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In the literature of information science a number of studies have been carried out attempting to model cognitive, affective, behavioral and contextual factors associated with human information seeking and retrieval. At the same time, in the field of musical creativity only a few studies have addressed the exploration of creative thinking in music, focusing on understanding and describing individuals' information behavior during the creative process. This book highlights the connection between human information seeking behaviour and retrieval and the creative process in music, providing a framework for understanding the role of information in musical creativity. The implications of this conceptual pathway may embrace the design of online and offline information systems, information literacy skills and musical heritage management issues.

In response to the emerging challenge of connecting information seeking and retrieval to musical creativity, the editorial team had to carry out a rather intricate task. The multidisciplinary nature of the subject as well as the specificity of music information impose additional difficulties and require a range of specialties in order to assure value. On many occasions the editorial team was impressed by the quality of the manuscripts received; in other cases we offered recommendations to authors for incorporating a few missing aspects that we felt would offer more clarity and focus to the concepts discussed. It was rewarding that in the Book we finally had the opportunity to include a total of fifteen chapters (including our own chapter) from twenty-nine prevalent scholars from around the globe (Belgium, Brazil, Canada, China, Croatia, France, Greece, Japan, U.S.A. and U.K.). We would like to thank all the authors and the reviewers for sharing with us the effort to develop and mature common theoretical and practical research grounding for relating information seeking and information technologies with inspiration and musical creativity.

Music information seeking and retrieval aims to satisfy individuals' music information needs within specific contexts and includes the way individuals seek music information and manage collections of musical material. The issue of the effective utilization of music information is important for all those who are engaged in musical professional (or not) activities. Musicians of all levels express themselves through musical creative activities/processes that result to the creation of musical products. Musical creativity is viewed as a multifaceted process that requires the sourcing of a variety of different types of information associated with variant levels of music-related information needs that contribute towards the fulfillment of the music creative process as a synergic concept which includes different layers of music related creative activities/tasks.

The 15 chapters of the Book present new research, case studies, surveys, theories, position papers, and other efforts within the context of information seeking, behavior, and retrieval for musical creativity. They discuss and address different aspects of information retrieval and information seeking behavior for

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musical creativity of diverse scholarly, professional and everyday life music communities (e.g. composers, performers, listeners, musicologists, programmers, information professionals, etc.) and would be of interest on different levels to that multiple audience. The book is structured with the broader and more theoretical chapters at the beginning, followed by those with more empirical and/or practical nature. We believe that this may help the reader to initially obtain background information and appreciate relevant theories and models in this area before delving into more specific applications and practices. In the analysis that follows, an overview of the Book contents is presented through a more analytical editorial perspective via a reflection provided for each chapter that enriches the original abstracts and highlights the significance of each work and the level of its contribution.

Chapter 1. Theoretical and Applied Issues on the Impact of Information on Musical Creativity: An Information Seeking Behavior Perspective

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This chapter discusses the impact of the online information environment on the way in which individuals interested in music (e.g. composers, performers, researchers, educators, students, etc.) search for music information and engage with musical creativity, within different music domains. In that way it examines the connections between musical creativity and information seeking behavior for different purposes which involve composition, performance and improvisation, analysis and listening. Music information seeking involves the utilization of multiple features of music, critical thinking and constant exposure to ideas and experiences which lead to personal discovery and construction of new knowledge. The analysis of these complex musical creative activities provides a useful framework for understanding individual music information seeking behavior. Most of the existing music creativity models acknowledge that creative thinking is a form of a complex problem solving activity which involves critical thinking and the construction of new knowledge via continuous exposure to information on multiple levels and stages.

Thus the chapter puts forward an integrated information seeking and musical creativity model that take into account the impact of information seeking behavior on musical creative activities, within the specific personal, interpersonal (e.g., social, cultural), organizational, community and physical environmental in which it takes place. Drawing on two established models, the information behavior macro model developed by Wilson and Webster's model for creative thinking in music, the authors provide a comprehensive framework for understanding the multiple and interacting determinants of music information seeking behaviors on specific musical creative activities. The framework highlights the key role of music information seeking behavior as a catalyst in the development of musical creativity and highlights the importance of a more collaborative relationship and effective dialogue between individuals who are interested in music creation, both professionals and amateurs. The chapter highlights the implications for research in this area and further presents a research agenda for the interrelation between music information seeking and musical creativity, specifically in the areas of big data and big considerations for the music information space, social-group based music information behavior and personality traits in music information seeking.

