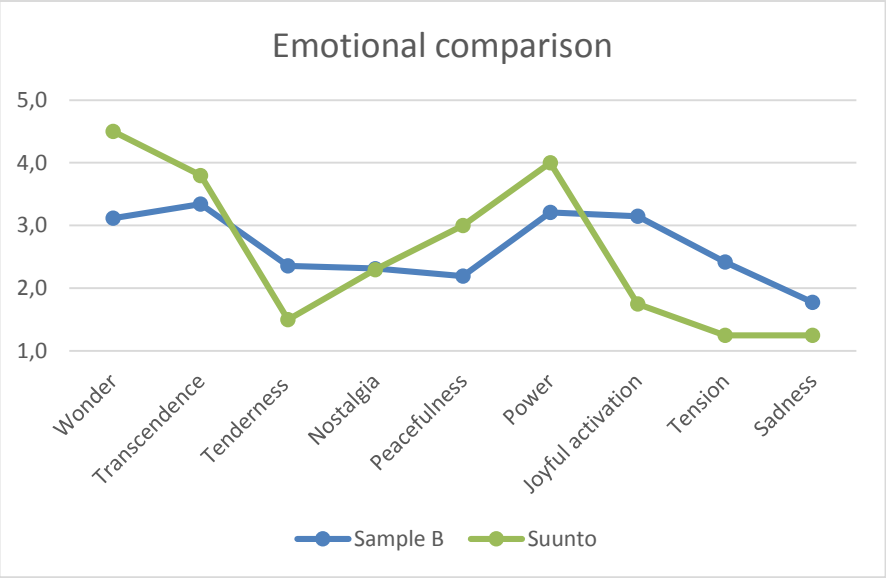


**Figure 30. Emotional comparison of Sample B with Suunto**

From the ratings of Musical fit, Samples B and F emerged clearly as most fitting based on the respondents' answers. Furthermore, these two were the most liked. The emotional profiles of these two samples were compared with the Suunto Emotional Profile. From this comparison, it can be seen that sample B evokes relatively strong emotions on Wonder (3,1) Transcendence (3,3) and Power (3,2), all of which are compatible with the emotions Suunto wishes to evoke (Figure 30).

The strong emotions of Wonder, Transcendence and Power evoked by Sample B can be originated to musical structures and psychological mechanisms. In section A of Sample B, the melody is played by a distorted electric guitar with a wah-wah effect. The distorted guitar may itself portray energy (North & Hargreaves 2011), which is one of the descriptions for Power. Wonder and Transcendence could be related to episodic memory. One of the psychological mechanisms evoking emotions is episodic memory, which refers to music evoking memories of special events (Juslin & Västfjäll 2008). One person remarked that Sample B evoked strong memories of past exercises:

> *"-- when I watch the track [Sample B] moving, it reminds me of the thrilling marathons and the hikings I've already experienced." Female, age 30–39.*

Another respondent liked all of the Samples C, B, and A especially due to the good beat and fast pace. She felt that the rhythm contributed to emotions of Power and Transcendence. Another psychological mechanism evoking memories is rhythmic entrainment, where emotions are evoked by the powerful, external rhythm of the music interacting with the internal body rhythm of the listener (Juslin et al. 2011).

*[Samples CBA] "I liked all of them! They made me want to hop out of bed and hit the trails running. All of them had a good beat to them that was fast paced without being hugely overwhelming. They make you feel very inspired and like a boss as some people might say." Female, age 20–29.*

Even though the listener was not running herself while listening to the samples, she could imagine herself running. Therefore, it seems that Rhythmic entrainment may evoke emotions even when the bodily rhythm is only imagined or remembered.

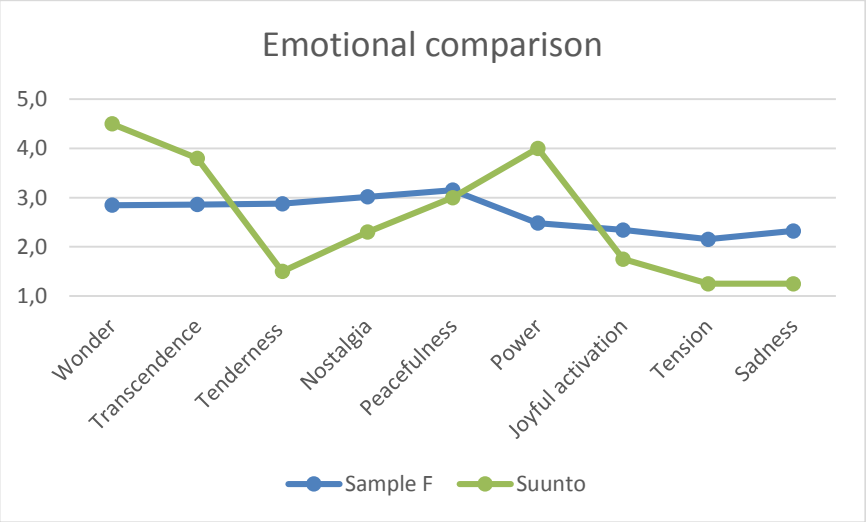


**Figure 31. Emotional comparison of Sample F with Suunto**

Sample F evokes relatively mild emotions with only Nostalgia (3,0) and Peacefulness (3,2) reaching above the neutral rating. Furthermore, there are no clear highs or lows on the emotional profile, which is different from the polarization of emotions that characterize the Suunto Emotional Profile (Figure 31). Suunto wishes to evoke particular emotions, not just any emotions. Moreover, the ratings for F on Tension (2,2) and Sadness (2,3) rank clearly too high compared to Suunto (Tension and Sadness 1,3).

Sadness evoked by Sample F could be traced back to musical structures. In the open comments sample F received descriptions such as dramatic, depressing and desperate. The melody consists of long piano notes playing slowly in a minor key with only small intervals in the pitch. Slow tempo, small pitch variation, and legato articulation express unpleasantness and low arousal, while minor mode usually expresses unpleasantness (Gabrielsson and Juslin 2003). Furthermore, the slow tempo of the melody may have contributed to associations with sadness and boredom (Gabrielsson & Lindström 2011). However, Sadness evoked by music is not necessarily considered as negative. Musical sadness is better described as melancholic, and it is not a feeling that people wish to avoid in general (Zentner et al. 2008). Furthermore, people voluntarily listen to sad music making them feel sad, while enjoying other qualities in the musical piece (Davies 2011b). Even though the respondents in the Suunto questionnaire did not wish for the music to evoke Sadness in Suunto users, they may have overlooked the ambiguity of it.

