Tampere University

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Music information modes and their situational relevance among musicians and music students

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ACADEMIC DISSERTATION
To be presented, with the permission of
the Faculty of Information Technology and Communication Sciences
of Tampere University,
for public discussion in the Lecture room D11
of the Main building, Kalevantie 4, Tampere,
on 29 May 2020, at 12 o'clock.

ACADEMIC DISSERTATION
Tampere University
The Faculty of Information Technology and Communication Sciences
Finland

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The originality of this thesis has been checked using the Turnitin OriginalityCheck service.

Cover design: Roihu Inc.

ISBN 978-952-03-1498-9 (print)
ISBN 978-952-03-1499-6 (pdf)
ISSN 2489-9860 (print)
ISSN 2490-0028 (pdf)
http://urn.fi/URN:ISBN:978-952-03-1499-6

PunaMusta Oy – Yliopistopaino
Tampere 2020

Dedication

To Krista, Aatos and Iisa

ACKNOWLEDGEMENTS

I wish to express my heartfelt gratitude to many people. I would like to thank my family and parents. I am grateful to my supervisors Pertti Vakkari and Reijo Savolainen, whose expertise and patience were invaluable in helping me write my dissertation. My great appreciation also goes to my co-authors Ulla Pohjannoro and Maaria Harviainen, students of Sibelius Academy, the reviewers of *Journal of Documentation* and my colleagues at Aalto University. In general, it seems to me that curiosity is a common trait of talented people whether they work in the academia and libraries, or as professional musicians. My special thanks go to grandmas Outi and Tea for looking after Aatos. Thank you, reader, for being interested in this dissertation.

I wish to express my sincere thanks to Dr. Konstantina Martzoukou and Dr. J. Stephen Downie for their work as the preliminary examiners of my dissertation. I am also grateful to Dr. Audrey Laplante for accepting to be my opponent in the public defence.

At the time of writing these acknowledgements Krista is expecting our second child, a baby girl. This morning, Aatos – now 2 years old – and I acted out the TV show *Wheeler Dealers*, which he enjoys. Although I am very proud of my dissertation, I reckon it will not be the first thing what comes to mind later when thinking of these years.

In Vallila on 20 August 2019,

Antti Rousi

ABSTRACT

Within the domain of music, knowledge resides not merely in written language, but also in diverse modes of information. Sources of music information may include the gestural language of music making, audible experiences of music, music notation and writings about music. The literature of musicology and musical semiotics suggests that different modes of music information may have roles and interpretations of their own and that it should not be assumed that a direct translation between them exists. As prior studies of musicians' and music students' information seeking often draw from humanist studies in general, they have not paid due attention to the modes of music information. Although music recordings and notation have been identified as information need types in prior studies of musicians and music students, the question of why these needs occur has not been examined so far. Thus, there is a need to elaborate on approaches to music information used in studies of music-related information seeking. Different music information modes should be defined as information types in their own right and subject to varying roles and interpretations in information seeking.

This dissertation research is pioneering in its examination of the situational relevance of music information modes representing music information at varying levels of abstraction. The research began with the development of a typology specifying the modes of music information relevant to the empirical analysis of music-related information seeking. The typology's accuracy and sufficiency were first examined empirically in a qualitative study focusing on how its information modes were reflected in a verbal description of the compositional process. The second empirical study examined how the situational relevance of the information modes was articulated by Doctor of Music students focusing on music performance. Finally, the third empirical study examined how the information modes were viewed as situationally relevant at different stages of information-seeking processes among Doctor of Music students focusing on music performance and master's students representing music education and music theory and analysis.

The findings of this dissertation research deepen our understanding of the role of varying music information types in information seeking for musical tasks. They

suggest that approaching music information through its many layers provides more accurate descriptions of music-related information-seeking processes.

TIIVISTELMÄ

Musiikkiin liittyvä tietämys ei ole vain sanallista. Muusikon kehonkieltä, musiikin synnyttämää kuulokuvaa, nuotteja ja kirjoituksia musiikista voidaan kaikkia käyttää musiikillisen informaation lähteinä. Koska musiikkiin liittyvät merkkijärjestelmät eivät käänny ongelmattomasti toisiinsa, niillä voi olla erilaisia moodikohtaisia rooleja ja tulkintoja musiikillisessa viestinnässä. Tätä musiikillisen informaation erityispiirrettä ei ole riittävästi huomioitu aikaisemmassa musiikkitiedon hankinnan tutkimuksessa. Vaikka aikaisempi tutkimus osoittaa musiikkiäänitteet ja nuotit muusikoiden ja musiikin opiskelijoiden keskeisiksi tiedontarpeiksi, kysymys siitä miksi eri kohderyhmät tarvitsevat näitä musiikki-informaation moodeja on jäänyt tarkastelematta. Musiikkitiedon hankintaan kohdistuvan tutkimuksen informaatiokäsitettä tulisikin täsmentää. Musiikki-informaation eri moodit tulisi nähdä omina kokonaisuuksina, joilla on moodikohtaisia rooleja ja tulkintoja tiedonhankinnassa.

Tämä väitöstutkimus tarkastelee eri abstraktiotasoisten musiikki-informaation moodien tilannerelevanssia tiedonhankinnassa. Tutkimuksen ensimmäisessä vaiheessa kehitettiin musiikki-informaation typologia, joka määrittelee musiikkitiedon hankinnan empiirisen tarkastelun kannalta relevantit musiikki-informaation moodit. Musiikki-informaatiotypologian toimivuutta testattiin tarkastelemalla miten määritellyt moodit ovat läsnä ammattisäveltäjän kuvauksessa omasta sävellysprosessistaan. Toisessa empiirisessä tutkimuksessa analysoitiin esittävän säveltaiteen tohtoriopiskelijoiden havaintoja musiikki-informaatiomoodien tilannerelevanssista. Kolmannessa empiirisessä tutkimuksessa tarkasteltiin, miten esittävän säveltaiteen tohtoriopiskelijat ja musiikkikasvatuksen ja musiikin teorian ja sävellyksen maisteriopiskelijat artikuloivat musiikki-informaatiomoodien tilannerelevanssin tehtäväperustaisen tiedonhankinnan eri vaiheissa.

Väitöstutkimuksen tulokset lisäävät ymmärrystämme eri informaatiomoodien rooleista musiikkitiedon hankinnassa ja osoittavat että musiikki-informaation eri abstraktiotasojen huomiointi mahdollistaa aikaisempaa tarkemmat kuvaukset erilaisten kohderyhmien musiikkitiedon hankinnasta.

CONTENTS

ORIGINAL PUBLICATIONS

Publication I Rousi, A.M., Savolainen, R. and Vakkari P. (2016), "A typology of music information for studies on information seeking", *Journal of Documentation*, Vol. 72 No. 2, pp. 265-276.

Publication II Pohjannoro, U. and Rousi, A.M. (2018), "The modes of music information in a compositional process. A case study", *Journal of Documentation*., Vol. 74 No. 5, pp. 987-1007.

Publication III Rousi, A.M., Savolainen, R., Harviainen, M. and Vakkari, P. (2018), "Situational relevance of music information modes: an empirical investigation among Doctor of Music students", *Journal of Documentation*, Vol. 74 No. 5, pp. 1008-1024.

Publication IV Rousi, A.M., Savolainen, R. and Vakkari, P. (2019) "Adopting situationally relevant modes of music information at different stages of information-seeking processes: a longitudinal investigation among music students", *Journal of Documentation*, Vol. 75 No. 6, pp. 1230-1257.

These publications are referred to as studies I–IV in the remainder of the dissertation. All four articles are reprinted by the permission of the publisher. The authors' contributions are as follows.

I. The first author designed the study and wrote the manuscript. The second and third authors contributed to the revisions of the manuscript.
II. The first author collected the data. Both authors contributed to the study design, data analysis and writing of the manuscript.
III. The first author designed the study, collected the data and wrote the manuscript. The second, third and fourth author contributed to the revisions of the manuscript.

IV. All authors contributed to the design of the study. The first author collected the data, conducted analyses and wrote the manuscript. The second and third authors contributed to the revisions of the manuscript.

1 INTRODUCTION

1.1 Motivation of the thesis

Within the domain of music, knowledge resides not merely in written language, but also in diverse modes of information. Sources of music information may include the gestural language of music making, audible experiences of music, music notation and writings about music. As a person may face great difficulty in trying to explain his or her recent experience with music verbally, it cannot be assumed that a direct translation between these diverse modes of music-related information exists (Tarasti, 1994). This problem of translation is also reflected in Kuhlthau's (2004, p. 112) Information Search Process model. It suggests that information types at varying levels of abstraction have differentiated interpretations, and that these interpretations can undergo change as the information-seeking process progresses.

As prior studies of musicians' and music scholars' information seeking often draw from the study of humanists in general (Brown, 2002), they have not paid due attention to this particular nature of the modes of music information. Although prior studies have identified music recordings and notation as information sources needed by users such as musicians (Kostagiolas *et al.*, 2015, p. 7), the question of why these needs occur has not been examined so far. This has resulted in a one-dimensional approach to music information in a domain where there is a plurality of information modes, each possibly subject to diverse interpretations and roles in information seeking.

The present study was motivated by the need to fill gaps in this research domain by elaborating on the approach to music information used in studies of information seeking. As a main point of departure, it was assumed that music information of diverse kinds should be defined as types of information in their own right and subject to varying roles and interpretations.

1.2 Key terminology

The following terminology is central to this dissertation research. The concept of *mode of representation* is used to examine the varying degrees of abstractness of information sources. The three modes of representation defined by Bruner (1966) are used as a starting point in this study. First, *enactive mode* of representation refers to sequences of activities for creating desired results. Second, *iconic mode* of representation refers to presenting a concept through a graphic without exhaustively defining it. Finally, the *symbolic mode* refers to a symbolic system that defines rules of expression and allows creation of arguments for describing a concept. (Bruner, 1966, pp. 44-45.)

Within the development of the conceptual framework for research, a grounding concept is *music-related information seeking*, which encompasses the objective of seeking all music-related information, be it in audible, written or notated form. When referring to the audible non-conceptual information modes of performing and listening to music, the concept of *music per se* is used.

In the finalized conceptual framework, the term *music information mode* refers to a set of information sources that are seen to represent music information at a certain level of abstraction. More specifically, the concept is used to group information sources based on their method of representation, be it gestural language, non-conceptual aural experiences of music or symbolic written representations, for example.

Music information typology presented in Study I conceptualizes the music information modes relevant for studies of information seeking. Six music information modes were identified: music making as the first mode of enactive representations; music listening as the second mode of enactive representations; iconic representations of music; technological models of music as the first mode of symbolic representations; ideological models of music as the second mode of symbolic representations and other symbolic information (detailed definitions are presented on pages 39-41).

The present study approaches the relevance of the modes of music information in relation to the situational requirements of accomplishing different music-related tasks. *Situational relevance types* are the domain-specific factors that make modes of music information relevant for the task types present in this dissertation's empirical research designs (studies III and IV).

1.3 Overview of the dissertation project

This dissertation consists of four papers and a summary. As the previous studies of music-information seeking have not paid due attention to the situational relevance of various music information modes, Study I of this dissertation aimed at developing the notion of music information to be used in studies of information-seeking. The general goal of Study I was to introduce a framework to music information where the different sign systems relevant to musical communication would be seen as information in their own right, subject to different roles and interpretations in information seeking.

Given that the music information typology presented in Study I was based solely on a conceptual analysis of literature, it was important to apply it to different empirical contexts to examine its validity. In Study II of this dissertation, the novel music information typology was first applied to examine the substance of information present in a compositional process of a piece representing the Western art music tradition. Whereas Study II sought to identify the different information modes from a verbal description of a composition process, Study III examined how Doctor of Music students focusing on music performance viewed the situational relevance of the music information modes during a certain stage of their dissertation projects. Given that the findings of Study III were a snapshot of the situational relevance of the modes of music information at a certain stage of an information-seeking task, Study IV sought to further elaborate on the picture of music information's situational relevance by examining how the different information modes were viewed as situationally relevant at different stages of information-seeking processes by university-level music students.

1.4 Research questions

The following research questions indicate the general focus and structure of the research. More precise research questions are formulated in each study (I-IV).

- How should the different modes of music information be defined when examining music-related information seeking? (Study I)
- What kind of music information modes may be identified from the verbal description of a compositional process by a composer? What are the

proportions of identified music information mode instances per stage of the compositional process? (Study II)

- What modes of music information are relevant for the dissertation projects of Doctor of Music students focusing on music performance? What are the reasons behind the perceived situational relevance? (Study III)
- How are the modes of music information viewed as situationally relevant at different stages of information-seeking processes among Doctor of Music students focusing on music performance and master's students representing music education and music theory and analysis? (Study IV)

1.5 Areas of contribution

The general goal of this dissertation is to elaborate on the approach to music information used in studies of information seeking, with the aim of contributing to the fields of music information seeking and music information retrieval (MIR) in particular. To achieve this, the present investigation developed a novel music information typology for studies of information seeking. The key feature of the novel typology is the categorisation of music information sources at diverse levels of abstraction. Importantly, the categorisation allows research questions (RQs) to be asked at the level of individual modes of music information. The typology thus enables research designs where the relevance of individual modes of music information are examined at different points of an information-seeking process, for example.