Chapter 2. The Knowledge Instinct, Cognitive Functions of Music and Cultural Evolution

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Nobuo Masataka, Kyoto University, Japan

Michel Cabanac, Laval University, Canada

This chapter presents a theory of musical emotions serving an important and concrete function in cognition, in the evolution of the mind and cultures. The main theme of the chapter centers on the concept that musical emotions resolve cognitive dissonances and help maintain a sense of purpose of one's life in the face of a multiplicity of contradictory knowledge. Music is necessary for cultural evolution as it helps us accumulate knowledge. Knowledge contains contradictions, which cause us emotional pain. We live in these contradictions, and music helps to tolerate the pain; this is the reason for music strongly affecting us. The authors draw from the work of Perlovsky to discuss the hierarchy of multiple levels of concepts in the mind. Concepts generate Top-Down (TD) signals to match Bottom-Up (BU) signals. Concepts therefore model BU signals, and are often called concept-models. The process of modeling BU signals proceeds from simple perceptual elements (like edges, or moving dots) to concepts of objects, to complex scenes, and up the hierarchy toward the highest concept-models. The highest concept-models near the top of the hierarchy are essential for understanding the nature of the beautiful and spiritually sublime.

To get closer to understanding musical emotions, the authors consider the interaction between cognition and language. The main mechanism of interaction between cognition and language is a dual concept-model. Each concept has two parts, the language part and the cognitive part (an object or situation). For everyday concepts the linguistic parts are crisp and conscious in every child's mind, but it will take the rest of the child's life to acquire equally crisp and conscious cognitive models. It is likely that most cognitive concept-models never attain equally conscious and crisp states to those of the language models. This is why many people speak words without being fully conscious about what they say. Humans possess a remarkable degree of voluntary control over the voice, which is necessary for language. The gradual differentiation of the psychic states with a significant degree of voluntary control over each part gradually evolved along with brain rewiring and language evolution. For example, humans can engage in deliberate conversations, and if they disagree, they do not have to come to blows. Language in order to evolve semantic capabilities it had to become free from involuntary emotional influences; it had to become less emotional. Human knowledge accumulated through language is not automatically connected to instinctual needs. But this freedom demanded a psychological payoff. We had to pay for this freedom with the lost unity of the human psyche. Culturally-developed conceptual knowledge sometimes contradicts instinctual needs, inherited from the primordial past.

To overcome these cognitive dissonances and to comprehend these unpleasant cognitions a special ability emerged, musical emotions via songs. Songs overcome strong contradictions by combining strong emotions with semantic contents. Musical emotions help people hold contradictory knowledge without rejecting or devaluing the contradictions. The evolution of this ability has been necessary for the evolution of culture. Gradually, songs evolved into music. The authors present experimental confirmations of this theory. For example, the experiment of Masataka and Perlovsky described in the chapter demonstrates that music could resolve cognitive dissonance without devaluation and those contradictory cognitions could be held simultaneously.

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The above experiment is similar to classical cognitive dissonance described 2500 years ago in Aesop's fable "The Fox and The Grapes." In Aesop's fable the fox sees low-hanging grapes that it cannot reach. The desire to eat the grapes and the inability to reach them creates cognitive dissonance in the fox's mind. The fox resolves the cognitive dissonance by devaluing the grapes, "the grapes are sour". The evolution of culture requires a balance between differentiation and synthesis. Differentiation is the very essence of cultural evolution. But it may lead to an emotional disconnect between conceptual knowledge and instinctual needs, to lost feelings of meaning and purpose, including the purpose of any cultural knowledge, with a devastating impact on culture itself. Accelerated differentiation of everyday life tips the balance between differentiation and synthesis. "It is difficult to keep the scissor blades together," as Brodsky so eloquently put it.

Chapter 3 Music Information Seeking Opportunities and Behavior Then and Now

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This chapter provides a summary of the challenges faced by music searchers and a chronological overview of how music information seeking capabilities and resulting user behavior in library settings have changed over time. Music is somewhat special in that, unlike other fields, many people consume and enjoy it whether or not they are musicians or music scholars. There is a difference between music needs and seeking behaviors in everyday life vs. those in academic or professional settings. It is therefore useful to know how those in non-academic settings and those who are not necessarily musicians are searching for music for enjoyment. In their everyday life, people frequently are searching for something after hearing it but without knowing the title or performer.