The high ranking of Tension may be attributed to several causes. The accompaniment for the melody in Sample F is a fast, repetitive polyrhythmic synthesized string sound.

This could have contributed to Tension, as rhythmic complexity expresses high arousal (Gabrielsson & Juslin 2003). Tension could also have been due to personal preferences conflicting with the sounds used. One person complained that the sounds were too synthetic, another one remarked that they did not like the barrel organ sound that became more prominent around 0:40. One person with Amateur musical training was irritated due to musical production. Overall, irritation towards music arises when people are exposed to music they do not understand nor like (Zentner et al. 2008).

> *"Both music tracks [Sample A as listening test, Sample F] so far were too artificial, cold, mechanical, hard-edged. Smoothen up a bit, make sound more natural." Male, age 40–49 [non-musician]*

Overall, it could be said that sample F did not evoke strongly those kind of emotions that Suunto wishes to evoke. The open comments reflect this same view.

> *[Sample F] "Music is too neutral. I think that suunto is energic but this music wasn´t that kind of." Female, age 50–59.*
>
> *[Sample F] "Doesn't fit the Suunto brand image I have" Male, age 30–39.*

Power was one of the most prominent emotions that Suunto wishes to evoke (4,0) (Figure 29). The highest rating of Power was received by Sample E (3,3). This was also the strongest emotion evoked by Sample E.

Sample E started with fast, repetitive sounds resembling the sounds of a helicopter. Some described the sample as exciting, energizing, and uplifting, whereas one respondent remarked that the beginning was too aggressive. The open comments associated the sample with science fiction, detective dramas from the 1980's or the movie Blade Runner. One respondent was reminded of a commercial for a sports camera. These associations may be explained by the psychological mechanism of evaluative conditioning, presented by Juslin et al. (2011). Evaluative conditioning is a strong and frequent source of emotions evoked by music. When a piece of music is paired with external stimuli, it will eventually produce the same emotion without the stimuli. In this case, Sample E itself was not paired with the abovementioned television programs or films, but rather the sounds resembled sounds used in those contexts.

Musical structures attributing to Power can be found from sections A and B of Sample E. The melody consists of strong piano notes emphasizing the first beat of the bar and progressing upwards. This melody is accompanied by classical string theme in the background and a driving synthesizer rhythm. Scheurer (2005) explains how heroism is accomplished in sports film scores, using gestures from classical music. These gestures include vigorous or driving rhythms and ascending melodic lines, among others.

## 8.4 User Experience in the context of music and sports

Section 7.4 The effect of music on User Experience presented the results of the AttrakDiff evaluation of User Experience. Most adjective pairs aim for as high on the positive adjective scale as possible: Clearly Structured, Stylish, Presentable, Creative, Captivating, Motivating and Beautiful. However, the adjective Simple–Complicated is

quite interesting in the musical context. Following the inverted U-shaped familiarity / complexity curve (Hargreaves & North 2011) the aim is to find just the right balance somewhere in the middle. If the music is too simple, it is not liked, as it is not interesting. If the music is too complicated, it is also not liked, as it cannot be understood. In a way, this rating is close to the adjective Clearly Structured. However, the opposite adjective of that is Confusing, which is clearly a negative evaluation. Therefore, when analyzing the Pragmatic Qualities of a musical sample ((PQ, average of adjective pairs Confusing–Clearly structured and Complicated–Simple), the interpretation of the result is not as straightforward as regarding the other qualities. The optimum amount of Complexity is a highly subjective value depending on the level of musical training (Hargreaves & North 2011). However, no consistent relation between the level of musical training and ratings of Complexity was found from the results of the questionnaire.

The various categories of User Experience seem to have an overall connection to the average Musical fit (Table 9). When analyzing the AttrakDiff results, the categories of User Experience should not be combined together. Yet, it can be noticed that if the music samples are arranged in the order of highest ratings of User Experience, the order is the same as when ordering according to Musical fit.

**Table 9. User Experience and Musical fit**

| User Experience | B | F | D | E | C | A |
|---|---|---|---|---|---|---|
| Pragmatic Qualities | 3,2 | 3,4 | 3,2 | 3,1 | 2,8 | 3 |
| Hedonic Qualities – Identification | 3,4 | 3,4 | 3,3 | 3,1 | 3,1 | 2,9 |
| Hedonic Qualities – Stimulation | 3,3 | 3,2 | 3 | 3,1 | 3,1 | 2,8 |
| Attractiveness | 3,4 | 3,2 | 3 | 3 | 3,1 | 2,8 |
| Musical fit (AVG) | 3,4 | 3,3 | 3,2 | 3,1 | 3,0 | 2,8 |

The overall musical quality of the samples received the most critical feedback from three Amateur musicians, all of whom had rated Electronic music either as like (4) or like very much (5). They paid close attention to the quality of synthetic sounds and music production and urged to improve them further. A few other respondents remarked that they found all samples too electronic or computer-made for their taste. However, samples D and E received positive feedback regarding the quality and music production. Sample D was constructed entirely of recorded audio, which was later on processed and manipulated. Sample E was a mix of synthesized sound, samples, and recorded audio. Interestingly, Sample B received the highest ratings of Liking even though it consisted entirely of synthetic sounds.

The adjective pair Discouraging–Motivating is especially interesting in the sports context. When discussing musical preference, Moors and Kuppens (2008) introduce the concept of cognitive appraisal as comparing music with aesthetic goals or standards. In this comparison, music is evaluated regarding its relevancy to the goals of the listener: will the music help the listener achieve their goals. Sample B was rated clearly as the

most Motivational (3,6) sample. Many respondents mentioned the motivational qualities in the open comments. Other respondents were hoping for even more motivational songs than sample B.

> *"The second song [Sample B] was very motivating and also in my taste. This kind of movie is nice addition if want to show youre track" Male, age 40–49*

One respondent described Sample B as upbeat and continued, that they could imagine the runner listening to this music while running. In the sporting context, music can be used to arouse the mood of the athlete before the actual exercise (Karageorghis & Terry 2008). This function of music also appeared in the open comments in other samples.