After defining a music information typology for studies on information seeking, empirical studies were conducted using this novel approach to music information. The general aim of the empirical studies was to examine how the situational relevance of the individual music information modes was articulated by musicians and music students engaged in information-seeking tasks. Study II examined how a professional composer viewed the substance of information present in a compositional process. The participants of Studies III-IV included Doctor of Music students focusing on music performance and master's students representing music education and music theory and analysis. The above focus groups were selected because they were seen to represent different task types common to musicians and music students: musical composition, music performances, writing academic texts on music education and conducting music theoretical analyses. By concentrating on these different focus groups, the present study sought to elaborate the picture on

how situational relevance of music information modes is viewed in information seeking for musical tasks common to musicians and music students.

The empirical findings regarding the context-sensitive relevance of the music information modes deepen our understanding of the roles of varying music information modes in information seeking for musical tasks. Furthermore, they suggest that approaching music information through its many layers provides more accurate descriptions of music-related information-seeking processes.

1.6 Structure of the thesis

This dissertation is structured as follows. After the introductory chapter, the second chapter describes the relevant previous studies and develops the conceptual framework of the dissertation research. In the third chapter, the methodologies of studies I–IV are described. The fourth chapter discusses the key findings, and the fifth chapter discusses theoretical and empirical contributions of the study; moreover, the practical implications of the findings are reflected upon. Lastly, the conclusions are presented in the sixth chapter.

2 DEVELOPING THE CONCEPTUAL FRAMEWORK FOR RESEARCH

2.1 Modes of representation

In *Towards a theory of instruction*, Bruner (1967) addresses the modes of representation relevant for learners. According to Bruner (1967), any domain of knowledge, and individual problems within that domain, can be presented using three modes of representation. The enactive mode of representation refers to sequences of activities aimed at creating desired results. The iconic mode of representation refers to a graphical presentation of a concept without exhaustively defining it. Lastly, the symbolic mode of representation is the most abstract of the modes. The symbolic realm of representation relies on a conceptual system that defines rules of expression, which again allows creation of arguments for describing a concept. (Bruner, 1967, pp. 44-45.)

Bruner's (1967) ideas regarding the modes of representation have influenced key models of information seeking. In *Seeking meaning*, Kuhlthau (2004), for example, borrows Bruner's modes of representation when examining the abstraction level of varying kinds of information in her Information Search Process model. However, it is not self-evident what constitutes the different modes of representation within the domain of music. Drawing on Bruner's ideas, the following question concerning music-related information seeking can thus be derived. How should the different modes of representation be defined when examining music-related information seeking? In *Towards a theory of instruction*, Bruner (1967) addresses the modes of representation relevant for learners. According to Bruner (1967), any domain of knowledge, and individual problems within that domain, can be presented using three modes of representation. The enactive mode of representation refers to sequences of activities aimed at creating desired results. The iconic mode of representation refers to a graphical presentation of a concept without exhaustively defining it. Lastly, the symbolic mode of representation is the most abstract of the modes. The symbolic realm of representation relies on a conceptual system that defines rules of expression, which again allows creation of arguments for describing a concept. (Bruner, 1967, pp. 44-45.)

2.2 Sign systems of musical communication

In their works on musicology and musical semiotics, Bengtsson (1977) and Tarasti (1994) discuss the sign systems relevant for musical communication. Bengtsson (1977) states that the concept of tone may refer to a notated tone, a measurable frequency or an aural experience. Tarasti (1994, p. 4) also views the gestural language of music making, which is needed to transform a notated tone into both a measurable frequency and an aural experience, as an important sign system in musical communication. Musical knowing therefore transpires within diverse sign systems, some of which are inherently non-conceptual (Ibid.). However, it should not be assumed that musical knowledge is transmitted only through musical non-conceptual sign systems (Bengtsson, 1977, p. 23; Tarasti, 1994, p. 4). As no sign system works in a vacuum, but in interaction with other systems, verbal sign systems have also had an important role in transmitting musical tradition (Tarasti, 1994, p. 4).

Bengtsson (1977, p. 18) has devoted attention to the specific nature of musical sign systems by emphasising that they should be approached as different categories of description. Due to the detached nature of the different sign systems, it is important to take into consideration the process of translation, with its imperfect nature, taking place between them (Bengtsson, 1977, p. 18). To summarise the notion of music information presented by Bengtsson (1977) and Tarasti (1994), musical knowing transpires simultaneously through diverse sign systems, including verbal ones, and the problem of translation suggests that the different sign systems related to musical communication may have interpretations and roles of their own in processes related to musical knowing. Given the multitude of sign systems relevant to musical communication, it is not self-evident how the modes of music information should be defined when examining the information seeking of musicians and music students, for example.

2.3 Situational relevance

Studies on situational relevance examine the relationships between information and the user's information problem situation (Schamber, 1994, p. 8; Saracevic, 2007, p. 1930). The situational relevance approach differs from the topical relevance approach, where the focus is placed on the relation of the topic expressed in a search query and topic covered by resulting information objects (Saracevic, 2007, p. 1929; 1931). The user's context and previous knowledge, the specific qualities sought and

the features of information in a document all affect the user's inferences of relevance (Barry, 1998, p. 1302). The relevance judgements of textual documents may change between the stages of the information-seeking tasks, which suggests that it is useful to approach the concept of relevance as a task- and process-oriented user construct (Bateman, 1998; Vakkari, 2000; 2001; Vakkari and Hakala, 2000).

In prior research, concepts such as success dimensions, criteria categories and factors influencing the selection of information objects (e.g. documents) have been used to describe the outcomes when examining situational relevance (Schamber, 1994, pp. 24-25). In the present dissertation, however, the construct of situational relevance type was preferred. This is due to the fact that such types are approached as domain-specific factors that make the seeking of modes of music information pertinent to the performance of ongoing study tasks.

2.4 Information substance of musical composition

Previous studies on the information substance of compositional processes are rare. Only a few previous studies have been conducted on information seeking and the needs of composers; of these studies, perhaps the most prominent is Hunter's (2006) investigation focusing on electroacoustic composers. The digital preservation of musical works, including live electronics (Boutard, 2016) and interpretational aspects of acousmatic music (Boutard and Féron, 2019), have been previously studied.

While musical composition has been examined in diverse fields of science, the substance of information has rarely been the focus of these investigations. Drawing from a study of five composers, Zembylas and Niederauer (2018) established a system of compositional knowledge. However, their focus was on the professional conditions of composers' artistic agency, and thus compositional thinking may have been only partly covered in their study. Within the field of musicology and music psychology, research on musical composition has focused on musicological and psychological aspects rather than on the substance of information. Musicology has concentrated on musical parameters and sketches (Donin, 2009; Donin and Féron, 2012; Roels, 2016), music education on the individual or group processes of novices or experts (Barrett, 2006; Burnard, 2012), and studies of psychology and cognition on thinking processes and problem solving (McAdams, 2004; Collins, 2005). In turn, creativity research has focused on divergent behaviour, insight, and imagination (Bailes and Bishop, 2012; Hargreaves, 2012; Katz and Gardner, 2012), for example.

As Study II sought not only to identify the information entities relevant to musical composition but to also examine how their significance varies in the different stages of the case compositional process, the framework developed by Pohjannoro (2008; 2014; 2016) was utilised to place the identified information mode instances into the timeline of the compositional process. Due to each creative (art) process producing an original and unique output and hence being non-repeatable (Gruber and Wallace, 1999), it is worth stressing that Pohjannoro's (2008; 2014; 2016) process framework was based on the analysis of the exactly same compositional process that is examined in Study II, and thus accurately reflects the stages of this specific compositional process.

Pohjannoro's framework defines the compositional process chosen for the study as comprising three main compositional stages that further divide into 18 compositional phases (i.e. substages). The first stage identified by Pohjannoro (2008; 2014; 2016) is "ideation", where the composer creates both the germinal ideas and main musical materials of the piece, explores the musical material and begins writing the first movement of the piece. The second main stage is labelled "crisis" by Pohjannoro (ibid.). During this stage, the composer encounters accumulated problems regarding the composition. After a lengthy period of deliberation, the composer settles the crisis by solving problems in a straightforward way. During the final stage, "adjustment", the composer works in an effortless way to refine and complete the work (Pohjannoro, 2008; 2014; 2016).

2.5 Information search process

In general, studies of information-seeking behaviour examine behaviours arising from an information need perceived by a person, who then takes actions to find information or services resulting in success or failure to find relevant information (Wilson, 1981; 1991, p. 251). If relevant information is found, the information seeker then uses this information to satisfy the information need (Ibid.). There are numerous models for information-seeking behaviour (Case and Given, 2016, pp. 141-175); many of them were created in the 1980s and 1990s. One of the most influential process-oriented frameworks of information seeking is Kuhlthau's (1991) Information Search Process (ISP) model.

In a series of empirical studies, Kuhlthau (2004) has demonstrated that the performance of information-seeking tasks typically occurs in several stages during which the seeker's thoughts, actions and emotions undergo change. In the model,

the six consecutive stages of the information search process are defined as follows: 1) initiation; 2) selection; 3) exploration; 4) formulation; 5) collection and 6) presentation (Kuhlthau, 2004, p. 44–50). According to Kuhlthau, the formulation stage is pivotal because during it, a more focused perspective of the task is attained. After focus formulation, the seeker's sense of direction and confidence increases, and actions change from exploring relevant information to seeking and documenting pertinent information (ibid.).

As stated in Section 1.1, the ISP model also suggests that information types at varying levels of abstraction may have differentiated interpretations, and that they can undergo change as the information-seeking process progresses (Kuhlthau, 2004, p. 112). Using Kuhlthau's ISP model as a point of departure, Vakkari (2000), among others, has shown that the types of information used vary during a longitudinal text writing process.

Whereas Study IV uses Kuhlthau's (2004) ISP model to conceptualise information-seeking processes, Study IV approaches the stages of information-seeking processes through Vakkari's (2001) framework. Drawing from Kuhlthau's ISP model, Vakkari (2001, p. 47) conceptualised the information-seeking process into three stages: 1) starting the thesis and identifying its general topic (pre-focus); 2) examining information concerning a general topic and formulating a specific focus (focus formulation); and 3) gathering information pertinent to a focused topic or finalising the thesis (post-focus). Vakkari's (2001, p. 47) operationalisation of the stages of information-seeking tasks was made at a higher level of generality, and thus his model was seen to also suit the examination of tasks incorporating music performances.

2.6 Information seeking of musicians and music students

Previous research on information seeking of musicians, music scholars and music students has shown that all these groups search for diverse types of music information as a part of their information seeking (Brown, 2002; Hunter, 2006; Liew and Siong, 2006; Kostagiolas *et al.*, 2015; Lavranos *et al.*, 2015; 2016; see also Weissenberger, Budd and Herold, 2018). Despite important works that describe and model information seeking and needs of musicians and music scholars (Brown, 2002; Hunter, 2006; Liew and Siong, 2006; Inskip, Butterworth and MacFarlane, 2008; Kostagiolas *et al.*, 2015; Lavranos, Kostagiolas and Martzoukou, 2016; Chandler, 2019), the question of how different music student groups view the situational

relevance of modes of music information within their information seeking has not yet been systematically addressed.

Research primarily focusing on the source preferences and user satisfaction among music scholars and students (Lai and Chan, 2009; Dougan, 2012; 2015; see also Matson and Shelley, 2013) often examines the frequency of use of pre-categorised sources of information. While these studies are very usable in collection development, they do not offer systematic attempts to examine the situational relevance pertinent to diverse modes of music information in information seeking.

Table 1 summarises the findings of selected empirical studies that examine information seeking of musicians, music scholars and music students as well as their approach to situational relevance of music information.

Table 1. Selected empirical studies of information seeking of musicians, music scholars and music students, and their approach to situational relevance

Study	Methodology	Main findings	Approach to situational relevance
Brown (2002)	A model of music scholars' research process was generated by interviewing 30 music faculty members. The model was verified by using survey methods.	A model of the research process of music scholars. The model specifies six stages: idea generation; background work; preparing and organising; analysing; writing and revision; and dissemination.	The findings affirm that music scholars use audio recordings as information sources and that music analysis is an important part of their research. However, why the above music information modes are pertinent to the faculty members is not examined.
Hunter (2006)	Interviews with five composers of electroacoustic music.	Participants had information needs related to digital signal processing, software, hardware, programming, aesthetics, the properties of acoustic instruments and fields outside of music.	The study provides descriptions about the situations where the information needs occur. However, no systematic study of the situational relevance of music information modes for the participants is conducted.
Liew and Siong (2006)	Interviews with fourteen ethnomusicologists.	The findings categorize the ethnomusicologists' modes of scanning and information-seeking episodes into formal search, undirected viewing, informal search and conditioned viewed. They also address the barriers related to their information seeking.	The findings do not go into detail as to why different modes of music information are situationally relevant for the participating ethnomusicologists.
Dougan (2012)	Questionnaire gathering about 80 answers from university-level music students, plus focus group interviews.	Findings show that university-level music students use different tools to search for both music scores and audio recordings. Moreover, differences specific to student groups in searching for information from such sources were observed.	The reasons why music scores and audio recordings are situationally relevant for different music student groups are not specified.
Kostagiolas *et al.* (2016)	Questionnaire gathering about 150 answers from amateur musicians.	Findings elaborate the picture of information motives and needs, information sources, and obstacles to information seeking among amateur musicians by showcasing that they seek various modes of music information to fulfil diverse information needs.	The findings do not go into detail why modes of music information are situationally relevant in meeting the information needs of amateur musicians.