Over the course of the 57 years covered in this review, music library collections have steadily diversified, both in terms of subjects represented and formats held. The tools used to describe and search them have evolved as well. Catalogs have moved from cards to online, from having a few focused access points to having multiple and diffuse ones (i.e. keywords), from having a narrow focus on local physical collections to a broad scope encompassing physical and online materials, not all of which are even owned by the library. At the same time music searchers have changed their behavior. In the transition from card catalogs to OPACs, perhaps unsurprisingly, user behavior changed the most drastically, especially once keyword searching was possible. But in the time since then, user needs, expectations, and behaviors have influenced as much as having been influenced by changes in search technology. Now the challenge of searching for music material (especially for non-librarians) is two-fold, first, knowing where to start and which of the myriad tools and sources to use, both through the library and outside of it, and, second, learning to evaluate search results given the ever-increasing amount of material being searched. Good searching has less to do with needing to know sophisticated search approaches that enable high precision and recall (although of course that helps) and more to do with understanding what has been found and how to access it.

Why is searching for music difficult? There are several factors at work. Music exists in a variety of formats and editions. In library catalogs and discovery layers, one can currently search for scores and recordings only by the bibliographic data provided about them. This generally does not include, for example, the text of songs. In addition, music subject headings differ from books in that scores and sound recordings are not "about" anything. Music subject headings instead indicate form, genre and instrumen-

tation. Printed music or scores range from individual parts, to vocal scores, to full scores, to miniatures scores, and beyond. Each serves a different function and is represented differently in the library catalog. There are a variety of types of editions as well: facsimiles, critical editions, performing editions across a spectrum of quality, and more. Larger musical works often have smaller works within in them, such as a song in a cycle or an aria in an opera, or a single etude or prelude in a collection. This means the searcher needs to know something about the larger work in question and this also creates titling issues that can be problematic for anyone attempting to search in the title field/index. Titling issues also arise due to the large variety of languages used in composing and publishing music. The largest obstacle in searching for music is the preponderance of generically titled works.

Chapter 4. Popular Songs and Social Change: East Meets West in Shanghai, China

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This chapter puts emphasis on the cultural and socio-political implications of music. The key focus is that music is a form of cultural and social practice, a form of meaning-making. Music information is presumed as a medium for understanding different music backgrounds and contexts as well as for understanding the cultural, historical and socio-political context of music. This presents implications for the organization, management, retrieval, communication and distribution of music information and provides a more rounded understanding of music information within the complexity of its context. On the other hand it can help in the creation of culturally meaningful collections of music information. For example, it provides a better grounding for music knowledge representation (e.g. the creation of classification systems and ontologies, metadata and social tags), filtering for music and music queries in information retrieval systems.

In a global digital information age that is marked by the increased interconnectedness of people within and between societies, the coexistence, mutual accommodation, and even cross-fertilization of popular music from different cultures is key to its future development in a multileveled cultural world (and it has impact on music information communication). The author, through an analysis of the background and lyrics of popular songs as social constructs in different periods, can help us to understand continuities and changes in the expression of creators' and consumers' views of and aspirations for the society in which they live; the use of discourse is inextricably linked to power and an understanding of power is concomitant to social relationships. These could have implications in terms of what music information is selected for digital music collections, how it is interpreted by music scholars and how it is presented for retrieval among others.

Chapter 5. Supporting Everyday Creativity in Ubiquitous Music Making

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Research on everyday musical phenomena has been fostered by the emerging field of ubiquitous music (UbiMus). UbiMus research focuses on the processes underlying everyday creative practices. One of the implications of the methodological framework proposed by ubiquitous music studies is the expanded

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notion of musical information as a product of creative experience which may be closer to the creative needs outside of specialized venues and lacking the training demanded by professional musicianship. Grounded on the convergent proposals of sociocultural general-creativity theory and ecologically inspired creative practices, creative music making may eventually become part of our daily life, rather than a privilege for the gifted few.

Based on sociocultural general creativity theory and ecologically inspired creative practices, ubiquitous music research may provide a window to creative phenomena that lie beyond the limitations of instrumentally oriented approaches, the isolated sound object without references to place-related factors and the isolated genius, an individual working in closed quarters. There are at least four aspects of everyday creativity that demand a stronger theoretical framework: (1) a change of focus from creative products to processes: synchronous musical activities can hardly be represented by a single performance instance or by an isolated creative product; (2) conceptualizing music information as a static entity imposes serious limitations on the study of creative phenomena. New analytical and epistemological approaches are necessary to deal with music making as a creative experience, a perspective that understands information not just as a product to be consumed or retrieved but as a resource for creative action and has better chances to engage with the complexity of real-world music making; (3) an increased reliance on information technology support: a difficulty faced by the designers of musical tools is the slowness of the validation cycle. Because complete integrated systems are hard to design and test, tools usually deal with isolated aspects of musical activity; (4) an increased importance of local resources in creative activities: ecologically grounded creative work highlights the need for effective collaborative tools for music making in the field, raising key methodological issues, such as how to provide support for everyday sound synthesis, how to track audience activity as a form-bearing process, enhancing audience participation (Basanta, 2010) and integrating environmental data in meaningful ways.