> *[Sample B] "This is good. Makes you feel to go out running" Male, age 40–49*

> *[Sample C] "Made me feel like I needed to run to achieve something" Female, age 40–49*

## 8.5 Emerging themes from the open comments

The open comments enabled the respondents to express their thoughts freely, either by elaborating on the choices made or offering other insights. There were some truly impressive, insightful comments on emotions. In some cases, the open comments revealed more on the psychological mechanisms evoking emotions, such as visual imagery and musical expectancy. Finally, there were many respondents requesting rock music for the Suunto Movie. The major reasons for this are analyzed in this section.

Section 7.5 Overall comments on music reported a large amount of open comments concerning overall feedback. In addition to the high quantity, the quality of the comments was also high. Some of the comments were very insightful, even poetic. Batt-Rawden and Denora (2005) noted in their study that musical listening and musical reflection created a sense of empowerment, enabling the participants to become increasingly conscious towards emotions evoked by music.

> *[Sample D] "The music sounds a bit apprehensive at first. It then becomes more soothing when the violin begins to play. Towards the end, I was left with the feeling like I had an unanswered question. Perhaps the question was "Can I do that?", but I'm not sure." Male, age 30–39*

One of the psychological mechanisms evoking emotion is visual imagery. In this process emotion is evoked because the own imagination of the listener creates visual images while listening to music. The musical structures may be mapped to concrete images, such as a melodic movement heard as "upward". (Juslin & Västfjäll 2008.) Two respondents described visual images that the music brought to their mind and how these images conflicted with the actual images of the Suunto Movie.

> *[Sample E] "This felt like it belongs with an urban city run not a majestic run on the waterfront" Female, age 40–49*

*[Sample C] "The music kept making it feel like it was going to build up to something like a tough climb, but that never appeared." Male, age 20–29*

What makes this second comment interesting is the origin of this particular composition. Sample C was first composed to accompany another Suunto Movie featuring a tough mountain hike. In this particular composition, the composer took a film music approach and wished to portray the images of that particular Movie in the music as well. The musical structures referring to the mountains could be the chromatic upward passages played by the piano. The heavy bass line could represent the toughness of the climb, as well as the low, slow distorted guitar theme played in section B.

Another psychological mechanism evoking emotions is the musical expectancy, referring to emotion evoked as the expectations for the musical structure are violated, delayed or confirmed. These expectations can form on various hierarchical levels. (Juslin & Västfjäll 2008). Some respondents commented on musical expectations. In general, they liked the intro, but it created expectations that the following section did not meet. Either the music raised tension too much or too little; the respondent expected the music to build up to something when it did not. It has been argued that listeners form continuous expectations on how the music will proceed, and experience various degrees of tension and relaxation depending on these expectations and the actual outcome (Krumhansl & Agres 2008). Another feedback was that the intensity of the song should have peaked during the workout instead of the end credits. However, in some cases the structure of the song worked out well for the listeners. Also Juslin & Västfjäll (2008) note that these expectancies vary for different listeners.

*[Sample D] "Didn't really grab me, I would have liked a more inspirational track with a buildup towards the end. more suspense to the finish." Male, age 30–39*

*[Sample D] "Stick to this format. Slow setting of scene, progressing to run, increasing tempo. The music does need arranging differently for if entering the mountains, do give of the scale of the challenge and the surroundings." Male, age 20–29*

In the open comments the respondents described that Suunto Movie should be uplifting, motivating, energetic and upbeat. Many wished for more rock music. This is partly due to of rock being overall the most preferred genre of the respondents; average rating 4,3 with a standard deviation of 0,7 (Table 5). This can be traced back to the fact that 69% of the respondents were between 30 and 49 years (Figure 7). Musical likes and dislikes in late adolescence and early adulthood influence strongly the musical taste developed later in life (Hargreaves & North 2011). A large majority of the respondents have been 15 years throughout the 1980's and the 1990's, during when rock music (post-punk, grunge, indie rock) has been widely popular. On the other hand, the preference for rock in this context can also be affected by the sports rock genre described by McLeod (2011), which consists of classic rock songs played at sporting events.

# 9 CONCLUSIONS AND DISCUSSION

Music is something that everybody has an opinion about, and this opinion is strongly based on personal preferences. Non-musicians may find it hard to distinguish the evaluation of music from the personal opinions. One of the objectives of this study has been to gather existing research findings and conduct an empirical study, thus basing the decisions concerning the music of the Suunto Movie on this knowledge instead of personal preferences. Another outcome has been the discovery and refinement of methods and vocabulary suitable for evaluating music in commercial context.

This final chapter discusses first the reliability and validity of the results. Then, the feedback on the test from the respondents is summarized. After this, the conclusions of this research are presented and the research questions are answered. The final section consists of the discussion along with further research topics.

## 9.1 Reliability and validity of the results

This section examines critically the material used in this research and analyzes the actual participants of the study. The limitations and shortcomings of the methods and the analysis are discussed. The principles of choosing test subjects have been described in Section 6.1 Selecting subjects, and the arguments for constructing of the questionnaire in Section 6.4 Questionnaire. The analysis based on quantitative and qualitative results have been presented in Section 8 Analysis.

The material used in the Music and Emotion chapter of the literature review was gathered around the Handbook of Music and Emotion, which is a collection of academic articles published by the most appreciated researchers in their fields. Other academic articles were either referred to by these authors or presented in various journals on Music and Emotion, which were checked for their academic relevancy. Music and emotion is a widely researched topic, but I believe the most relevant articles are included in this study. References concerning other topics were mainly academic articles or books written for the academia. A clear exception was the topic of sonic branding, which is a relatively new field, strongly based on marketing and practical knowledge. Books and industrial papers written by practitioners working in sonic branding agencies were counterbalanced with an academic article, taking a critical overall view on the field.

The respondents of the survey sent by email were chosen carefully, but as the response rate remained at 23%, more responses were obtained with an open invitation link published at the Movescount Facebook group. The Movescount Facebook group proved a good source for more responses during a relatively short period of time. However, the background of the users could not be controlled. Furthermore, the Facebook questionnaire may have attracted respondents, who were only participating for the possibility of winning a prize. Five respondents answered the 12-page questionnaire, including three one minute videos, in 3–5 minutes, and 10 in 5–8 minutes. Some responses should probably have been removed from the final results. However, drawing the line between fast decision-makers and non-informative answers would have been difficult.