The context of everyday music information seeking differs from the settings where such information is sought for occupational and school-related purposes. Everyday music information seeking is often initiated by hedonistic, social and cognitive needs related to constructing one's identity, managing one's mood, maintaining interpersonal relations and alleviating monotony (Cunningham, Reeves and Britland, 2003; Laplante, 2008; Laplante and Downie, 2011; see also Bourdieu, 1984; DeNora, 2002). Musicians and music students may certainly utilise music also in the aforementioned ways. However, with reference to the previous sections of this literature review, there is a greater lack of studies examining how musicians view the situational relevance of music information in their vocational or school-related contexts.

The situational relevance of music information has been predominantly studied in the field of music information retrieval (MIR). The research of MIR focuses on and evaluates the different methods through which individual pieces of music can be accessed in an MIR system. MIR studies have examined the relevance of music information objects through context-based approaches matching string search queries with textual metadata representations and through content-based approaches that match music audio data by examining the rhythm and melodies, for example (Downie, 2003; 2004; Casey *et al.*, 2008; Inskip, MacFarlane and Rafferty, 2010; Kim, 2015; Burgoyne, Fujinaga and Downie, 2016). Moreover, the extra-musical relevance cues found from metadata have been studied from the viewpoint of everyday music information retrieval (Laplante, 2010). Users' situational or contextual factors have also been incorporated into MIR techniques. Context-aware music recommender systems utilise, for example, the user's mood or emotion (Kim *et al.*, 2010), daily activities, such as working, sleeping and running (Wang, Rosenblum and Wang, 2012) and location (Cheng and Shen, 2014) as contextual data when suggesting music choices. However, these factors are general in nature, and do not tell why, for example, musicians and music students see the different modes of music information as situationally relevant for their information-seeking tasks. While utilisation of the data gathered from the users' contexts is still limited in MIR, it is becoming increasingly important (Taheri-Panar and MacFarlane, 2004; Inskip, MacFarlane and Rafferty 2007; Weissenberger, 2015). The possibilities of music-related gestural language for MIR have also been investigated (Godøy and Jensenius, 2009).

2.7 Conceptual framework

When reflecting on the notions of music information presented by Bengtsson (1977) and Tarasti (1994), as opposed to approaches to music information in prior research on this topic, the following observations can be made. Even though previous research has approached music information in terms of types of information sources needed by users – for example, audio recordings, notation and music-related literature – insufficient attention has been paid to the fact that different modes of music information might have situational relevance types of their own in information seeking. Previous studies have thus left open significant questions, such as the following: how should the modes of music information be defined when examining the music-related information seeking of musicians and music scholars? What kind of situational relevance types or factors make diverse modes of music information pertinent to the performance of ongoing study tasks? Moreover, how are modes of music information viewed as situationally relevant at different stages of information-seeking processes?

This dissertation starts by juxtaposing Bruner's ideas regarding modes of representation with the sign systems of musical communication as presented by Bengtsson (1977) and Tarasti (1994) to develop a music information typology for the needs of empirical research on information seeking (RQ1). After forming such a typology, its accuracy and sufficiency are evaluated by examining how the modes of music information specified in the typology are present in the verbal description of a compositional process by a professional composer engaged in modern art music (RQ2). Pohjannoro's (2008; 2014; 2016) framework is used to conceptualize the case compositional process into stages, which enables stage-specific examination of relevant music information modes. Once the accuracy and sufficiency of the music information typology has been examined in the context of musical composition, the third step is to examine which of the modes of music information specified in the typology are situationally relevant for the dissertation projects of Doctor of Music students focusing on music performance and to determine why such modes are perceived as situationally relevant (RQ3). In the final stage of this dissertation research, the focus is placed on how music information modes are viewed as situationally relevant in the different stages of the information-search processes of music students representing different fields and levels of university studies (RQ4). Kuhlthau's (2004) ISP model and Vakkari's (2001) definition of the three stages of performing information-seeking tasks are used to enable the process approach in

this final stage of this dissertation research. Figure 1 specifies the main components of the conceptual framework and indicates how they are connected to RQs 1-4.

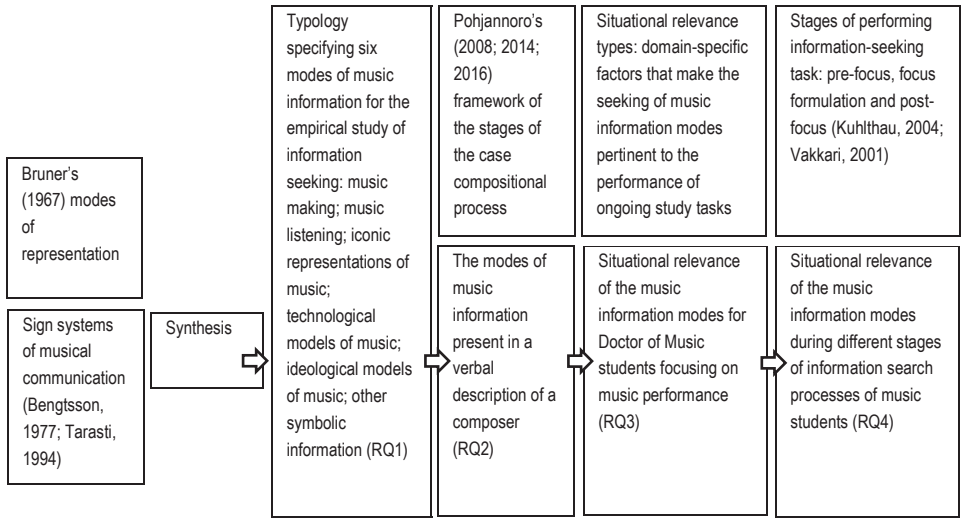

Figure 1. The conceptual framework and the research questions

As indicated in Figure 1, the key components of the conceptual framework in the present study comprise the typology of music information, which specifies six modes of music information, Pohjannoro's (2008; 2014; 2016) process framework of case compositional process, situational relevance, and the three stages of performing the information-seeking task (pre-focus, focus formulation and post-focus) as defined by Kuhlthau (2004) and Vakkari (2001). These components and their relations were examined by seeking answers to RQs 1-4. The four articles included in the present study were designed to each focus on one of the prior research questions. In other words, Study I focused on RQ1, Study II on RQ2, and so on. The following section explains the methodologies of these four articles, and Section 4 presents the key findings.

3 METHODOLOGY

3.1 Conceptual analysis

As demonstrated in Section 2.6 above, prior studies on information seeking among musicians and music students have devoted insufficient attention to the modes of music information. The present study fills gaps in this area by developing the notion of music information to be used in studies of information seeking. To achieve this, Study I attempts to identify notions of music information from literature of musicology and music semiotics and create a framework for studies of music-related information seeking. Conceptual analysis of selected literature was seen as the most suitable method to be used in Study I. The general aim of Study I was to juxtapose Bruner's (1967) ideas about the modes of representation introduced in *Towards a theory of instruction* with the sign systems relevant to musical communication as presented by Tarasti (1994) in *Theory of musical semiotics*, and to form a typology of music information for studies of information seeking. The RQ of Study I was formulated as follows: how should the different modes of music information be defined when examining music-related information seeking? Table 2 summarises the research design of Study I.

Table 2. Research design of Study I

Research question	Data collection	Data source	Data analysis
RQ. How should the different modes of music information be defined when examining music-related information seeking?	Purposive selection of literature.	Bruner's (1967) *Towards a theory of instruction* and Tarasti's (1994) in *Theory of musical semiotics*.	Conceptual analysis.

3.2 Case study of a compositional process

Study I resulted in a typology of modes of music information. The accuracy and sufficiency of the typology was then tested in an empirical study by examining the verbal description, manuscripts, and sketches of a compositional process. To this end, Study II reutilised rich empirical data collected previously by Pohjannoro (2008; 2014; 2016). The data documented the single compositional process of a composer informant that occurred in 2004–2005 and included recorded interview audio data and materials related to the compositional process examined in Study II. The informant was an academically trained Finnish composer engaging in modernist aesthetics. The interview audio data comprised 12 interviews conducted at the different stages of the compositional process. The material included 4 material matrices, 11 sketches, and 17 score versions.

As the music information typology presented in Study I was developed for the examination of music-related information seeking, the operationalisation of the typology was carefully modified to suit the context and purpose of Pohjannoro's (2008; 2014; 2016) original empirical data. For example, when the composer informant pondered about instrumentation or playing technique of a musical instrument, the verbal segment of the data was seen to represent the information mode of music making as the first mode of enactive representation. Pohjannoro and Rousi (2018, pp. 992-993) provide the detailed description of how the music information modes were operationalised to examine musical composition in Study II.

The qualitative analysis of Study II was conducted as follows. First, the verbal data segments representing the different modes of music information were identified from the interview data and coded by the first author. Here, the cross-validation of the verbal and manuscript data, each of which were unintelligible without the support of the other, was crucial. The preliminary coding of utterances was assessed by the composer informant and the first author. As a result of the member-check validation, two new information modes were added to the original typology presented in Study I. After the refinement of the music information typology to better suit the context of musical composition, the whole data were examined and coded again. Lastly, the coding scheme was specified based on the second author's comments about the correctness and intelligibility of the coding decisions.

To examine the text proportions of the transcribed interview data depicting music information modes per stages of the compositional process, the identified information mode instances were placed into the process framework of the

compositional process (Pohjannoro, 2008; 2014; 2016) based on their location in the timeline of the verbal data. Pohjannoro's (2008; 2014; 2016) framework specifies the case composition process examined in Study II into three main stages, which further divide into 18 phases (substages). As stated earlier, it is worth stressing that Pohjannoro's (2008; 2014; 2016) process framework was based on the analysis of the exactly same compositional process that is examined in Study II. See Appendix I of Pohjannoro and Rousi (2018) for the full description of the framework used in Study II. Table 3 summarises the research design of Study II.

Table 3. Research design of Study II

Research questions	Data collection	Data source	Data analysis
RQ1. To what extent is the music information typology developed in Study I specific and sufficient enough in describing the modes of music information present in a composer's verbal description of his compositional process? RQ2. What are the proportions of identified music information mode instances per stages and phases of the compositional process, and what are the roles and dynamics of such modes within the process as a whole?	A compositional process documented during 2004-2005. The material consisted of 12 interviews, 4 material matrices, 11 sketches, and 17 score versions.	An academically trained Finnish composer engaging in modernist aesthetics.	Qualitative analysis preceded by member-check validation performed by the composer informant. The identified information mode instances were placed into the process framework of the case compositional process (Pohjannoro, 2014; 2016).

3.3 Empirical studies of music students' information seeking

Whereas Study II sought to identify the different information modes from a verbal description of a composition process, Study III examined how Doctor of Music students focusing on music performance viewed the situational relevance of the music information modes during a certain moment of their dissertation work on music projects. The dissertations of Doctor of Music students comprised of five concerts and a written thesis. The participants in Study III were six Doctor of Music students from Sibelius Academy, Helsinki University of Arts in Finland.

The present study approached the participants' dissertation on music tasks as tasks of information seeking. Therefore, the original music information typology

developed in Study I was used as a starting point of research in Study III, instead of the typology revised to incorporate music information modes pertinent to musical composition used in Study II. Furthermore, as Study III examined how Doctor of Music students focusing on music performance viewed the situational relevance of the music information modes during a certain moment in their dissertation projects, no process framework was needed to enable longitudinal analysis.

Study III approached situational relevance types of the modes of music information through the question of why Doctor of Music students considered the individual information modes important to their dissertation on music tasks. The problem of translation presented by Tarasti (1994, p. 4) suggests that there may be no unequivocal translations occurring between the music information modes. Therefore, the operationalisation of situational relevance based on concepts implying a direct relation or utility between the music information modes was seen problematic. The concept of importance was thought as broader one that includes the aspect of utility, too.

The data of the empirical studies were gathered using audio-taped recordings and an additional questionnaire filled during the interviews. This mix of methods was seen to provide sufficiently detailed accounts for the analysis of the situational relevance of the music information modes. Prior to the interviews, the participants had submitted their final dissertation proposal. In the questionnaires, the participants were asked to indicate on a four-point scale (0 = not at all important, 1 = not that important, 2 = important and 3 = very important) how important they consider each music information mode for their dissertation on music. Thereafter, they were asked to further explain and elaborate on their answers (see Appendices A and B for both the questionnaire and interview guide used in Study III). The interview data collected in 2013 and 2014 consist of 305 minutes of audio-taped recordings.

The questionnaire data were analysed by calculating mode-specific averages of perceived importance. The transcribed interview data were scrutinised through qualitative content analysis. The open-ended answers explaining the perceived importance of information modes were interpreted to identify types of situational relevance. In other words, the situational relevance types of the modes of music information were approached in Study III through the question of why Doctor of Music students considered the individual information modes important to their dissertation on music tasks. Table 4 summarises the research design of Study III.