The authors suggest a shift from prescriptive, disembodied methods to open, embedded-embodied approaches. The constraints formerly imposed by acoustic instrumental writing – such as working indoors and excluding the audience as an active participant in the creative process – were also adopted by professional creative activities. This gap between the organizational systems applied on the musical material and the context where the material resources are gathered enforces creative techniques based on the objectification of sound. The studio as a compositional environment follows the model of the physics or the biology lab. Sounds are isolated and dissected according to well-established protocols, giving the composer total control over his creative product. Thus the following challenges are highlighted: 1. simplified depictions of musical creativity, such as the instrumental metaphor, i.e., instruments, orchestras and scores; 2. focus on narrow aspects of musical interaction, bypassing the impact of the local resources during creative activities; 3. lack of support for designs that take into account place-related factors; 4. emphasis on professionally oriented designs for individual activities, enforcing abstract manipulations of musical data.

The chapter discusses four theoretical perspectives on general creativity: Beghetto's and Kaufmans four-c model, Runco's two-tier hierarchy, Rhodes' 4P classification and Glăveanu 5A framework. According to Beghetto and Kaufman and Kaufman and Beghetto creativity magnitudes encompass four categories: Big-c, pro-c, little-c and mini-c. Big-c or eminent creativity are manifestations socially established as paradigmatic examples of creative outcomes. Typical examples are published works of art and scientific theories. Personal experiences that lead to creative products are treated within the context of everyday or little-c creativity studies. Mini-c creativity involves internal, subjective and emotional

aspects of everyday creativity. Everyday creativity demands the usage of local material resources, social interaction with unforeseen participants (engagement of multiple -sometimes anonymous- actors for creative action) and quick adaptation to volatile conditions. This is one of the reasons why ubiquitous music research is so closely related to everyday-creativity investigations.

Studies of creative potentials strive to identify factors that foster or suppress creativity in individuals and human groups. Examples of predictors are: personality traits, environmental pressures (impacting long-term and short-term adaptations) and cognitive and social resources available for creative activities. Runco's two-tier framework incorporates one of the most influential classifications of the basic elements of creativity, the 4Ps: person, product, process and press. Rhodes proposed that "the word creativity is a noun naming the phenomenon in which a person communicates a new concept (which is the product). Mental activity (or mental process) is implicit in the definition, and of course no one could conceive of a person living or operating in a vacuum, so the term press is also implicit." More recently, a sociocultural approach has been laid out by Glăveanu. Glăveanu's 5 as framework feature a systemic relationship among three stakeholders: actors, audiences and artifacts. In this sociocultural model, creativity is concerned with the action of an actor or a group of actors, interacting with other actors (audiences) and with the material world. In addition, ecologically grounded creative practice has furnished mechanisms to change the role of the audience from a passive spectator to a co-creator in several artistic endeavors. Rather than focus on the creative outcome, experiments can target the increase of creative potentials that encompass both cognitive and material resources, embedded in specific social contexts. Thus experiments where subjects are given a task to complete in laboratory settings and the results measuring their efficiency in task completion – within a closed epistemic field – do not provide information on the ecosystem's support for the emergence of relational properties. The material resources chosen by the experimenter may not fulfill the creative needs of the subject. The design does not take into account the conditions of real-world settings.

Analyses of creative products are not enough to inform creativity-centered design procedures. At least three case scenarios include implicit factors within the decision-making process involved in creative activities: 1. persuasion may be shaped by creative biases; 2. the quality of the creative products in performative creativity may be influenced by the profile of the stakeholders' creative biases; For example, novices' decisions tend to favor low resource consumption that lead to low-quality outcomes, while experts' generally adopt strategies that lead to high-quality products without the need to increase resource usage; 3. the choice of teleological procedures over exploratory actions may be motivated by decisions favoring low resource consumption at the cost of reduced quality of the creative process. The logic of the teleological approach is that if we restrict exploratory actions to a minimum, the efficiency of the decision processes will increase. What we are dealing with here is a bias favoring low resource consumption at the cost of reduced process quality. In teleological activities, the epistemic goal is also set in advance. A classic example is problem-solving that may be effective for utilitarian purposes but it is not well-suited for non-utilitarian creative practice. Creative practice is self-reflective. This means that the creative strategies are shaped during the creative activity rather than before the activity takes place, hence they cannot be fixed a priori.