With the Facebook questionnaire, there were only two groups of respondents, listening to samples CBA and FED. This was due to practical reasons, as I was not the one publishing the link at the Facebook group. The first link for questionnaire FED was published late in the evening Finnish time, and the next morning the link was changed to questionnaire CBA. Dividing these two main groups to subgroups would have required constant monitoring and a quicker reaction time. Overall, this led to an uneven distribution of the order of samples listened: group ABC received 11 responses, group CBA 56 responses, group DEF 18 responses, and group FED 63 responses. Ideally, these groups should have been even. The fact that sample F was listened as the first sample, may have attributed to the likings positively. On the other hand, sample C, which was also the first sample listened by many, did not reach high ratings of liking. With both samples, there was a listening test with a short evaluation of liking before the actual evaluations of comparable samples. This was partly for testing the listening conditions, but also partly for diminishing the effect of first listening, which attracts more attention than the following samples and may remain as a comparison for the rest of the samples.

In the Facebook questionnaire, the only parameter controlled was the countries where the link was published. Therefore, the gender distribution (16% women) fell far from the intended 50% of women. However, this gender distribution was slightly better than what Suunto questionnaires normally receive. Furthermore, observing differences based on gender was not in the scope of this study.

Regarding the respondents' previous experience of Suunto Movie, the division of the actual respondents followed the recommendations of Bangor and Miller (2008), who suggested that when adding a new modality to a product, part of the test users should be familiar with the product and part should be new users. In this study, 46% respondents had no experience and 54% had at least some experience of the Suunto Movie.

The distribution of the nationalities did not aim to fully represent all Suunto users around the world, but rather present a varied sample. The approach of this study was in line with Boer & Fischer (2012), who built their analysis upon culturally varied data but analyzed it as a whole to prevent culturally biased and ethnocentric interpretations of answers. In this study, the respondents who spoke Finnish or English as native language were over-represented. There were also other factors not taken into consideration at all. Personality and mood affect the emotions evoked by music (Vuoskoski & Eerola 2011). If a person is sad or angry for other reasons, they might not experience as much positive emotions as they would otherwise. However, it would have been beyond the scope of this study to include these factors in the background information.

A clear shortcoming of the test was that the listening environment of the respondents was not known. There was a separate listening test for controlling the volume of the samples. Recommendations of using headphones or external speakers were given both in the email invitation and in the questionnaire itself. However, it remains unknown if the respondents actually followed this recommendation. Comments on the tinny quality of the sounds or lack of bass could just as well have amounted to low quality laptop speakers. On the other hand, the listening environment of the Suunto Movies cannot be

controlled either; it could be even worse with people listening to the Movie sounds from mobile phone speakers. Therefore, the samples need to sound good also in poor listening conditions.

In the test results, the option of leaving a question unanswered may have led to unintentional blank answers. However, as some of the adjectives were quite difficult for non-native speakers, I preferred this risk to forcing people rate something they do not quite understand. A considerably low amount of fields were left empty. All users answered all questions regarding Musical fit and User Experience. The GEMS adjectives on evoked emotions were left empty in only a few occasions. Out of all the GEMS adjectives answered by all respondents, only a few fields were left unanswered (0,8% for Sample A, 0% for Sample B, 0,5% for Sample C, 0,8% for Sample D, 0,7% for Sample E, and 0,5% for Sample F.) The empty fields resulted evenly from different adjectives, so no particular adjective emerged as receiving considerably less answers. Overall, the non-native English speakers may have misinterpreted some verbal questions, even though there were explanatory adjectives within the GEMS scale of emotions.

The qualitative research included in this study consisted of open comments that were presented next to the quantitative questions, and overall evaluations in the end of the whole questionnaire. The open comments associated to the quantitative questions were used as enriching the data and finding out various explanations for the quantitative results. The analysis of the general open comments did not aim to provide an overall in-depth analysis, but rather illustrate interesting themes emerging from the open comments and related clearly to the themes discussed in the literature review. The fact, that I have been working both for Suunto, and for the Suunto Movie Music project, may have unintentionally biased the analysis towards a more positive overall view.

The Suunto Emotional Profile used in the analysis is not a final profile nor a guideline for further product development. The profile was rather a short, in-house survey with preliminary answers and directions to aid the analysis. The possible shortcomings of the Suunto Emotional Profile may have been due to the abstract level of the questions. One respondent felt that the abstract level made the questions too difficult to answer, so this person left the questions blank and offered this explanation in the open comments. Also, major differences within the ratings of Transcendence may suggest that the adjective was not fully understood. For further use, more people from different departments should answer this survey.

Another way of analyzing the emotional experience of Suunto could also have been by selecting a few existing songs, defining their musical fit with Suunto and then analyzing more closely the emotions these songs evoke. This would have made the questions more concrete and easier to answer. On the other hand, with individual known songs, the associations of these songs and the individual genre/artist/song preferences of the Suunto employers might have affected the outcome too much and moved the focus away from overall abstract emotional experiences.

## 9.2 Feedback on the test

The respondents were given an opportunity to write open comments on the questionnaire itself on the final page. Most respondents commented that the test was not too long. The average completion time was 18:37, with 18 respondents spending 30 minutes or more to construct their answers. The respondents enjoyed the opportunity to give customer feedback to Suunto and were happy to participate in an academic study. They thought the test was overall well done, interesting and good. Also, a few were enthusiastic about the possibility to win Suunto equipment. As Gustafsson (2015) presumed, the involvement on customers on the choice of music did receive considerable goodwill also in this case.

> *"Great idea! Involving users this way in R&D is a very nice way of listening to the end-user's voice." Male, age 30–39*

Overall the test received 68 comments including 39 positive and 8 negative comments. 6 displayed interest on the results, 8 gave neutral comments. Moreover, 7 respondents gave suggestions concerning the test. The test structure and the methodology received positive feedback. Some remarked that the test setting was well designed for this purpose and the AttrakDiff adjectives on User Experience and the GEMS adjectives on emotions evoked by music seemed to work well in this context.