Table 4. Research design of Study III

Research questions	Data collection	Data source	Data analysis
RQ1. What kind of types of situational relevance can be identified from diverse modes of music information sought for dissertation projects by Doctor of Music students? RQ2. How does the perceived importance of music information of diverse modes vary from the viewpoint of situational relevance?	Audio-taped interviews with a questionnaire filled during the interviews. The interview data consist of 305 minutes of audio-taped records.	Six Doctor of Music students from Sibelius Academy, Helsinki University of Arts in Finland focusing on music performance.	The questionnaire data were analysed by calculating mode-specific averages of perceived importance. The transcribed interview data were scrutinised through qualitative content analysis.

While Study III examined the situational relevance types pertinent to the music information modes by Doctor of Music students during a certain moment in their dissertation on music projects, the question of how modes of music information are viewed as situationally relevant at different stages of information-seeking processes remained unexamined. Study IV aimed to fill this gap in research by examining how modes of music information are viewed as situationally relevant at different stages of information-seeking processes among music students. To this end, Study IV utilised a longitudinal research design to examine the information-seeking processes among university-level music students representing different fields of music studies.

The participants of Study IV were all recruited from Sibelius Academy, Helsinki University of Arts. Altogether 14 music students representing doctoral studies in music performance, master's studies in music theory and composition, and master's and doctoral studies in music education took part in Study IV. Six of the participants were Doctor of Music students focusing on music performance. The main outcome of their dissertation projects was a series of five concerts; in addition, a written thesis was included in the grading of the dissertations. Five of the participants were students of music performance specialising in music education. The main outcome of the project was a written study focusing on music education. Four out of five of these music education students worked on their master's thesis and one worked on a doctoral dissertation. Lastly, the three remaining participants were students of music theory and composition who worked on their master's thesis. The main outcome of the master's thesis was a written treatise on music analysis. Before the first data collection phase of the longitudinal study, both groups of master's-level

students had begun their masters' theses and the Doctor of Music students were working on their dissertation proposal.

The dissertation tasks Doctor of Music students and masters' theses tasks of master's-level students were approached as information-seeking tasks in Study IV. Given that the context of information seeking differs from that of musical composition, the original music information typology developed in Study I was also used as the starting point of research in Study IV. Furthermore, similar to Study III, Study IV approached situational relevance types of the modes of music information through the question of why different participant groups considered the individual information modes important to their ongoing thesis tasks. To examine how the perceived situational relevance of music information modes were perceived in different stages in these information-seeking tasks, Kuhlthau's (2004) ISP model and Vakkari's (2001) framework were used to enable the process approach in Study IV. More specifically, the ISP model (Kuhlthau, 2004) was used to conceptualize the changes within the actions, thoughts and emotions of the participants during their tasks, whereas Vakkari's (2001) framework was used to define the different stages of the information-seeking process (see Rousi *et al.*, 2019 p. 1236 for the detailed description of the process framework used).

In Study IV, the data were also collected using questionnaire and interview methods. The questionnaire had three main sections. First, the participants were asked to indicate the stage of their task using a three-point scale introduced by Vakkari (2001): 1) pre-focus, 2) focus formulation and 3) post-focus. Second, they were asked to report their current thoughts, emotions and actions by choosing items from the pre-defined lists of the modified process survey questionnaire instrument originally used by Kuhlthau (see Kuhlthau, 2004, p. 60). Lastly, there were six sections specific to music information based on the information typology presented in Study I. In these sections, the participants were first asked to indicate on a four-point scale how important each of the information modes was to them at the current stage of their tasks and then briefly explain their answers in an open-ended question. The interview methods were used to complement the data collection, which occurred by the means of the questionnaire instrument. More specifically, a thematic interview guide was developed for this purpose. In the interviews, more detailed questions regarding the participants' thesis tasks were presented, and the participants were asked to elaborate on the answers they gave while filling in the questionnaires. The interview guide consisted of general questions regarding the participants' thesis tasks; in addition, there were sections focusing on the situational relevance of the six information modes. Within the mode-specific sections of music information, the

participants could explain in depth why a specific information mode was or was not important to their tasks. Furthermore, they could assess whether the situational relevance of the information mode had changed during the information-seeking process (see Appendices A and B for both the questionnaire and interview guide used in Study IV).

The longitudinal research design of Study IV was as follows. First, during the autumn semesters of 2013 or 2014, the 14 participants were asked to fill in the questionnaire instrument described above. The latter phase of data collection took place during the following year's spring semester. During the latter phase, the participants were first asked again to fill in the above questionnaire, after which more detailed questions were asked in the interview. Once individual music information mode sections were covered during the second phase of the data collection, the previous answers given in the first phase were shown to the participants and the differences identified in the assessments of perceived situational relevance were discussed in the interview. The average time period between the first and second data collection phases was about four and half months. All 14 music students were awarded a sum of 40 euros for their participation in Study IV. The study designs of both Study III and IV were reviewed and approved by the representatives of Sibelius Academy, Helsinki University of Arts.

The questionnaire and interview data for Study IV were analysed as follows. The participants' self-assessments regarding the progress of their information-seeking tasks were first summarised. Second, their answers to the questionnaire were analysed so that the share of participants expressing different thoughts, actions and emotions was identified per phase of data collection. Third, the information mode-specific averages of perceived importance were calculated from the questionnaire data. Fourth, the open-ended answers explaining the assessment of the perceived importance of an information mode were interpreted as indicative of its situational relevance. Furthermore, the qualitative analysis discerning conceptual dissimilarities between the answers specific to a data-collection phase were conducted to identify how the assessments of situational relevance per music information mode changed as the tasks of the participants progressed. Finally, the above results were summarised per music student group for a description of their information-seeking processes. Rousi *et al.* (2019, p. 1238) provide a more detailed description of analysis of data in Study IV. Table 5 summarises the research design of Study IV.

Table 5. Research design of Study IV

Research questions	Data collection	Data source	Data analysis
RQ. Which situationally relevant modes of music information are adopted during the information seeking-processes of music students representing the fields of music performance, music education, and music theory and composition?	A longitudinal research design utilising both questionnaire and interview methods.	Fourteen music students at Sibelius Academy, Helsinki University of Arts representing doctoral studies in music performance (n=6), master's studies in music theory and composition (n=3), and master's (n=4) and doctoral studies (n=1) in music education.	The questionnaire answers regarding the progress in the task performance among the participants were analysed. The ISP model (Kuhlthau, 2004) was used to examine the changes within the actions, thoughts and emotions of the participants during their tasks, whereas Vakkari's (2001) framework was used to define the different stages of the information-seeking process. The interview and questionnaire examining the perceived importance of music information modes were scrutinized to both identify the types of situational relevance and to examine variance between data collection phases. These results were then summarised per music student group to produce a description of their information seeking-processes.

It is important to note that regarding to the empirical data collected from Doctor of Music students, Study IV partially utilized the same data as Study III. More specifically, the perceived importance and situational relevance types of music information modes identified by Doctor of Music students in Study III were used as the starting point of analysis for this student group in Study IV. However, in Study IV, the analysis was elaborated further as follows. Both perceived importance and situational relevance types of music information modes were observed at data two collection phases of the longitudinal study, whereas in Study III their examination was based on one data collection point alone. In other words, Study III utilized the same survey and interview data that was eventually used also in Study IV as the phase two data for Doctor of Music students. In Study IV, the perceived importance and situational relevance types of music information modes were examined at two data collection phases to model their situational relevance in different stages of the Doctor of Music students' information-seeking tasks. Furthermore, the analysis how the tasks of Doctor of Music students had progressed between the data collection phases were new in Study IV. For the groups of music education students and

students of music theory and composition all data and analyses were new in Study IV.

4 KEY FINDINGS OF STUDIES I-IV

4.1 Typology of music information for studies of information seeking

As the previous studies on information seeking of musicians, music scholars and music students had not paid due attention to the situational relevance of various music information modes, Study I aimed at developing the notion of music information to be used in studies of information seeking. The general goal of Study I was to introduce a framework to music information where the different sign systems relevant to musical communication would be seen as information in their own right, subject to different roles and interpretations in information seeking. To this end, Study I employed Bruner's (1967) modes representation as a point of departure and defined their content for the domain of music by examining the sign systems relevant to musical communication as presented in Tarasti's *Theory of musical semiotics* (1994). This literature-based conceptual analysis resulted in a music information typology that encompasses different music information facets by categorising music information sources according to their level of abstraction. The typology allows the formulation of research questions at the level of individual music information modes, including examining of their situational relevance within information seeking.

The main contribution of Study I is the development of the typology of music information presented below. The aim of the typology is not to categorise individual sources of music information into one mode alone. The same information source may include many of the modes of information listed below that transpire through the information needs and context of the person engaged in the information-seeking process.

I. *Music making as the first mode of enactive representations*. This mode of representation refers to concrete action to produce sounds for musical purposes. This action may appear in varied forms, such as playing the violin, singing or creating electronic music with a computer. Whereas the term 'music making' may in its common use refer to either playing or composing

music, here it is used in a broader meaning to illustrate the information resided in different sequences of actions that aim at producing sounds for musical purposes.

II. *Receiving music as the second mode of enactive representations*. This mode refers to receiving musical performances of others, whether being present in the moment of the creation or through a recording, but without the possibility of control over the sonic results. The lack of this control is seen to produce a distinction between the level of interaction present between this mode and the first enactive mode.

III. *Iconic representations of music.* Iconic representations of music refer to the graphic illustrations presenting music-related information. Different notations, such as modern staff notation, function as examples of these kinds of representations.

IV. *Technological models of music as the first mode of symbolic representations.* This mode of representation is derived from Tarasti's (1994, pp. 16-17) concept "technological models of musical communication". It refers to the structures of both tonal organisation (e.g. harmony and counterpoint) and sonic formulae (e.g. orchestration and interpretation), and it strives to translate these structures to symbolic representations. In contrast to the mode that follows, the structures examined transpire in the enactive information modes.

V. *Ideological models of music as the second mode of symbolic representations.* The typology's most abstract mode of representations is an extension of Tarasti's (1994, pp. 16-17) original concept of "ideological models of musical communication". This second mode of symbolic representations addresses music, but not the qualities that transpire in the enactive modes of representation. It functions as information that negotiates music concerning conceptual symbolism with other fields and their conceptual representations. For example, it is possible to produce narratives on concepts such as "western classical music" and "history" or "music" and "aesthetics" without reference to actual phenomena present in music *per se*. Examples of information sources that can be more geared towards the second symbolic mode include monographs on philosophy of music and some texts concerning the history of music, such as some biographies of composers.

VI. As music students might also have non-music-related information needs, such as information needs about academic writing, a sixth information mode titled *other symbolic information* was added into the typology. This mode was defined to include all symbolic, i.e., conceptual, information sources from other than music-related disciplines, such as conventions of scientific writing.

4.2 The modes of music information in a compositional process

Given that the music information typology presented in Study I was based solely on a conceptual analysis of literature, it was important to apply it to different empirical contexts to examine its validity. As stated previously, in Study II of this dissertation, the novel music information typology was first applied to examine the substance of information present in a compositional process of a piece representing the Western art music tradition. Previous studies regarding the substance of information on musical composition are scarce, so this approach was expected to result in new and valuable empirical results. The aim of Study II was to find out how the modes of music information are articulated in a verbal description of a compositional process and manuscript data in order to examine the proportions of identified information mode instances per phase (substage) of the compositional process.

The findings of Study II suggest that the music information typology presented in Study I is fairly specific within the context of musical composition – that is, its music information modes could be identified from the composer's verbal description of his compositional process. The findings revealed, however, that the typology is not sufficient in this context, as two additional modes of music-related information relevant to musical composition were identified: shaping music as the third mode of enactive representation and genuine iconic representations. During the member-check validation, the composer disputed that certain utterances fell into any of the modes of information introduced in Study I. These utterances were characterised by the composer's shaping of musical ideas and structures: "this is what I do when I compose". In other words, the composer experimented with how the music should proceed and what kind of impact it would have on the listener. Further, the utterances marked by the composer expressed his reflections on the process and its advancement. These utterances conveying the habitual compositional acts were seen to form a new information mode of shaping music as the third mode of enactive representation. Furthermore, the iconic mode introduced in Study I was renamed

the "symbolic-iconic mode" and a new information mode titled "iconic mode" was added to the typology. This was due to observations of more genuine iconic representations being significant for the compositional process examined in Study II. These genuine iconic representations included characterisations of the future piece through visual metaphors, such as "glacier", "sculpture" or "like a fresco", and the composer's drawings visualising the future piece, for example.

Based on the empirical findings, Study II presented a revised music information typology that includes information types also relevant to musical composition. Below is the revised typology with definitions added for the additional or renamed modes.