The chapter presents two experimental cases indicating the need of a broader understanding of the support requirements for everyday creativity: In the first case study, "Supporting little-c creativity through time tagging", the environmental impact on the creative activities was consistently documented in the first set of reviewed studies. The second case study entitled "Planning study, ubiquitous music in educational

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settings” indicated a tenuous line between the formal educational activities (formal knowledge) and the informal educational opportunities (informal knowledge). The profile of the participants needs to be considered when dealing with creative musical activities in educational contexts. Rather than dealing with ‘generic users’, everyday musical creativity demands support tailored for the profiles of the participants.

Chapter 6. Musical Information Beyond Measurement and Computation: Interaction, Symbol Processing and the Dynamic Approach

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This chapter brings together ecological and constructivist approaches in an attempt to provide a framework for musical sense-making. The music user is interpreted as a subject of change on both, the basis of their internal state and the external situation. The work raises questions in relation to the nature of musical information. Should we conceive of musical information in terms of “internal semantics”, with meaning having no relations to the external world or should we rely on “external semantics”, establishing relations to the outer world? Can we conceive of musical information in terms of the classical “information processing paradigm”, with a complete separation between the information and its physical embodiment? Or is there need to consider the actual contextual situation and the relations and interactions of the perceiver of musical information with the world?

The author juxtaposes computational versus dynamic, discrete versus continuous, inside versus outside approaches, and subjective versus objectives dichotomies to the interpretation of music. He questions the concept of “ownership” of musical information and the way in which musical knowledge is stored and represented in time. Is music knowledge continuously evolving with the environment? Is musical knowledge located in the music or in the mind of the listener? Is musical knowledge “frozen”, conceptual knowledge, that can be considered to be static and discrete or “situated” and “embodied” knowledge which has different temporal representations and interpretations?

Chapter 7. Overview of Approaches and Future Challenges for Development of Music Recommendation Socio-Technical Systems

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This chapter analyses the position of music recommendations in the wider context of music information behavior research. It argues that music recommender algorithms should include socio-cognitive processes and support the freedom of end users but still keep them happy and intrigued by the novelty and serendipity that new music can provide. Following Wilson’s theoretical approach, the authors put emphasis on the socio-cognitive information experiences and characteristics of music information users that shape their music information seeking behavior. The chapter proposes five music information behavior dimensions: socio-cognitive information experience, information seeking, information retrieval, recommendations, and content consumption and analysis. As a large quantity of online music is available for the end user to select and listen to and there is a shift from just selling online music to selling the experience of exploring and finding music of interest and thus more emphasis should be placed on the development of effective recommendation systems (RS). The authors argue that there are a number of fundamental principles that provide the basis for building any RS (e.g. the type of data that should be available in the

database of the system, the filtering algorithm that should be used and the information retrieval model that should be chosen, the level of scalability and sparsity of the database, the performance of the system in terms of time and memory and the objectives and desired quality of the RS); however, these are not sufficient on their own. User-related functions should be addressed together with the technical functions of the system. RS should be thus developed as socio-technical systems, and we should shift our focus to the relationship and interaction of technical and socio-cognitive functions.

The chapter examines different approaches in the development of music recommendation systems which are applicable to all types of web information resources. These approaches are classified as content-based, collaborative, demographic, knowledge-based, meta-data-based, emotion-based and context-based, while the hybrid approach to RS development combines two or more approaches into one. Also, recent developments in the domain of music recommendations are discussed in detail. The authors, address the importance of social tagging and data collected from online social networks, the value of contextual data (user location and time preferences) and the importance of combining different sources of data into one input in RS as well as cross-domain approaches, which integrate linked data and recommend music artists, based on places of interest and music venues users visited. Thus RS can offer recommendations on the basis of actual content (i.e., a song), on the basis of collaborative filtering (e.g. similar users), and on user demographics. They can also recommend content based on specific domain knowledge to develop particular cases that meet user information needs (based on a similarity function estimates match between needs and recommendations). The chapter discusses metadata retrieval models (where textual metadata creators or agents make content available to the system), emotion-based models (based on users' emotional states and the emotional characteristics of the content (this is particularly important in music RS since music relates to the user's emotional state), context-based models (that address the context of the user when recommending items), and, finally, hybrid RS, (which combine two or more approaches into one). Finally, challenges and opportunities for collaboration between the scientific and the commercial communities on the development of new RS models are being explored.