> *"Really enjoyed the same video with different music, amazing the impact/impression changes" Female, age 30–39*

> *"Words in this test can almostly describe all the feeling happen to me when I watched those movies and listened to the musics." Female, age 30–39*

I tried to make the instructions and questions as simple as possible. Most respondents seemed to understand the test well, but a few problems were reported in the neutral/negative comments. The GEMS questionnaire used some complicated adjectives and it seems that the explanations were not sufficient for everyone. In the suggestions concerning the test, some respondents would have wished for more tracks and many remarked that the samples played were too similar. In the overall comments concerning music, some ranked the samples in the end, even though that was not required. I initially thought that this kind of ranking would not benefit the results. Nevertheless, it seemed that the ranking helped some respondents clarify their thoughts.

## 9.3 Conclusions

The objective of this study was to find musical fit for the Suunto Movie; a musical composition with characteristics fitting with the Suunto brand and the Movie itself. Six different original compositions (Samples A, B, C, D, E, and F) were evaluated with a web questionnaire, and answered by Suunto users.

**1. What could be a musical fit for the Suunto Movie?**

The various ratings of Musical fit were fairly neutral overall. Average Musical fit had a strong 0,79 correlation with the ratings of Liking. Samples B and F received highest

ratings of both Liking and Musical fit. Sample F was considered well synchronized with the beginning titles of the Movie, thus emphasizing the information presented. Sample B was evaluated as best musical fit with the track. This could have been caused by the rhythmic features of the track resembling the sound and pace of a person running, or the distorted electric guitar referring to rock music frequently played at sporting events. Sample E received second best musical fit with the track, with touches of major mode expressing and evoking pleasantness in some respondents and driving rhythm fitting the sports context. Based on these results, a sample is considered a good musical fit when it is liked, important points are well synchronized with the music and the music during the track is rhythmic, pleasant, and refers to rock music.

### 1.1. What kind of emotions does music evoke in listeners?

The Geneva Emotional Music Scale consists of a selection of refined emotions chosen to suit the musical context. The scale emphasizes a varied scale of positive emotions, which are also suitable for commercial purposes. The emotional profiles of different samples highlighted different emotions. Samples A, D, and F evoked most the emotions Peacefulness and Nostalgia, while Sample C evoked only Nostalgia as the strongest emotion. The evaluations of Samples B and E resulted in diverged emotional profiles; Sample B received strongest evaluations on Transcendence and Power, and Sample E evoked mostly Power. With all samples, the Liking of the piece correlated with the strongest positive emotion evoked by 0,59. Thus, the musical preference and the intensity of evoked emotions are strongly intertwined, with preference resulting in more detailed and refined emotions.

In the context of Suunto Movie, some emotions were more desirable than others. An emotional profile for Suunto was constructed, emphasizing strongly the emotions Wonder, Transcendence, and Power. This profile compared well with sample B. The distorted electric guitar may have evoked emotions of Power, while evoked memories of past exercises could have contributed to Wonder and Transcendence. Overall, the rhythm of the samples contributed to Power and Transcendence by rhythmic entrainment, where the rhythm of the movie interacts with the body rhythm of the listener. Sample E may have evoked emotions of Power by evaluative conditioning, as the sounds used were associated with sports advertisements, or dramatic and powerful television series and films. Furthermore, Sample E included elements from classical music portraying heroism, such as driving rhythms and ascending melodies.

### 1.2. How does music affect user experience?

Music provides varying emotional content to the Suunto Movie, structures the Movie and emphasizes information presented to the user. The User Experience of the samples was rated with the AttrakDiff adjective pairs. The aim was to find out, how combining different musical samples to the Suunto Movie affected the overall user experience. All samples received fairly neutral average values, although samples B and F rated slightly better than the others. In the musical context, the adjective pair Simple–Complicated aims for an optimal value somewhere between the two extremes. This value is highly subjective. All other adjective pairs ranged clearly from negative to positive evaluations, thus aiming to high ratings. The adjective pair Discouraging–Motivating is espe-

cially interesting in the sports context, as musical preference can be evaluated regarding the relevancy of the music to the goals of the listener. Music can be used to arouse the mood of the athlete before the actual exercise.

**Open comments and emerging themes**

Overall, the Suunto Movescount users were eager to state their opinions. They expressed passionate feelings towards the brand but mixed feelings towards the music. The chance of giving feedback and thus influencing product development was appreciated. Some respondents wished to use their own music, others offered suggestions on developing the current samples. The synthetic sounds were criticized, hoping for more real instruments. The psychological mechanism of visual imagery influenced some emotions, as the music brought images to mind that conflicted with the actual images of the Suunto Movie. Musical expectancy affected other emotions, as the intro raised tension and created expectations that the following section did not meet. In the suggestions offered by the respondents, music for Suunto Movie was hoped to be uplifting, motivating, energetic and upbeat. Rock music was wished for, as it rated high on the overall preferred genre of the respondents.

**Overall conclusion**

To conclude, the results indicate that the samples may need to be developed further. Sample B received the best ratings of Liking, Musical fit and User Experience, although all average values remained only mildly positive. Furthermore, the emotions evoked by Sample B were most desirable when compared to the Suunto Emotional Profile. Overall, the results of this study offer useful guidelines for further work and the methods provided interesting insights. Liking, Musical fit, and User Experience all examine the Emotions of the user in the context of sports and film. The detailed evaluation of emotions and the comparison to the Suunto Emotional Profile ensure that the music evokes emotions relevant to the brand — thus returning to the definition of Musical fit. The opinions on music are as varied as the users; it may not even be possible to find music that would cater all preferences. However, a few common elements can be found. The most important topics are driving rhythms and synchronization of music with visuals. The samples could use more recorded audio instead of synthetic sound. The samples need to evoke Wonder, Transcendence, and Power and could use musical gestures of classical music and key elements of rock music to reach these goals.

## 9.4 Discussion and further research

The user experience evaluation of the samples resulted in fairly neutral average ratings for Musical fit and User Experience for all samples. However, it may not be possible to reach high average values. After all, opinions on music are highly subjective and the personal musical preferences of the listener affect the evaluations. Most people find it difficult to separate objective evaluation from subjective opinions. For example, the quality of a musical piece is most likely not appreciated by a listener who does not like the piece in question. For musically trained persons, such as musicians and critics, this might be easier than for non-musicians. But even the most educated musicians are humans, with their own opinions, biases and hidden agendas affecting their evaluations.

The emotions evoked by the compositions may have been evaluated as a summary of all emotions experienced during the listening. Another interpretation of the results is that the ratings expressed the emotions felt at that certain point in time when the question was answered, whether this was during or after listening the whole composition. One further research direction is continuous recording of emotion, which could offer more information on particular musical structures evoking emotions. This would require an inquiry of the respondents overall mood prior to the listening as well.