I. *Music making as the first mode of enactive representations.*
II. *Receiving music as the second mode of enactive representations.*
III. *Shaping music as the third mode of enactive representations.* This refers to composer shaping musical ideas and structures into expressive forms and organising his compositional actions in terms of metacognitive acts of evaluation, setting musical goals, or making operative plans.
IV. *Iconic representations.* This refers to verbalised visual images – such as landscapes, matter, pictures, sketches, or drawings – depicting a musical idea, passage, or whole composition.
V. *Symbolic-iconic representations of music.* This refers to presenting musical ideas through use of modern staff notation
VI. *Technological models of music as the first mode of symbolic representations.*
VII. *Ideological models of music as the second mode of symbolic representations.*

Throughout the compositional process, the most prevalent information mode identified from the verbal data was shaping music as the third mode of enactive representation. The utterances identified to represent this mode comprised around 45% of all utterance data. The first and second enactive modes, the iconic mode and second symbolic mode prevailed during the first stage (ideation). In the second stage (crisis), the proportion of the third enactive mode reached its zenith (around 58% of all identified utterances), while the other modes became less significant. In the final stage (adjustment), the third enactive mode turned out to be less significant, though it retained its prevalence over the other modes. Furthermore, the proportional curve of the symbolic-iconic mode reached its peak during this final stage. Figure 2 summarises the proportions of identified information mode instances per stage of the compositional process.

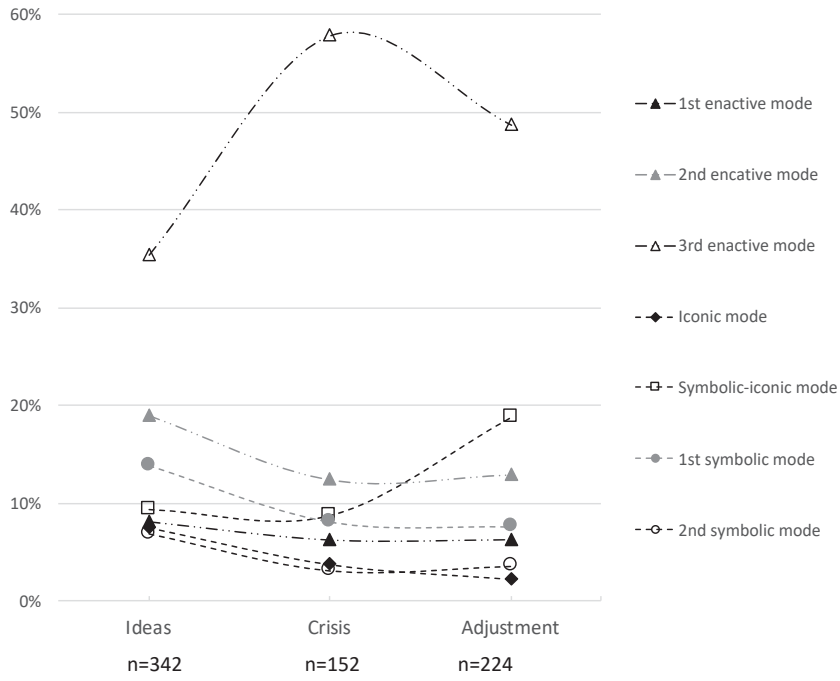

Figure 2. Proportions of information modes within 3 compositional stages (Pohjannoro and Rousi, 2018, p. 1000)

Study II demonstrated the pivotal but partly inadequate role of the third enactive mode of shaping music in the compositional process. While being the most important information mode and the driving force in generating the performative power of the music, the facilitation of the aesthetic framework (i.e. the first and second enactive modes, the iconic mode and second symbolic mode) were required to create the germinal ideas during the first ideation stage and to design the formal structure of the piece.

4.3 Situational relevance of music information modes: an empirical investigation among Doctor of Music students

Study III sought to broaden the empirical applications of the music information typology by examining how Doctor of Music students focusing on music performance viewed the situational relevance of the music information modes during a certain moment of time in their dissertation projects. The situational relevance was examined by asking how important the participants considered the individual modes for their tasks and what the reasons were behind the perceived importance.

The findings indicate that the Doctor of Music students saw on average all the information modes as either very important or important for their dissertation on music tasks (on a scale of 0 = not at all important, 1 = not that important, 2 = important and 3 = very important). Here, the perceived importance (average score) of the music information modes are presented in descending order: 1) iconic representation of music (2.7); 2) music making as the first mode of enactive representation (2.5); 3) receiving music as the second mode of enactive representation (2.5); 4) ideological models of music as the second mode of symbolic representation (2.4); 5) other symbolic modes (2.2); and 6) technological models of music as the first mode of symbolic representation (1.7). The following paragraph presents the reasons behind these assessments of perceived importance as explained by the Doctor of Music students.

The participants not only viewed the iconic representations of music as important due to music notation's role as the foundational gestural language of the concert pieces, but also due to notation's important functions in theoretical analysis and making arrangements. Music making as the first enactive mode was seen as important by the participants due their efforts at mastering the gestural language required by the concert pieces, as well as their interest in studying the gestural language of other performing musicians. Listening to music as the second enactive mode was seen as important for the purpose of selecting the concert pieces, but also for studying thematic material and the aural experience of pieces and interpretations made by other musicians. The situational relevance types linked to ideological models of music as the second mode of symbolic representation included examining the ideological models behind the concert pieces, using music history as a framework and familiarising oneself with the terminology of the dissertation topic. The other symbolic mode was seen as important for the purposes of studying the cultural history of the concert pieces and conventions of scientific writing, for example.

Technological models of music as the first mode of symbolic representation were seen as the least important mode by the participants, although still averaging as important on the four-point scale of perceived importance. Its situational relevance types included analyses of the concert pieces and era-specific analysis methods.

In general, the findings of Study III elaborated on the picture of the situational relevance of music information modes from a perspective of Doctor of Music students focusing on music performance and offered new insights as to why Doctor of Music students experience needs for certain types of information sources, such as audio recordings and music notation. The findings highlight that the modes of music information may suggest diverse situational relevance types of their own when evaluated by Doctor of Music students focusing on music performance. Table 6 presents the summarised findings of Study III.

Table 6. Summarised findings of Study III (Rousi *et al.*, 2018, p.1015)

Music information mode	Perceived importance (avg.)	Situational relevance types
III Iconic representations of music	Very important (2.7)	III.1 Notations as the foundation of gestural language; III.2 Utilising notations in creating arrangements; III. 3 Utilising notations in music analyses; III.4 Notated traditions of performance
I Music making as the first mode of enactive representations	Very important (2.5)	I.1 Gestural language of the concert pieces; I.2 Models of gestural language as the focus of written examination; I.3 Own interpretation as the focus of written examination
II Receiving music as the second mode of enactive representations	Very important (2.5)	II.1 Selecting the concert pieces; II.2 Thematic material of the concert pieces; II.3 Complementing the aural experience of the piece; II. 4 Interpretations of other musicians; II.5 Recorded traditions of performance
V Ideological models of music as the second mode of symbolic representations	Important (2.4)	V.1 Ideological models of concert pieces; V.2 Music history as a framework; V.3 Familiarising with terminology
VI Other symbolic information	Important (2.2)	VI.1 Cultural history of the concert pieces; VI.2 Multidisciplinary approaches to dissertations topics; VI.3 Conventions of scientific writing
IV Technological models of music as the first mode of symbolic representations	Important (1.7)	IV.1 Technological models of the concert pieces; IV.2 Previous analyses of the concert pieces; IV.3 Analysing music of different eras

4.4 Adopting situationally relevant modes of music information at different stages of information-seeking processes: a longitudinal investigation among music students

Given that the findings of Study III were a snapshot of the situational relevance of the modes of music information at a certain stage of an information-seeking task, Study IV sought to further elaborate on the picture of music information's situational relevance by examining how the different information modes were viewed as situationally relevant at different stages of information-seeking processes by university-level music students. Furthermore, besides Doctor of Music students

focusing on music performance, the participants of Study IV included students of music education and music theory and analysis. These three focus groups were chosen due to the fact that preparing music performances, conducting music analyses and writing music educational texts were seen to represent the common study tasks of university-level music students. As in Study III, the situational relevance of the music information modes was examined through the question of why the participating music students saw the information modes as important for their tasks. What follows is the presentation of key findings regarding the student group-specific summaries regarding important information modes and their situational relevance within different stages of information-seeking processes.

Study IV revealed that the participating Doctor of Music students viewed the series of five music performance concerts as the main outcome of their tasks, and this influenced their view regarding the situational relevance of the music information modes. Within the pre-focus stage, the enactive and iconic modes were viewed as most important, and they were used for the exploration of the topic, while the symbolic modes were viewed as of less importance. During and after the focus formulation, the importance of the symbolic modes was enhanced among the Doctor of Music students and these modes were viewed as relevant for new, diverse reasons. The high importance of the enactive and iconic modes remained constant for the Doctor of Music students.

Table 7 summarises the findings of Study IV with regard to the situational relevance of the music information modes as viewed by Doctor of Music students focusing on music performance.

Table 7. Important information modes and changes in situational relevance among Doctor of Music students focusing on music performance (Rousi, Savolainen and Vakkari, 2019, p. 1244) (n=6)

Important information modes Iconic representations of music; Music making as the first mode of enactive representations; Receiving music as the second mode of enactive representations; Ideological models of music as the second mode of symbolic representations; Other symbolic information; Technological models of music as the first mode of symbolic representations (at the 2nd phase, not at 1st)		
Changes in situational relevance		
Pre-focus	Focus formulation	Post focus
Notations as the foundation of gestural language of the concert pieces (iconic mode)	During and after focus formulation the situational relevance of the iconic mode may expand to other relevance types, such as studying the traditions of performance transmitted in the articulation marks.	
Own rehearsing as the means to gain control over the gestural language of the pieces (1st enactive)	During and after focus formulation the situational relevance of the 1st enactive mode may expand to other relevance types, such as studying the gestural language of other performers.	
Study of the topic and concert pieces through listening of audio recordings (2nd enactive)	During and after focus formulation the situational relevance of the 2st enactive mode may expand to other relevance types, such as conducting different analysis based on recordings.	
Pre-focus, the symbolic modes appear as secondary in relevance to enactive and iconic modes	During and after focus formulation, the situational relevance of certain symbolic modes may increase, such as technological models (1st symbolic) and other symbolic information.	

The main outcome of the tasks of music performance students focusing on music education were written theses, which influenced the way they viewed the situational relevance of the modes of music information. Their information search process focused on the symbolic modes of information. During the pre-focus stages of their tasks, they browsed and examined literature of varying kinds. During the focus formulation and post-focus stages, they focused to the literature type they found as most important for their tasks, which within the data of Study IV was the ideological models of music as the second mode of symbolic representation.

Table 8 summarises how students of music education viewed the situational relevance of music information modes at different stages of their information-seeking processes.

Table 8. Important information modes and changes in situational relevance among students focusing on music education (Rousi, Savolainen and Vakkari, 2019, p.1244) (n=5)

Important information modes Ideological models of music as the second mode of symbolic representations; Other symbolic information		
Changes in situational relevance		
Pre-focus	Focus formulation	Post focus
The symbolic modes most relevant when examining a general topic	The participants focused their works to matters related to ideological models and relevance of the other symbolic modes diminished.	
During pre-focus, the enactive modes were often seen as not relevant	If own approach to instrument and musicianship was considered significant from the viewpoint of the thesis, the importance of the enactive modes could slightly increase after and during focus formulation	

The main outcome of the tasks of the students of music theory and composition were written theses focusing on music analyses. The way this participant group viewed the situational relevance of music information modes during their information-seeking processes can be described as follows. The enactive and iconic modes were of importance for this participant group even though the output of their task was a written thesis focusing on music analyses. As with Doctor of Music students, the importance of the enactive and iconic modes remained constant during the information search processes. However, two of the participants stated in the interviews that the importance of listening to music as the second enactive mode diminished as the task progressed. Not surprisingly, the technological models of music as the first symbolic mode of representation were viewed as the most important by students of music theory and composition.

Table 9 summarises how students of music theory and composition viewed the situational relevance of music information during the different stages of their information-seeking processes.

Table 9. Important information modes and changes in situational relevance among students of music theory and composition (Rousi, Savolainen and Vakkari, 2019, p.1245) (n=3)

Important information modes Receiving music as the second mode of enactive representations; Music making as the first mode of enactive representations; Technological models of music as the first mode of symbolic representations; Iconic representations of music		
Changes in situational relevance		
Pre-focus	Focus formulation	Post focus
Study of the topic and analysed pieces at more general level through listening of audio recordings (2nd enactive).		The relevance of audio recordings may diminish after the analyses become more detailed.
	Once the music analyses get more detailed, own playing (1st enactive) becomes more relevant from the view-point of analyses. Own playing is used to bring forth details of the pieces to be used in the analyses.	

As a summary, the findings of Study IV indicate that it was not only the modes of music information which were seen as situationally relevant for different reasons by the three participating music student groups when starting their tasks. It also appeared that the situational relevance of the information modes underwent changes as their tasks progressed to the focus formulation and post-focus stages. Within the tasks of Doctor of Music students, the enactive and iconic modes were of most importance during the pre-focus stage of topic exploration. During and after focus formulation, the increased ability to discern pertinent information led to perceiving the symbolic information modes as important and relevant due to new, diverse reasons. The group summary of the Doctor of Music students suggests that tasks focusing on enactive outputs such as music performances are more expansive when it comes to using the different modes of music information at different stages of tasks. This appears as somewhat contradictory to the music education students working to create a written thesis, because they strived to narrow their focus to the most relevant symbolic information mode.