Chapter 8. Automatic Melodic Harmonization: An Overview, Challenges and Future Directions

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This chapter is incorporated into the more technical strand of the Book which addresses musical creativity and information retrieval processes. The chapter discussed s the process of automatic melodic harmonization which tackles the assignment of harmony content (musical chords) over a given melody. It offers an overview of probabilistic approaches (machine learning approaches and algorithms) which have been proposed for melodic harmonization and discusses challenges, new trends and future directions in this area. Probabilistic approaches in melodic harmonization utilize statistical information derived from a training dataset, and can be used as a means for producing harmonies that encapsulate some harmonic characteristics of that training dataset. The study helps strengthening the utilization of efficient & effective music information using probabilistic systems. The role of algorithmic systems is to provide new ideas for the composer as the probabilistic nature of the systems may generate alternative possibilities (or paths) which motivate users to modify their compositions or stimulate further compositional ideas.

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From this perspective, the very design of those systems can be considered part of the creative process and act like an autonomous musical instrument. Moreover, algorithmic systems can be designed to create early pre-compositional material in addition to being applied during the stages of composition to create variations or extensions to existing material.

Chapter 9. Innovative Sound Design of Car Alarms: A Case Study on Information Needs and Musical Creativity

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This chapter approaches the wider field of sound, situating sound artifacts into an interactive context and specifically describes an alarm/will/sound research project which interestingly treats the function of the alarm system as a type of musical instrument. The work presents the results of ongoing experiments which confirm that embodiment and interactivity may play a key role in the development of an innovative auditory warning design (in relation to car alarms and beyond). The authors examine the relationships between the fine structure of auditory warnings and the repulsion effects that they produce. The authors wish to extend the current domain of auditory warnings, i.e. the perception of a specific musical sound corpus to other contexts in order to evaluate others types of sounds. If one considers the audible alarm more broadly as a communication and sensing device, a vast array of possible physical parameters emerge to which the alarm may be sensitive, and an extensive body of information that may be transmitted to either the driver or the passer-by. Such a body of information could include auditory stimuli specific to a given location, creating for the driver a sense of place, as the vehicle passes through different geographic regions. Thus the car alarm system shifts from being a mechanism of deterrence to one that engages the driver where the “user” (driver or passer-by) would be given the opportunity to dynamically influence different sound parameters via changes across a given set of physical parameters, thereby treating the alarm system as a sort of musical instrument. The work is using the “theory of auditory affordances” and proposes a methodology for designing auditory warnings that assumes that “people understand sounds in the world in terms of their potential for action”. The work offers the implication of this research for the domain of musical creativity and other domains in the final sections.

Chapter 10. Design of an Automatic Music Transcription System for the Traditional Repertoire of the Marovany Zither from Madagascar: Application to Human-Machine Music Improvisation with ImproteK

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This chapter describes an operational transcription system, ImproteK, for marovany music, and explores the original use of such a tool for musical creativity in human-machine interactive environments. It aims to model the playing style of a musician, by obtaining precise transcripts directly from his/her musical performance. The ImproteK system can improvise in real time capturing the real style of a musician. The argument presented is that automatic transcription tools could provide an extended original sound

corpus that can be exploited within a computer environment in view of original artistic prospects. The chapter presents an interesting method of combining digital technology accommodating the existing context and provides new perspectives for using systems such as the ImprobeK in a creative way in order to participate to the renewal of culture, meeting digital technology with traditional practices. It also includes some fieldwork to test the system with real marovany (a Malagasy traditional plucked string instrument) players to examine the interesting relationship between information retrieval technology, creativity and culture.

The integration of a wide variety of case studies and theories reveal their diversity and capture their evolutionary process employed by developers and content experts in the field. The comprehensive selection of material is aiming to be an essential reference and current awareness source, building on the available literature in the field of music information and musical creativity; while providing ideas for further research opportunities in this dynamic field. It is hoped that this text will provide an interesting topic for investigation; the interaction and associations between music information seeking, behavior and retrieval and the activities of musical creativity.