When evaluating the compositions, the effect of gender, age, musical training and musical preferences on ratings of Liking, Musical fit, Emotions and User Experience could be explored further. What were the influences of a person's background on their evaluations and opinions? This would require an even larger sample of respondents, preferably representing two or more essentially different cultures. With this set of respondents, it would be interesting to compare Finnish respondents with all the other respondents, discovering potential differences in the evaluations of Liking and the Emotions evoked by the samples. Does cultural background affect the type of emotions evoked by a particular piece of music? Are there differences in preferred emotions in different cultures? When a piece of music evokes Sadness, would Finns perceive Sadness as a more positive or common emotion than other cultures?

Continuing on the theme of culture, it would be interesting to consider the individualism–collectivism dimension in a cross-cultural context. Is the whole idea of the Suunto Movie just a manifestation of individual culture? Is the Movie only a way of expressing your own sporting experience; measuring your personal achievements, creating a personal movie and rating a musical sample that would fit your own exercise as well as possible. However, another viewpoint is the collective and social side of the Movie—exercising with friends, creating a Movie together and sharing it with even more friends, maybe even motivating them to do the same exercise.

> *[Samples FED] "I love the idea and I think it will be great to share something like this on Facebook and other social media." Male, age 30–39*

A significant amount of suggestions and wishes referred to sonification, which was originally left out of scope from both the Suunto Movie Music project and this study. Sonification transmits information by generating sound based on data and interactions (Hermann et al. 2011). The topic was clearly of interest and could benefit this work as well. The respondents hoped that the music would reflect accurately the events of the track and be generated by the track. They suggested that the rhythm of the exercise could be synchronized with the stops in the track, building and fading with the track speeding and slowing down. The intensity or loudness of the music could peak when the values peak. The volume, tempo, or the frequency of the music could follow the track profile, heart rate or pace. Also the music could reflect the challenge of the track.

> *"If you create the music automatically for each exercise, taking into account the speed, elevation, heartbeat etc., that would be so cool. Don't know if you plan to do that already but this would be great, if it produces music which itself is also good. A difficult task, I guess..." Male, age 40–49*

In the open comments, many respondents of the survey were hoping for an option to user their own music. However, one problem with this approach (e.g. linking the Suunto Movie to Spotify and sharing the Movie in social media) are the copyright issues. Suunto cannot allow the users to link their own music within the Movescount App, as the listener only has a right to listen to this music. On the other hand, the users are already able to download the Suunto Movie on their own computer and add music with any video editing software. This approach frees Suunto of the copyright issues, yet presents the user with another problem. As synchronizing music with important events was considered important, this leaves the synchronization to the users.

Some respondents were hoping for more options on the samples and genres. These options could be provided according to either the musical preferences of the user or the sport performed. Providing options to select from is a good idea, but what would be a sufficient amount of choices? The samples could be matched to sports, but they could also be matched to the mood of the users, which is even now indicated in Movescount by selecting a smiley. They could also be matched to the genre preferences of the users, or to the terrain (whether the exercise is performed at seaside, at the mountains, in the city or in the forest). The advantage of choosing only one sample is the consistency in the brand message regarding auditory senses as well. One recognizable sample could be the basis for a sonic brand for Suunto, strengthening the emotional characters that Suunto wishes to portray. The sample chosen could then be varied just a little according to different parameters, while maintaining its distinct, recognizable and memorable essence. The construction of a sonic brand requires considerably more compositions to start with, developing these compositions further and evaluating them with actual and target users. However, the results of this study can be used as a basis for this work.

Composing a piece of music is always creating a work of art, even for commercial purposes. This raises a question of whether art can be created by asking users their preferences. If the aim is to please everybody, or at least all target users, the final result may please nobody. My personal opinion is that up to a certain point, you can map the context, ask the users' preferences beforehand, and get feedback along with improvement suggestions for existing musical samples. A composition can be set certain restrictions or required characteristics. However, the detail and the amount of these specifications has a limit. The longer the list of essential research-based musical structures is, the less room it leaves for artistic freedom and interpretation. This may result in a piece of music that has no soul or character of its own. The composer needs to know which emotions are the ones that the brand wishes to evoke. But the means of reaching those emotions should be left to the artistic view of the composer.

> "Science provides an understanding of a universal experience, and arts provides a universal understanding of a personal experience."
> Mae C. Jemison

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# APPENDICES



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## Suunto Movie Music variations

For optimal listening conditions, headphones or external speakers should be used.

Composer: Guy Dowsett
http://guydowsett.com/

Listening test (Sample D) for groups rating samples ABC and CBA
https://www.youtube.com/watch?v=oeBu9p2HVKc

Sample A
https://www.youtube.com/watch?v=H5Dj7OwOE7w

Sample B
https://www.youtube.com/watch?v=Oo-UHMfVQ28

Sample C
https://www.youtube.com/watch?v=H4UlnkU03aM

Listening test (Sample A) for groups rating samples DEF and FED
https://www.youtube.com/watch?v=8NMDij6lb2w

Sample D
https://www.youtube.com/watch?v=eo6DkEVcGc0

Sample E
https://www.youtube.com/watch?v=KGKeLTf0__Q

Sample F
https://www.youtube.com/watch?v=RFbwGK5jm40

**SUUNTO MOVIE MUSIC** [Page 1]

This study is for developing music for the Suunto Movie. Answering the questions will take approximately 15 minutes of your time. If possible, use headphones or external speakers, eliminate noise sources and ensure a comfortable listening environment. By completing this questionnaire, you can participate in a raffle for one Suunto Smart Sensor (compatible with Ambit3 watch or Suunto Movescount App).

Suunto Movies are animated videos of your adventures. These Movies are created with the Suunto Movescount App on your own exercise tracked with either a Suunto GPS watch (Ambit3 Peak or Ambit3 Sport) or the App itself. The Movescount App is currently available for iPhone and Android phones.

This survey is a part of my Master's Thesis for Aalto University and Suunto Ltd. The aim is to study music and emotion in a cross-cultural context, while finding a musical fit for the Suunto Movie.

Thank you for your participation!