4.5 Summary of findings

Study I integrated Bruner's (1967) ideas of modes of representation with sign systems relevant to musical communication as presented by Tarasti (1994). As a result, a

music information typology ranging from the enactive music information representations to the abstract symbolic representations was presented; a total of six information modes were identified. Study II suggested that the music information typology may be applied within the context of musical composition. However, two additional significant information modes for musical composition were identified: shaping music as the third mode of enactive representation and genuine iconic representations. Furthermore, Study II also described the way the identified music information modes contributed to the creative aspirations of the composer. Study III elaborated on the picture of situational relevance of music information modes from a viewpoint of Doctor of Music students focusing on music performance and offered new insights as to why Doctor of Music students have information needs regarding certain types of music information sources. Study IV further elaborated on the picture of the situational relevance of music information by examining how information modes are viewed as situationally relevant at different stages of information-seeking processes among music students representing music performance, music education, and music theory and composition. Study IV resulted in student group-specific summaries of how they saw the situational relevance of the modes of music information at different stages of their information-seeking processes. The main finding of Study IV was that the perceived situational relevance of music information modes is context-sensitive and depends on the features of the information-seeking task. The Doctor of Music students focusing on a series of concerts viewed the situational relevance of the music information modes differently compared to music performance students focusing on theses about music education, for example.

5 DISCUSSION

5.1 Theoretical contributions

This dissertation research reveals how information science's notions of information can be elaborated on by making use of conceptualisations developed in other domains, such as music semiotics. Study I of this dissertation research drew on the ideas of music information presented in the musicological and music semiotics works of Bengtsson (1977) and Tarasti (1994) to introduce a music information typology that categorises music information sources according to their level of abstraction. The empirical studies (studies II–IV) showcase that the information typology can be used to restructure the research of music-related information seeking. The empirical findings suggest that approaching music information through its many layers enables research designs that add to the understanding of information seeking among musicians and music students. The aim of the present research was not to create a universal notion of music information, but to define this phenomenon so that it may be used in domain-specific research to analyse the contextually sensitive features of task-based information seeking (cf. Ingwersen and Järvelin, 2005, p. 32). Applied to the context of the present investigation, the domain is music, and contextually sensitive task-based information seeking deals with the acquisition of music information needed in music-related studies and composition.

Second, the present investigation contributed to elaborating on the domain-specific nature of the situational relevance of music information. Although previous research has shown that musicians and music students seek and need different modes of music information (e.g. Brown, 2002; Hunter, 2006; Liew and Siong, 2006; Kostagiolas *et al.*, 2015), due attention has not been paid to the fact that different music information modes might have situational relevance types of their own in information seeking. The findings of the present research showed that the different modes of music information have situational relevance types of their own – that is, their roles and interpretations within information seeking by musicians and music students may vary. The context of the information-seeking task significantly affected on how the situational relevance of the music information modes was viewed. Doctor of Music students performing a series of concerts viewed the situational

relevance of enactive modes differently compared to music performance students focusing on music education, for example. Furthermore, within the information-seeking tasks of students focusing on music performance, music education and music analyses, the situational relevance of the modes developed in different ways as the students progressed to the focus formulation and post-focus stages in their tasks. These findings deepen our understanding regarding the situational relevance of music-related information.

Summing up: approaching music information through its diverse layers allows research questions to be asked at the level of individual information modes. This results in more detailed accounts of the information seeking of musicians and music students compared to prior, one-dimensional approaches to music information. In particular, this approach coupled with longitudinal studies utilising process frameworks to categorise the different stages of information-seeking tasks hold good promise for the further elaboration of the picture of music information behaviour. This allows the examination of the situational relevance of music information modes per stage of information search process, which brings forth the context-sensitive changes in their situational relevance within the different stages of the tasks. As suggested by the findings of the present investigation, this type of research design results in accurate descriptions of music-related information-seeking processes, which reveal why different modes of music information are relevant at different stages of the information-seeking process.

One of the most interesting lines for future research is suggested by the findings of Study IV. The students of music education who had a written thesis as their tasks' outcome found only the symbolic information modes important in the early stages of their task. Furthermore, during the focus formulation, they preferred the most important symbolic mode and excluded other non-relevant symbolic modes from examination. This change dynamic within the relevance of textual documents is well documented in prior longitudinal studies (Bateman, 1998; Vakkari, 2000; Vakkari and Hakala, 2000; Vakkari, 2001). The information seeker exhibits more readiness to identify pertinent texts in the later stages of the task, even if these changes could be subtle with text documents (Vakkari and Hakala, 2000, p. 559). However, within the tasks of the Doctor of Music students, who had five music performances as the main outcome of their tasks, a different dynamic regarding the relevance of the music information modes was observed. While in the early stages of their tasks, the Doctor of Music students worked mostly with the enactive and iconic information modes – i.e. they played music, read scores, and listened to music for focus formulation. For this participant group, the symbolic modes were less important in the early stages of

their tasks. Once the Doctor of Music students were able to form a focus in their tasks; the symbolic modes were seen to be of more importance and they gained new types of situational relevance. These results suggest that tasks resulting in enactive outcomes, such as music performances, may be more expansive with regard to the use of various information modes compared to tasks having a written output as the main outcome. This suggests the need for further longitudinal studies regarding the situational relevance of diverse information modes within information-seeking tasks where the outcomes are mainly enactive, such as music or dance performances.

5.2 Practical implications

The findings of the present dissertation suggest that more accurate descriptions of information seeking are possible when examining music information through its many layers of abstraction. With further research, such findings may inform practices within MIR, information literacy instruction and the design of online learning environments, for example. For MIR, the finding that the situational relevance of music information modes is context-specific and dependent of the nature of task – i.e. whether task is focused on music performance or music analysis – could be of importance. For information literacy instruction, the detailed descriptions of why different music student groups have information needs concerning certain types of music-related information result in more detailed descriptions of their thesis processes which may further inform current practices. Modelling information-seeking processes of music students including pertinent information modes and documentation on how the situational relevance of these modes is viewed during the different stages of information-seeking tasks could further enhance the design of online learning environments by suggesting how the content of information sources should be organised for use. Given the ubiquitous presence of search engines and digital information sources, accurate descriptions of information-seeking processes are important to inform their design in order to optimally serve persons engaged in information seeking for the purpose of learning (see e.g. Rieh *et al.*, 2016).

5.3 Reliability and validity

5.3.1 Assessment of the music information typology

The music information typology developed in Study I of this dissertation research may be used to restructure the research of music-related information seeking. Perhaps most importantly, it enables research questions to be posed at the level of individual music information modes. Longitudinal studies can now be designed to examine how the situational relevance of individual music information modes is viewed in different stages of information-seeking tasks, for example. As the music information typology presented in Study I was a conceptual work, it was important to apply it to empirical research settings to evaluate its accuracy and sufficiency.

It is evident that music-related modes of information could also be defined in many other ways than was done within this dissertation research. Diverse definitions of modes of music information will lead to different findings when examining the information seeking of musicians and music students. Thus, it is important to reflect critically on whether the typology of music information presented in Study I is sufficiently nuanced for the empirical study of information seeking taking place in diverse contexts. The findings of Study II suggested that even though all of the modes presented in the typology could be identified from the verbal description of a composition process, two additional relevant information modes were identified. First, there was shaping music as the third enactive mode, which referred to the metacognitive acts of organising compositional actions or "this is what I do when I compose", as expressed by the composer. Second, there were the genuine iconic representations that consisted of extra-musical images such as "whiteness", "glacier" and "fresco", which had an important role in the compositional process. Both of these findings regarding the sufficiency of the music information typology are significant and are discussed at a more general level below.

As with the metacognitive acts of organising compositional actions, the music information typology presented in Study I includes neither metacognitive acts of organising other music-related activities, such as ones transpiring in preparations for music performances, nor the writing of a thesis on music education. These metacognitive acts of organising actions may be described through the following hypothetical examples. A performing musician may first learn to play the first eight bars from memory before proceeding to the next eight bars. A student working on a master's thesis on music education may first write the methodology section, before

finalising the literature review and introduction, for example. The importance and situational relevance of external information sources may to some extent reflect these metacognitive acts of activity organisation, such as the importance of music notation for the composer at the late stages of the compositional process. Nevertheless, it is important to acknowledge that these metacognitive acts of organising music-related actions are not the focus of the music information typology introduced in this dissertation research. However, it is noteworthy that the music information typology presented in Study I was not originally intended for the examination of these metacognitive actions, but for restructuring studies of music-related information seeking to produce more accurate descriptions of these processes.

The observation that genuine iconic representations were not a part of the original music information typology also highlights a limitation that needs to be addressed. It is noteworthy that whereas symbolic information representing other fields than music was included in the typology through the inclusion of the other symbolic mode, the enactive and iconic modes of information were defined so they only focused on music-related information. This means that when examining music-related information seeking through the typology presented in Study I, enactive and iconic modes of information of other fields – such as the gestural language of dance and iconic representations of visual arts – are likely left out of the analysis. Within the enactive and iconic modes of information, the music information typology presented in Study I is geared towards examining the gestural language of music making, audible experiences of music and music notation.

The fact that the music information typology of Study I focuses on the above general enactive and iconic information elements within the domain of music may also be seen as its strength. When the focus is placed on the enactive and iconic modes of music-related information, it is possible to scrutinise the situational relevance of these music information modes in detail within information-seeking processes. Furthermore, the general nature of the music information typology seems to lend itself well to examining information-seeking processes of different music student groups, as suggested by Study IV. The music students participating in Study IV viewed different modes of music information as relevant, but each of the six information modes were seen as important for the information-seeking processes by at least one of the participating music groups. The typology appears general enough for the description of information-seeking processes among different music student groups, but specific enough to provide new information regarding the roles and interpretations of the music information modes within these processes.

5.3.2 Reliability and validity of empirical studies

In general, a common limitation related to all the empirical studies conducted within this dissertation research is that they either are case studies (Study II) or have a limited number of participants (studies III and IV). Therefore, this research sought not to create models of the information seeking of Doctor of Music students or students of music education, for example, but provided exemplary accounts to illustrate how the situational relevance of music information modes may develop while performing different kinds of music-related information-seeking tasks. The limited number of participants might not reveal the full variance of the situational relevance types by which the importance of the music information modes is assessed by music students. The main purpose of the empirical studies was to showcase that more detailed descriptions of music-related information seeking are possible when approaching music information through its many layers of abstraction, and more research is needed to validate these accounts as plausible models. However, given the scarcity of previous studies, the empirical results were nevertheless seen to deepen our understanding of music-related information seeking. What follows is a more detailed discussion regarding the reliability and validity of the individual empirical studies.

Study II demonstrated an actual compositional process that entails the diversity of the music information modes and described the way these modes contribute to the creative aspirations of a specific composer. As for its limitations, the purpose of Study II was not to claim that these results apply to all compositional processes representing diverse genres of music or even the particular genre featured. Study II sought to improve the validity through the member-check validation performed by the composer informant. Moreover, the validity was strengthened through the second author's checking of the coding lists consisting of utterances identified to represent individual information modes. As stated previously, the empirical data of Study II were gathered in 2004-2005 by Pohjannoro (see Pohjannoro 2008; 2014; 2016); thus, the above material is about 15 years old. However, the data were seen as valid for the particular needs of Study II. All Pohjannoro's rich empirical materials were available for re-coding and re-analysis to examine how the different music information modes were present in the verbal description of the compositional process by the composer informant. The empirical data of Study II were not seen as outdated because each creative (art) process produces an original and unique output thus being totally non-repeatable. Moreover, creative processes tend to change slowly as well as in an unpredicted way (Gruber and Wallace, 1999).

Study III elaborated on the picture of the situational relevance of music information modes from a view point of Doctor of Music students focusing on music performance and offers new insights as to why Doctor of Music students have information needs regarding certain types of music information sources, such as audio recordings and music notation. The findings highlight that the modes of music information may suggest diverse situational relevance types of their own when evaluated by students of music performance. It is important to note that even though all of the participating Doctor of Music students also were professional musicians, the context of preparing concerts for dissertation on music could differ from their normal vocational contexts, albeit if the difference is subtle. Therefore, further studies should be conducted to examine whether the music information modes have similar situational relevance types also within the context of performing musicians preparing for concerts in vocational settings. Given the small number of participants, the goal of Study III was not to create a generalisable list of situational relevance types suggested by modes of music information for student of music performance or a model of the information seeking of students of music performance.

The findings of Study IV indicate that it was not only the modes of music information which were seen as situationally relevant for different reasons by the three participating music student groups when initiating their study tasks. Moreover, it appeared that the situational relevance of the information modes underwent changes as their tasks progressed to the focus formulation and post-focus stages. Due to the small number of participants, the findings describing information-seeking processes among students of music performance, music education and music theory and composition are not generalisable to all students representing these fields, and as such should not be seen as models of their information seeking. However, the findings of Study IV highlight that approaching music information through frameworks that classify information sources at diverse levels of abstraction enables an accurate description of information-seeking processes and illuminates the context-sensitive development of the situational relevance of music information of diverse modes.

Furthermore, with regard to the validity and reliability of studies III and IV, an important question is how the theoretical concepts of music information modes were understood by the participants – that is, whether the participants understood them in a similar manner so that the results are comparable within the answers of a specific music student group. Studies III and IV sought to aid the participants' understanding of the information mode concepts through the provision of definitions of information modes. In addition, the participants were provided with

extensive lists of example sources of information within the data collection (see Appendix A). Moreover, in studies III and IV, the definitions of the information modes were discussed in the interviews with the participants.