Chapter 11. A Smallest Grammar Approach to the Symbolic Analysis of Music

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In this chapter, the authors claim that of all arts, music is likely to be the first one to transition from art into the engineering stage. This transition can be made possible when factual, empirical knowledge is summarized in explanatory (mathematical, computational) theories and music already has a formal, universally understood language and musical theory already attempts to summarize empirical knowledge and explain musical phenomena in rigorous terms of acoustics, psychology, and psychoacoustics. The study hypothesizes that the essence of music lies not in the material itself (e.g. melodies, harmonies) but rather in the operations which the composer applies to the material, how the composer works with material, transforming and manipulating it in creative ways, rather than inventing new material. The authors therefore argue that any meaningful analysis necessitates analysis of a work's structure with the aim to reverse-engineer the composer's intent. One powerful model for musical structure is the use of grammars and in terms of explanatory power, the best model explaining a given piece of music is the most compact one. Hence, given a piece of music, the task is to find the shortest possible context free grammar that generates a particular piece of music as this is the most powerful analysis tool. Searching for such a grammar is known as the smallest grammar problem.

In this chapter a method for automatically deriving a compact grammar from a musical work (using a selection of Bach's fugues) and demonstrating its effectiveness as a tool for analyzing musical structure is presented, focusing on music that can be represented as several monophonic voices (such as voices in a fugue, or orchestral parts), that is, on the horizontal aspects of the music. The method concentrates on the melodic information only, ignoring rhythm (note durations). Reverse-engineering the composer's intent by building parsimonious grammars has applications reaching beyond mere structural analysis and the authors suggest a wide range of scenarios to which this approach could be applied. For example, grammar-based modeling can be used for musical "spell-checking" to correct errors in typesetting (much like a word processor does for text), or in optical music recognition (OMR). It may also be a useful and

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intuitive next-generation method for creatively transforming scores. In addition the model may be used in other ways: for estimation of complexity and information content in a musical piece; as a means for automatic summarization by analyzing the most compressive rules; for improved detection of similarity and plagiarism (including structural similarity); for automatic simplification of music (by transforming a piece so as to decrease its grammar size); for classification and retrieval of music according to its structural properties and for even telling good music from bad music.

Chapter 12. Catalogue Aesthetics: Database In and As Music

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This chapter presents the contemporary music culture which is characterized by a fragmented, interactive, dynamic and distributed listening paradigm which focuses on dynamically traversing/performing (big) data. Drawing upon the big data paradigm (i.e. big music), the author, discusses the transition of music audiences from passive receivers to active clients and their role in synthesizing music, rather than just be presented with music. New ways to organize, access, generate and distribute music content have been enabled via digital libraries and ‘Big music’ where music-files can be downloaded or streamed in real time has transformed existing compositional schemata. Database music is about what artists select to include and about what audiences select to retrieve and the ways in which they re-structure their selections to implement their own narratives about music. Database music is thus about music data that are meant to be traversed/manipulated by audiences rather than by composers. In that way, the separation between listeners and composers collapses; it is out-of-time and beyond experience, since there is no way for a listener to synchronously encounter all of its contingencies; it no longer privileges any particular point of view, instead, it celebrates a rather fragmented, distributed, non-linear and non-hierarchical way to engage with the world.

Chapter 13. Greek Copyright Law Framework for Musical Databases and Academic Research Use

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In this work the authors present, in a concise form, the copyright and sui generis protection framework for musical databases and their contents which should inform music information research activities. The limitations created for MIR academic researchers by this legal framework are also examined. The exclusive purpose of reproducing a music work should be the private use of the copy and not the economic or commercial exploitation of the copy. Hence academic research processes which conflict with the aforementioned rationale cannot refer to the private use limitation. However, it is not straightforward whether using parts of musical works for academic purposes can fit within this limitation, while it depends on the merits of the specific case. In addition, it is not certain whether the limitations prescribed by the law to limit the economic rights of an original music database owner can provide a basis on which researchers may rely when using them for academic research purposes. For example, extracting

material from a music database will be considered an unlawful operation in case it fulfills commercial purposes even if realized by non-profit institutions. In addition, for research and teaching purposes it is allowed to extract a material part of a database but not to distribute the extracted part to students or make it available to the public in any way, namely through the Internet or in hard copies. The authors call for future extended examinations of the issues raised in the chapter within other contexts, for example within U.S. and U.K. copyright law legislations, as well as the introduction of amelioration proposals to all copyright law legislations examined, in order to underpin relevant MIR academic research processes.

Chapter 14. Engagement and Creativity in Music Education

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This chapter is about school music education and musical creativity. The authors discuss the wider benefits of active engagement with music throughout life and the power of music on the intellectual, personal and social development of children and young people. Creativity is defined as an active, constructed and dynamic mental process which swings between convergent (factual) and divergent (imaginative) thinking (Webster, 1990). Children are actively involved in creative work through an active interplay of affective, behaviour and cognitive facets of engagement. Creative behaviour in music and musical engagement is maintained through skilled awareness of and responsiveness to opportunities for increased complexity, functioning at the height of one's abilities.