Karoliina Tiuraniemi
Usability Specialist,
Suunto Ltd

Bachelor of Technology,
Information Networks
Aalto University, Helsinki, Finland

**Background**
**Age**

- -19
- 20-29
- 30-39
- 40-49
- 50-59
- 60-

**Gender**

- Female
- Male

Appendix B. Questionnaire for the empirical study

**Native language**

- English
- Finnish
- French
- Swedish
-

Other, please specify

**I studied English at school** (for non-native English speakers)

- 0-1 years
- 1-4 years
- 5-8 years
- More than 8 years

**I generally listen to music**

- Never
- Sometimes
- Quite often
- Very often

**My level of musical training**

- Non-musician
- Music as a hobby (just for fun)
- Amateur (serious interest, but non-professional)
- Semi-professional
- Professional

Appendix B. Questionnaire for the empirical study

**My musical preferences**

Please state your **personal opinion** of these musical genres. If you don't know a certain genre, you can leave the question unanswered.

| | don't like at all | don't like | neutral | like | like very much |
|---|---|---|---|---|---|
| Pop | ○ | ○ | ○ | ○ | ○ |
| R&B/Soul | ○ | ○ | ○ | ○ | ○ |
| Hip hop | ○ | ○ | ○ | ○ | ○ |
| Electronic | ○ | ○ | ○ | ○ | ○ |
| Jazz | ○ | ○ | ○ | ○ | ○ |
| Latin | ○ | ○ | ○ | ○ | ○ |
| Folk | ○ | ○ | ○ | ○ | ○ |
| Country | ○ | ○ | ○ | ○ | ○ |
| Rock | ○ | ○ | ○ | ○ | ○ |
| Hard rock/Metal | ○ | ○ | ○ | ○ | ○ |
| Alternative/Indie | ○ | ○ | ○ | ○ | ○ |
| Classical | ○ | ○ | ○ | ○ | ○ |

Appendix B. Questionnaire for the empirical study

**My experience as a Suunto user**

| | None | Some | Regular | Expert |
|---|---|---|---|---|
| Ambit | ○ | ○ | ○ | ○ |
| Movescount | ○ | ○ | ○ | ○ |
| Movescount App | ○ | ○ | ○ | ○ |
| Suunto Movie | ○ | ○ | ○ | ○ |

Next Back

Save and continue later

**Listening test** [Page 2]

For optimized listening conditions, listen first to this musical excerpt. If possible, use headphones or external speakers. Adjust the volume to a suitable level, eliminate noise sources and get into a comfortable listening position.

**My overall impression of this music**

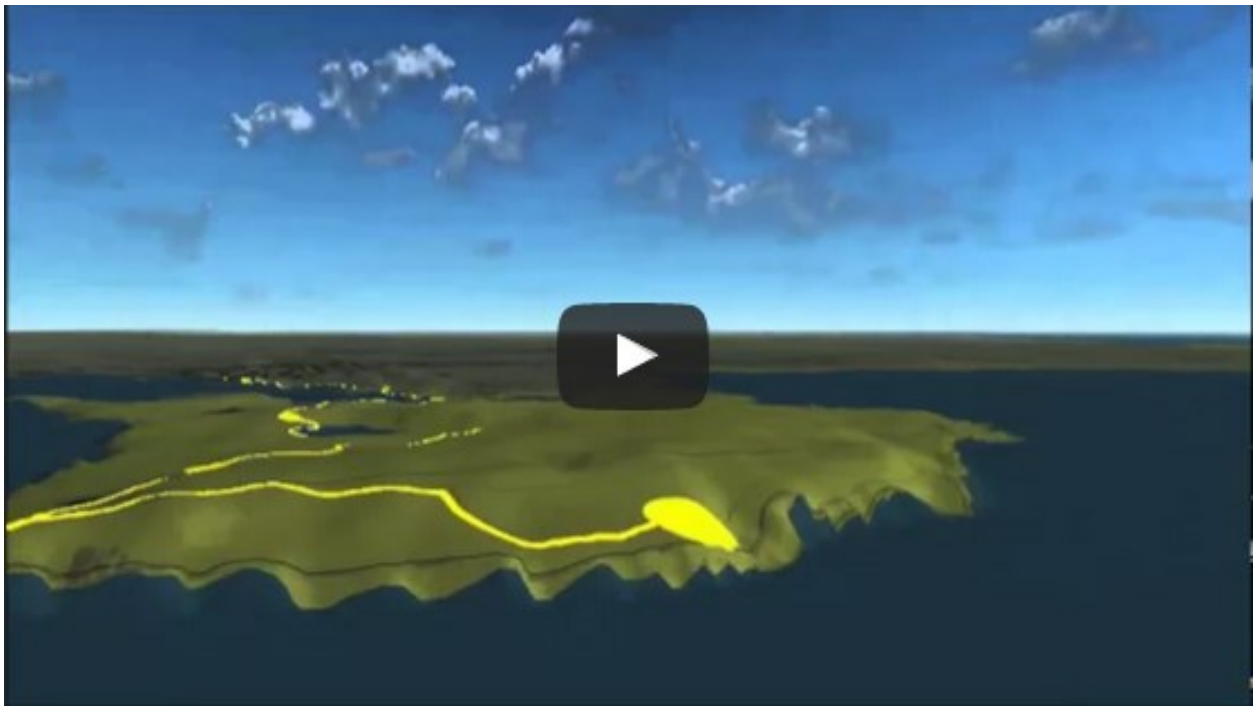
| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| don't like at all | ○ | ○ | ○ | ○ | ○ | like very much |

Next Back

Save and continue later

**Movie Sample 1, first listening** [Page 3]

**Please watch the entire Suunto Movie once through.** Listen to the music and concentrate on your own emotions and opinions on it. **After you have watched the video**, please answer the following questions. You can watch the video again, if you wish.



**My overall impression of this music**

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| don't like at all | ○ | ○ | ○ | ○ | ○ | like very much |

**Musical fit overall**

The music was predictable regarding to the Suunto Movie overall.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Musical fit with titles**

The music fit well with the start / end titles in the Suunto Movie.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Musical fit with track**

The music fit well with the exercise track.