Finally, as the problem of translation occurring between music information modes occupied an important role in the building of the theoretical framework of the present study, it is reasonable to ask whether the above problem has affected the validity of the empirical studies. Study II examined a verbal description of a compositional process documented in 2004–2005 through a modified coding scheme for the identification of music information modes from the transcribed verbal data. Within this analysis, the composer informant's material matrices, sketches and score versions were of high importance. Thus, Study II essentially examined a composition process already translated into verbal language with the aid of iconic matrices, sketches and score versions. The elements of the compositional process that may be missing from the verbal description are discussed in more detail in Study II. Similarly, in studies III and IV, it is noteworthy that when the participants were asked to explain the situational relevance of music information modes, they did not describe detailed phenomena transpiring in music *per se*, but generally depicted how diverse information modes are related to their information-seeking task at hand. The explicated situational relevance types were thus not direct translations of qualities present in audible music, but thoughts about relations present between the theoretical concepts of music information modes and their information-seeking task. It is also important to note that the participants of studies III and IV were all either doctoral or master's degree students at Sibelius Academy, Helsinki University of the Arts, and that they therefore represent experts in their field. It is likely that these individuals have a greater readiness to examine their own learning verbally compared to music hobbyists, for example.

5.4 Recommendations for further research

As this dissertation research was among the first investigations examining how the situational relevance of different modes of music information is viewed in different music-related tasks, several recommendations for further research may be presented. First, as the number of the participants was limited, further studies of compositional processes within the Western art music tradition and of the information seeking of students of music performance, music education students and students of music theory and composition would help to further validate and generalise the results of

this dissertation research. Moreover, an examination of how the situational relevance of modes of music information is viewed could be expanded to other music student groups and creative processes representing different genres and cultural traditions of music. Second, the present dissertation did not examine comprehensively the elements of information-seeking processes identified in diverse frameworks such as Kuhlthau's (2004) ISP model, nor their relations to the music information modes. Most notably, the present research did not examine information sources (see e.g. Laplante and Downie, 2011; Dougan, 2012) linked to the modes of music information by the participating music students. By inclusion of the information source level, the longitudinal research design introduced in Study IV would produce more accurate descriptions of music-related information-seeking processes. Other elements of established information-seeking models that were not examined from the viewpoint of individual music information modes within this dissertation research were emotions experienced during the information-seeking processes (see Kuhlthau, 2004; Savolainen, 2014; 2015). Third, even though the focus of this dissertation research is in the domain of music, the principle of categorising information sources according to their level of abstraction can be applied to any domain of knowledge. Similar research should be conducted on information-seeking tasks related to other artistic disciplines, such as other performing or visual arts.

6 CONCLUSION

This dissertation research is pioneering in its examination of the situational relevance of music information modes representing music information at varying levels of abstraction. The research began with a definition of the information modes relevant to music-related information seeking; they were presented in the form of a music information typology. The typology's accuracy and sufficiency were first tested through how the information modes were reflected on in a verbal description of the compositional process. A second empirical study examined how the situational relevance of the information modes were seen by Doctor of Music students focusing on music performance. Lastly, the third empirical study examined how the information modes were viewed as situationally relevant at different stages of the information-seeking processes among Doctor of Music students focusing on music performance and master's students representing music education and music theory and analysis. By concentrating on these different focus groups, the present study sought to elaborate the picture on how situational relevance of music information modes is viewed during information seeking for musical tasks common to musicians and music students.

The empirical findings regarding the context-sensitive relevance of the music information modes deepen our understanding of the roles of varying music information modes in information seeking for musical tasks. Furthermore, they suggest that approaching music information through its many layers provides more accurate descriptions of music-related information-seeking processes.

All in all, the findings deepen our understanding of the ways in which people value and seek information in specific domains of human action. As exemplified by the domain of music, the modes of information and the assessments of situational relevance exhibit particular features characteristic to this domain. However, music-related information seeking is not a world of its own, separate from other domains of information behaviour. This is perhaps best evidenced by the fact that the categories of generic frameworks, such as Kuhlthau's (2004) information search process model, appeared to be highly relevant for the analysis of music-related information-seeking processes.

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APPENDICES

Appendix A Questionnaire instrument used in Studies III and IV.

1 Background information

Alias:
(Use the same alias in both questionnaires. Your alias will not be published)
Study programme:
Age:
How many years have you studied at Sibelius Academy?

What is the main topic of your thesis? Choose one of the following:

☐ music history	☐ music education	☐ music theory
☐ ethnomusicology	☐ own artistic activity (e.g. composition or music performance)	☐ other topic, please define _ _____

2 Phase of the information-seeking task

2.1 What is your primary task concerning your thesis at the moment? Choose one of the following:

- ☐ Start of the thesis and identifying its general topic
- ☐ Examining information concerning a general topic and formulating a specific focus
- ☐ Gathering information pertinent to a focused topic or finalising the thesis
- ☐ Other, please define? _____

2.2 What are you thinking in the current phase of your task? Choose all options that apply.

- ☐ Organising ideas and information
- ☐ Identifying possible alternative topics
- ☐ Becoming informed about the general topic
- ☐ Exhausting all possible sources of information
- ☐ Considering alternative topics in light of the requirements of the project
- ☐ Choosing a broad topic that has potential for success
- ☐ Comprehending the task before me
- ☐ Recognising ways to draw the project to a close
- ☐ Considering alternative topics in the light of the information available to me
- ☐ Confronting the inconsistency and incompatibility in the information encountered
- ☐ Defining and extending my specific topic
- ☐ Gaining a sense of direction and clarity
- ☐ Recalling a previous project when I searched for information
- ☐ Predicting the success of each possible area of concentration
- ☐ Identifying several possible areas of concentration in the broad topic
- ☐ Considering alternative topics in light of the things that are of personal interest to me
- ☐ Seeking information about my specific area of concentration
- ☐ Other, please define? _____

2.3 What are you doing in the current phase of your task? (the musical aspects of your thesis are examined in more detail in the following section of the questionnaire.) Choose all options that apply.

- ☐ Getting acquainted with a music piece related to my topic by trying out different parts with my instrument
- ☐ Rehearsing a piece for public performance
- ☐ Performing music in public
- ☐ Doing preliminary music analyses related to my topic
- ☐ Doing detailed music analyses related to my topic
- ☐ Composing music
- ☐ Listening to music that is broadly related to my topic
- ☐ Listening to a selected set of musical pieces
- ☐ Discussing the topic
- ☐ Making a summary search of the library
- ☐ Skimming and scanning sources of information
- ☐ Outlining to organise information
- ☐ Reading over notes for themes
- ☐ Making a preliminary search from the library
- ☐ Conferring with people who know the topic
- ☐ Writing about themes and ideas
- ☐ Reading about the topic
- ☐ Taking detailed notes on facts and ideas
- ☐ Taking brief notes on facts and ideas
- ☐ Rechecking sources for information initially overlooked
- ☐ Recording bibliographic citations
- ☐ Other, please define? _____

2.4 From the following, choose all adjectives that describe your emotions at the current phase of your task.

- ☐ Sure
- ☐ Confused
- ☐ Disappointed
- ☐ Doubtful
- ☐ Frustrated
- ☐ Optimistic
- ☐ Relieved
- ☐ Satisfied
- ☐ Confident
- ☐ Uncertain
- ☐ Other, please define?_____

3 Acquired or used sources of information

3.1 Playing or performing pieces yourself and information on this activity

3.1.1 How important it is for you to play or perform pieces in the current phase of your thesis task? Choose one of the following.

- ☐ Not at all important
- ☐ Not that important
- ☐ Important
- ☐ Very important

3.1.2 Explain your previous answer

3.1.3 What information sources incorporating this information mode have you acquired or utilised during your thesis task? Choose all options that apply. Mark all applicable information sources.

- ☐ Own personal rehearsing
- ☐ Making music with the academic faculty or in other rehearsals arranged at your university
- ☐ Making music in concerts arranged by the university
- ☐ Making music in rehearsals arranged outside the university (networks outside your academic institution)
- ☐ Making music in concerts or other public performances arranged outside the university (networks outside your academic institution)
- ☐ Different online and media services (e.g., YouTube, Sibelius Academy's "Do you know enough about rehearsing" [Tiedätkö harjoittelusta riittävästi] online material)
- ☐ Different materials available from the Sibelius Academy Library regarding music performance (e.g. instructional material regarding specific instruments)
(music notation from their own information mode, which is examined in section 3.3)
- ☐ Other information sources related to playing or performing pieces yourself, please define (music notations from their own information mode, which is examined in section 3.3)?

3.2 Music performances and information received from them (excluding playing or performing pieces yourself)

3.2.1 How important is information received from different music performances (excluding playing or performing music yourself) in the current phase of your task? Choose one of the following.

- ☐ Not at all important
- ☐ Not that important
- ☐ Important
- ☐ Very important

3.2.2 Explain your previous answer

3.2.3 What information sources incorporating this information mode have you acquired or utilised during your thesis task? Choose all options that apply. Mark all applicable information sources.

- ☐ Audio recordings available from the Sibelius Academy Library (SACD/CDs, vinyls)
- ☐ Sibelius Academy Library's electronic databases, licenced or produced by the Library, and audio recordings available through them (e.g., Classical Music Library, Contemporary World Music, Naxos Music Library, Doria)
- ☐ Audio recordings or suggestions received from the personnel of Sibelius Academy Library
- ☐ Following concerts and rehearsals arranged by Sibelius Academy
- ☐ Audio recordings or suggestions received from the teaching and academic faculty of Sibelius Academy
- ☐ Audio recordings or suggestions received from other students of Sibelius Academy
- ☐ Following concerts and rehearsals arranged outside of your academic institution
- ☐ Audio recordings or suggestions received from your networks outside your academic institution
- ☐ Own personal collection of audio recordings
- ☐ Retail stores and their online stores that sell audio recordings (e.g. Ostinato)
- ☐ Online subscription-based music streaming services providing digital audio (e.g. Spotify)
- ☐ Other online and media services providing audio (e.g. YouTube, other social media, radio, online radio)
- ☐ Audio recordings available from the collections of other libraries
- ☐ Other information sources related music performances and information received from them (excluding playing or performing pieces yourself), please define.

3.3 Music scores or other music notation types and information received from them

3.3.1 How important are music scores or other notation types in the current phase of your thesis task? Choose one of the following.

- ☐ Not at all important
- ☐ Not that important
- ☐ Important
- ☐ Very important

3.3.2 Explain your previous answer

3.3.3 What information sources incorporating this information mode have you acquired or utilised during your thesis task? Choose all options that apply. Mark all applicable information sources.

- ☐ Music scores and notation available from the Sibelius Academy Library
- ☐ Sibelius Academy Library's collection of anthologies, collected works of composers, score manuscripts or historically valuable scores
- ☐ Sibelius Academy Library's electronic databases, licenced or produced by the Library, and digital music scores available through them (Classical Scores Library, Doria)
- ☐ Music scores or suggestions received from the personnel of Sibelius Academy Library
- ☐ Music scores, extracts from course materials or suggestions received from the teaching and academic faculty of Sibelius Academy
- ☐ Music scores or suggestions received from other students of Sibelius Academy
- ☐ Music scores or suggestions received from your networks outside your academic institution
- ☐ Own personal collection of music scores
- ☐ Retail stores and their online stores that sell music notation (e.g. Ostinato)
- ☐ Free online services focusing on digital music scores (e.g. American Memory, Bach Cantatas Website, IMSLP/Petrucci Music Library, Musopen.org) and materials available through them
- ☐ Chargeable online services focusing on digital music scores (e.g. Boosey & Hawkes - Sheet music download, Luck's Music Library, Sheetmusicdb.net) and materials available through them
- ☐ Music scores available from the collections of other libraries
- ☐ Other information sources related music scores and other music notation types and information received from them (excluding playing or performing pieces yourself), please define?

3.4 Information examining music theory (e.g. harmony, voice leading, music analysis and orchestration)

3.4.1 How important is information examining music theory in the current phase of your thesis task? Choose one of the following.

- ☐ Not at all important
- ☐ Not that important
- ☐ Important
- ☐ Very important

3.4.2 Explain your previous answer

3.4.3 What information sources incorporating this information mode have you acquired or utilised during your thesis task? Choose all options that apply. Mark all applying information sources.

- ☐ Sibelius Academy Library's collection of printed books, printed journals and other printed materials
- ☐ Sibelius Academy Library's collection of printed theses
- ☐ Sibelius Academy Library's collection of electronic materials and databases (e.g. RIPM, IIMP), including materials such as electronic journals or theses or electronic encyclopaedias
- ☐ Sibelius Academy Library's eThesis database and its electronic theses
- ☐ Materials or suggestions received from the personnel of Sibelius Academy Library
- ☐ Materials or suggestions received from the teaching and academic faculty of Sibelius Academy
- ☐ Materials or suggestions received from other students of Sibelius Academy
- ☐ Materials or suggestions received from your networks outside your academic institution
- ☐ Your own personal collection of literature

- ☐ Retail stores and their online stores that sell this literature (e.g. Ostinato)
- ☐ Free online services focusing on music (e.g.. Aleatori. other open courseware - e.g. MIT, Bach bibliography, Beethoven gateway DOAJ - Journal of Music History Pedagogy, DOAJ - Journal of Seventeenth-Century Music)
- ☐ Other online and media services (incl. Delicious.com, discussion forums, email lists)
- ☐ Printed or electronic collections from other libraries or archives
- ☐ Other information sources examining music theory, please define?