It is important that musical experiences that stimulate children's interest in music are being offered through formal music provision at the very earliest years of formal education. Schools can play a major role in helping children develop a positive musical identity by encouraging active participation in musical activities which is considered important in their positive identification with school music lessons and with school in general. A vital stage after the completion of the musical product is the evaluation or reflection phase where the musical product is verified and assessed by both the teacher and the pupil that created the piece of work. Knowing appropriate assessment criteria can help teachers to summatively assess students' creative progress in music in the first instance which can then be used to provide appropriate formative interventions in students' work.

With a focus on schools in England, the authors discuss that there is a problem with lack of engagement in formal music education and a number of educators have argued that we need to do more to understand the reasons why many students are disengaged with music at school and put music to its proper place of being an integral part of students' lives both in and outside of school. The authors address only briefly pupils' understanding information-seeking needs and behaviors for encouraging their active participation in creative activities in the music classroom and the growing interest in the use of information technology for listening to and creating music. An engaging music information-seeking environment where information technology is effectively integrated in the music classroom can raise pupils' motivation and the quality of learning. It was important to expand more on this discussion. More exposure to music information and emphasis on developing effective music information behaviour could be discussed more analytically in relation to this point. How can teachers support self-initiated discovery? Do they students have access to music resources and how to exploit the wealth of online music information?

Chapter 15. Exploring Singing Vocal Pedagogy in the Greek Elementary School through Interactive Technologies

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In this chapter the authors argue that structured engagement in musical activities may have a positive impact on social inclusion by means of offering opportunities for social bonding, developing interpersonal relationships and empowering self-expression, health and well-being. Within a school-based context, in particular, research reports evidence connected to a number of social benefits as a result of children's participation in musical activities, including developing their creativity, enhancing their cognitive and social skills, and supporting their self-esteem and overall sense of achievement. Therefore singing is a very important skill that must be cultivated as early as the preschool education stage and throughout the elementary school. With reference to the Greek elementary school environment, which forms the basis of this study, the music curriculum is focused on developing pupils' ability to listen, understand and perform music, there is lack of a well-structured program aiming towards cultivating children's singing ability systematically. Music teachers have access to resources for selecting songs according to specific requirements (such as by composer, education level, subject, etc.) but there is no support for the purposes of vocal acoustic pedagogy.

With that in view, the authors investigate children's voice accuracy and quality through new assistive technologies and report on an experimental research project in which they used a visual feedback singing software (Singing Coach 5 Pro) to find out if children can benefit from that system for the purpose of improving voice accuracy and quality. The experiment study took place in two public elementary schools in Athens with 60 children ranging from 6-9 years old who were recorded singing two different types of songs. The authors examined the amelioration of the children's voice quality before and after the use of the software and concluded that this type of intervention has a positive impact on children's voice quality. The chapter thus presents a new approach for the purposes of singing instruction by means of investigating the vocal acoustic characteristics (such as pitch, intensity, timber) of elementary school children and helping them improve their singing performance at school with the help of a visual feedback music software tool.

The wide variety of case studies and theories as well as the different perspectives and contexts that relate to music and music information incorporated in this Book drawing from a range of fields, such as that of information seeking (Chapters 1 and 3), information retrieval and automated music systems development for music performance, analysis and composition (Chapters 6, 7, 8, 9, 10 & 11), music education (Chapters 14 & 15), copyright and intellectual property (Chapter 13) as well as works that offer critical socio-cultural and historical approaches to music (Chapters 2, 4 & 5) or even challenge our preconceived definitions of music (Chapter 12) reveal the diversity and complexity of the nature of current studies focusing on music as an object of research, innovation and theoretical analysis. This growing body of interdisciplinary research demonstrates the value and need of more holistic, multicultural and integrated approaches to the study of music to address the intersections of what appears to be quite distinct areas of focus, yet encapsulate dimensions of music that may change our perceptions about music creation, analysis, management, systems development, education, performance and management. It is, therefore, hoped that our work offers not only a comprehensive synthesis of music research but that

is also reflects these multidimensional perspectives that may constitute the basis for further innovative research directions, creative discussions and new collaborations. The interaction and associations between music information seeking, behavior and retrieval and the activities of musical creativity, within the diverse contexts presented in this Book, demonstrate a dynamic field; one that is subject to constant technological and cultural change but also one that remains faithful to the values and the creative power of music in different areas of our contemporary society. The Book itself is a metaphor for music, a collaborative endeavor, constantly developing and receptive to creative exploration and innovative syntheses of diverse intellectual input.

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