Appendix B. Questionnaire for the empirical study

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Musical fit with Suunto**

The music fit well with my impression of Suunto.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

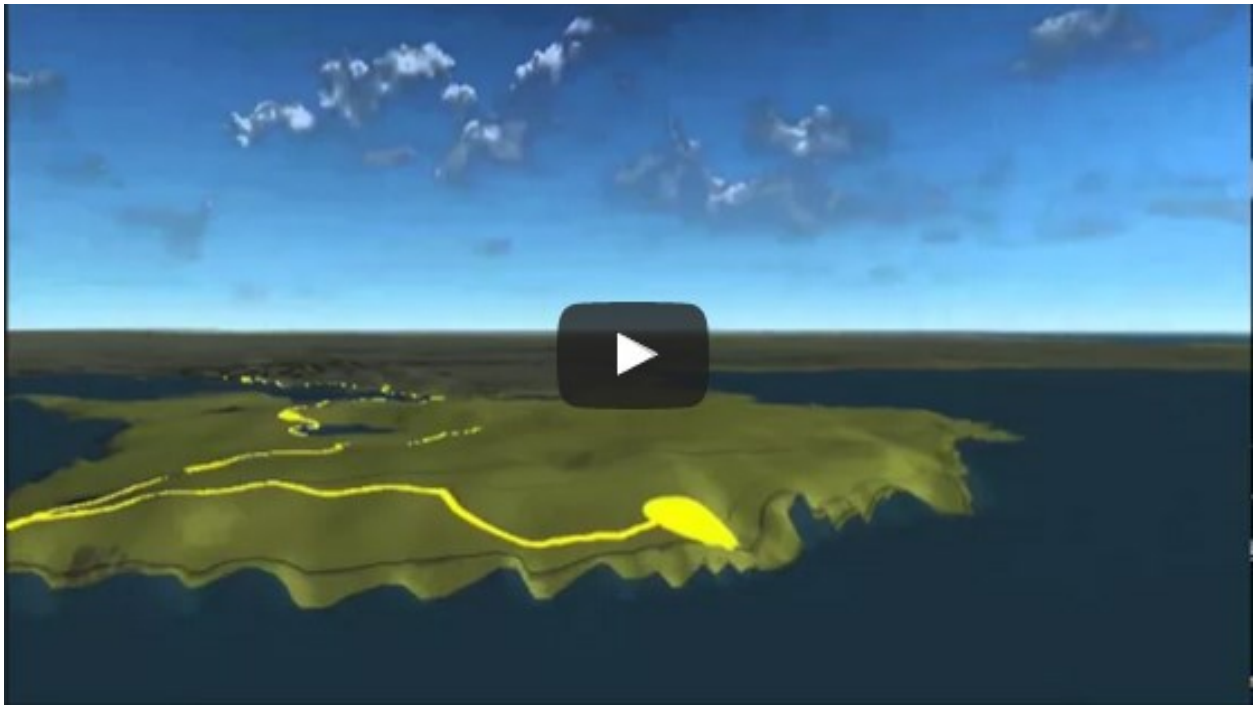
Comments on the musical fit

Next Back

Save and continue later

**Movie Sample 1, second listening** [Page 4]

Now you can watch the same video again and listen to the music. You can answer the following questions **while listening.** If you don't understand a question, you can leave it unanswered.



**Emotions the music made me feel**

Please concentrate on your own emotions that this music **made you feel** while listening to it. How strongly did you feel these emotions if you felt them? **Your personal opinion is what counts.** Do not spend time thinking about words, try to give a spontaneous response.

**Wonder**
Allured, moved, admiring, amazed

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Transcendence**
Fascinated, overwhelmed, thrills, inspired

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

Appendix B. Questionnaire for the empirical study

**Tenderness**
Mellowed, affectionate, in love, sensual

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Nostalgia**
Sentimental, dreamy, melancholic

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Peacefulness**
Calm, relaxed, soothed, meditative

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Power**
Energetic, triumphant, strong, heroic

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Joyful activation**
Animated, bouncy, amused, feel like dancing

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Tension**
Agitated, irritated, nervous, impatient

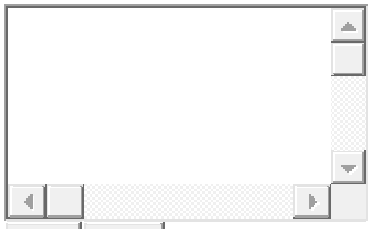
| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

**Sadness**
Tearful, sorrowful

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| not at all | ○ | ○ | ○ | ○ | ○ | very much |

Appendix B. Questionnaire for the empirical study

Comments on your emotions



Next Back

Save and continue later

Appendix B. Questionnaire for the empirical study

**Movie Sample 1, evaluating** [Page 5]

**User Experience**

Below are pairs of adjectives that describe this music sample. Please indicate how you evaluate this music. Do not spend time thinking about word-pairs, try to give a spontaneous response. Keep in mind that there are no right or wrong answers.**Your personal opinion is what counts.**

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| complicated | ○ | ○ | ○ | ○ | ○ | simple |
| stylish | ○ | ○ | ○ | ○ | ○ | tacky |
| unimaginative | ○ | ○ | ○ | ○ | ○ | creative |
| motivating | ○ | ○ | ○ | ○ | ○ | discouraging |
| confusing | ○ | ○ | ○ | ○ | ○ | clearly structured |
| presentable | ○ | ○ | ○ | ○ | ○ | unpresentable |
| dull | ○ | ○ | ○ | ○ | ○ | captivating |
| beautiful | ○ | ○ | ○ | ○ | ○ | ugly |

Comments on evaluating the music

Next Back

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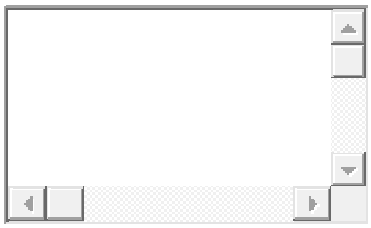
[Pages 6–11 — Repeat Pages 3–5 for Movie Sample 2 and Movie Sample 3]

**Overall feedback** [Page 12]

Feedback on the music for Suunto Movies

Feedback on this test



Other feedback for the Suunto team

**Email for the raffle** [This question was only for the Movescount Facebook replies]

Please leave your email address if you wish to participate in the raffle for a Suunto Smart Sensor. The winner will be contacted personally by the end of August. The email address will not be stored nor used for any other purposes.

**Thank you for participating!**

Karoliina Tiuraniemi, Usability Specialist, Suunto
karoliina.tiuraniemi@suunto.com

Submit Back

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