3.5 Information examining music but not directly the qualities manifest in it (such as music history, philosophy of music, aesthetics of music)

3.5.1 How important is information examining music but not the qualities directly manifested in it (such as music history, philosophy of music, aesthetics of music) in the current phase of your theses task? Choose one of the following.

- ☐ Not at all important
- ☐ Not that important
- ☐ Important
- ☐ Very important

3.5.2 Explain your previous answer

3.5.3 What information sources incorporating this information mode have you acquired or utilised during your thesis task? Choose all options that apply. Mark all applicable information sources.

- ☐ Sibelius Academy Library's collection of printed books, printed journals and other printed materials
- ☐ Sibelius Academy Library's collection of printed theses
- ☐ Sibelius Academy Library's collection of electronic materials and databases (e.g. RIPM, IIMP), including materials such as electronic journals, theses and electronic encyclopaedias
- ☐ Sibelius Academy Library's eThesis database and its electronic theses
- ☐ Materials or suggestions received from the personnel of Sibelius Academy Library
- ☐ Materials or suggestions received from the teaching and academic faculty of Sibelius Academy
- ☐ Materials or suggestions received from other students of Sibelius Academy
- ☐ Materials or suggestions received from your networks outside your academic institution
- ☐ Your own personal collection of literature
- ☐ Retail stores and their online stores that sell this literature (e.g. Ostinato)
- ☐ Free online services focusing on music (e.g.. Aleatori. other open courseware - e.g. MIT, Bach bibliography, Beethoven gateway DOAJ - Journal of Music History Pedagogy, DOAJ - Journal of Seventeenth-Century Music)
- ☐ Other online and media services (incl. Delicious.com, discussion forums, email lists)
- ☐ Printed or electronic collections from other libraries or archives
- ☐ Other information sources examining music theory, please define?

3.6 Information not examining music (e.g. scientific writing, educational sciences, sociology, philosophy or fiction)

3.6.1 How important is information not examining music in the current phase of your thesis task (e.g. scientific writing, educational sciences, sociology, philosophy or fiction)? Choose one of the following.

- ☐ Not at all important
- ☐ Not that important
- ☐ Important
- ☐ Very important

3.6.2 Explain your previous answer

3.6.3 What information sources incorporating this information mode have you acquired or utilised during your thesis task? Choose all options that apply. Mark all applicable information sources.

- ☐ Sibelius Academy Library's collection of printed books, printed journals and other printed materials
- ☐ Sibelius Academy Library's collection of printed theses
- ☐ Sibelius Academy Library's collection of electronic materials and databases (e.g. RIPM, IIMP), including materials such as electronic journals, theses and electronic encyclopaedias
- ☐ Sibelius Academy Library's eThesis database and its electronic theses
- ☐ Materials or suggestions received from the personnel of Sibelius Academy Library
- ☐ Materials or suggestions received from the teaching and academic faculty of Sibelius Academy
- ☐ Materials or suggestions received from other students of Sibelius Academy
- ☐ Materials or suggestions received from your networks outside your academic institution
- ☐ Your own personal collection of literature
- ☐ Retail stores and their online stores that sell this literature (e.g. Ostinato)
- ☐ Free online services focusing on music (e.g.. Aleatori. other open courseware - e.g. MIT, Bach bibliography, Beethoven gateway DOAJ - Journal of Music History Pedagogy, DOAJ - Journal of Seventeenth-Century Music)
- ☐ Other online and media services (incl. Delicious.com, discussion forums, email lists)
- ☐ Printed or electronic collections from other libraries or archives
- ☐ Other information sources examining music theory, please define?

Appendix B
Interview guide used in Studies III and IV

Background information

1. What is the topic of your thesis?
2. Why did you choose this topic?
3. Were you acquainted with this topic before? How and when?
4. Do you have a focus in your topic? Are you able to define your focus in detail?
5. What significant problems have you encountered during your project?
6. Are you able to assess the timetable of your project at the moment?
7. How do you plan to proceed with your project?
8. What kind of information needs do you have at the moment?
9. What do you find encouraging in your project?
10. What do you find discouraging in your project?
11. Have your feelings changed during your project?
12. How do you see your information retrieval skills? How much have you used information retrieval system?
13. Do you feel that participating in this study has changed the way you seek information? If so, how?

Questions concerning music information modes

1. Why has this information mode has been important for your thesis project? Alternatively, why has it not been important?
2. Has the meaning of this information mode changed during your project? If so, how?
3. Are you able to utilise this information mode as a part of your written thesis? Has this information translated to the level of the written thesis? Have you encountered problems regarding this translation? If so, please specify.
4. Has your information seeking regarding this particular information mode changed during your project? If so, how?
5. From the information sources you chose in the questionnaire, please choose the three most important- Please explain why you chose these three.
6. Did you encounter problems when searching for this information? If so, please explain why.
7. While undertaking your project, have you had significant emotional experiences related to this information mode? If so, how have they affected your thesis project?

PUBLICATIONS

PUBLICATION I

A typology of music information for studies on information seeking

Rousi, A.M., Savolainen, R. and Vakkari, P.

Journal of Documentation, Vol. 72 No. 2, pp. 265-276
https://doi.org/10.1108/JD-12-2018-0210

Abstract

Purpose - A need to renew music-related information notions arises from both information-seeking models and literature of musical semiotics. The present article creates a music information typology, which aims at facilitating the examination of music information types at varying levels of abstraction in the context of information seeking.

Design/methodology/approach - Literature of musical semiotics and information seeking are juxtaposed to develop a novel approach to music-related information. The grounding concepts are Bruner's enactive, iconic and symbolic modes of representation. The modes of representation offer a universal scheme of knowledge that is applied to the domain of music by defining their content through Tarasti's *Theory of musical semiotics.*

Findings - This conceptual paper results in a music information typology ranging from the enactive music information representations to the abstract ones as follows. Music making as the first mode of enactive representations; music listening as the second mode of enactive representations; iconic representations of music; technological models of music as the first mode of symbolic representations; and ideological models of music as the second mode of symbolic representations.

Originality/value - The present article develops a music information typology that encompasses broadly different music information facets by categorizing music information sources according to their level of abstraction. When applied into empirical research, the typology opens a new window into the perceived roles of music information types in the context of information seeking.

Keywords Information representations, Information search process, Information seeking, Music, Music information, Musical semiotics

Introduction

The domain of music offers an opportunity for self-contemplation and renewal of information notions used in information science research. What does it mean to know about music? How is information science approaching music information? It is likely that the traditional scope of the notions of information does not cover all aspects relevant to representing music information for information-seeking studies. The validity of our information notions should be from time to time tested with theories of knowing and information emerging from particular domains such as music. The aim of this paper is to extend the

notion of information used in information-seeking studies to include facets relevant for representing music information, too.

The juxtaposition of Tarasti's (1994) *Theory of musical semiotics* and Kuhlthau's (2004) *Information search process* (ISP) *model* creates the starting point for this study. In their works on musicology and musical semiotics, Bengtsson (1977) and Tarasti (1994) examine the different systems of description relevant to musical communication. According to Bengtsson (1977), the concept of tone may refer to a notated tone, a measurable frequency or an aural experience. Tarasti (1994, p. 4) adds to the latter the gestural language, which is needed to transform a notated tone into both a measurable frequency and an aural experience. Tarasti (1994) affirms Bengtsson's (1977, p. 18) claim that these different systems of description should be held as separate and that it cannot be assumed that the possibility of direct transformation between these systems exists. The problem of transformation is reflected in Kuhlthau's (2004, p. 112) ISP model. It suggests that information types at varying levels of abstraction have differentiated interpretations, and that these interpretations can undergo change as the information-seeking process progresses.

Studies of music scholars' information seeking have shown that their work is based on a dialogue of different information types, such as music per se, notations and literature (Brown, 2002). However, the information notions used in these studies confine to textual information and they do not attempt to examine the interpretations of other information types. Neither from the research branches of music information retrieval or everyday life music information seeking can one find information notions designed for examining the interpretations of various music information types in the context of information seeking. Tarasti's (1994; also Bengtsson, 1977) claim about the problem of transformation between music information types and Kuhlthau's (2004) statement about the possibly developing differentiated interpretations of information types at varying levels of abstraction assert from a need to renew information notions used in examining music-related information seeking.

To elaborate the above issues, the present article develops a music information typology where the information sources are categorized according to their level of abstraction. By approaching music information through the level of source abstraction, the perceived roles given to a source category can be examined. The typology opens a new window into the perceived roles of different music information types, such as first-hand playing and music listening, within music-related information seeking. This approach not only broadens information science's understanding of the roles of different music information types, but also helps to understand how people can seek music information at varying levels of abstraction. When applied to empirical research, this typology produces new kinds of user behaviour

data, for which there is a demand in the fields related to music information-seeking behaviour (see e.g. Brown, 2001; 2002; Lee and Downie, 2004; Hunter, 2006; Liew and Siong, 2006; Casey *et al.*, 2008; Laplante, 2008).

The grounding concepts of the novel information typology are Bruner's (1966) enactive, iconic and symbolic modes of representation. Bruner's modes of representation offer a universal scheme of knowledge that is applied into the domain of music by defining their content through Tarasti's (1994) *Theory of musical semiotics*. Even though the focus of the present study is placed on the domain of music, the principles behind the construction of the typology can be applied to any domain of knowledge.

Since the present study deals with sign systems other than written or spoken language, it is important to define how such systems are identified in the development of the framework. The grounding concept of the article is music-related information seeking, and it encompasses as object of seeking all music-related information, be it in audible, written or notated form. When referring to the audible non-conceptual[i] information types of performing and listening to music, for example, the concept of music per se is used.

This article is structured as follows. First, the problem statement is defined through Bruner's (1966) concepts of enactive, iconic and symbolic mode of representation. What follows is a literature review of information notions used in the research branches of research describing and modelling information seeking of music scholars and students, everyday life music information seeking and music information retrieval. Thirdly, the problem of musical knowing is discussed and approached through Tarasti's (1994) work on music semiotics. What follows is merging of Bruner's and Tarasti's works resulting in a novel information typology for studies on information seeking. The final chapter discusses the integration of the typology into empirical research.

Problem statement

As stated above, Kuhlthau's (2004) ISP model claims that information source's level of abstraction affects its interpretation in information seeking, and that this interpretation can undergo changes as the information seeking progresses from a stage to another. When examining information sources at varying degrees of abstractness, Kuhlthau (2004) borrows Bruner's (1966) concept of mode of representation. According to Bruner, any domain of knowledge, and every single problem within that domain, can be presented to the learner through using three modes of representation. *Enactive mode* of representation refers to sequences of activities for creating desired results. *Iconic mode* of representation refers to presenting a concept through a graphic without exhaustively defining it. Most abstract of modes is the

symbolic mode where through a system that defines rules of expression, a set of arguments is created for describing a concept. (Bruner, 1966, pp. 44-45.)

From the works of Bruner and Kuhlthau, the following question concerning music-related information seeking can thus be derived. How to define the different modes of representation while examining music-related information seeking?

Literature review

Previous studies have provided diverse approaches to music information. Often, studies describing and modelling information seeking and needs of music scholars review information behaviour among humanists in general (Brown, 2002, p. 74). Despite important works in this area (Brown, 2002; Hunter, 2006; Liew and Siong, 2006; Inskip, Butterworth and MacFarlane, 2008), emphasis on textual information seems to create a one-dimensional notion of information that does not make visible the perceived roles of the other information types. The branch of research primarily focusing on the source preferences and user satisfaction among music scholars and students (Brown, 2001; Lai and Chan, 2009; Dougan, 2012) often examines the perceived helpfulness of a set of pre-categorized sources of information. While these studies are very usable in collection development, they are less relevant for the interpretation of information types at varying levels of abstraction.

The context of everyday life music information seeking differs from the settings of vocational and school-related information seeking. Everyday life music information seeking and needs constitute not so much a goal-oriented activity, but are often initiated by hedonistic, social and cognitive needs, such as identity constructing, mood managing, maintaining interpersonal relations and alleviating monotony (Cunningham, Reeves and Britland, 2003; Laplante, 2008; Laplante and Downie, 2011; see also Bourdieu, 1984 and DeNora, 2002). In contrast to vocational and school-related information seeking, everyday information seeking is "definitionally unsystematic in order to incorporate counter-productive-type behavior" (Spink and Cole 2001, p. 301). As the above views differ considerably, it seems difficult to transfer information notions between them for the purposes of creating a framework for examining the perceived roles of varied music information types within an information-seeking process.

The research of music information retrieval (MIR) focuses on, and evaluates, different methods through which individual pieces of music can be accessed in a MIR system. Within this branch of research, the notion of information is, by necessity, more system- than learner oriented. (e.g. Downie, 2003; Downie, 2004; Lee and Downie, 2004; Casey *et al.*, 2008, see also Laplante, 2008, p. 49.) A good example of the latter is Downie's (2003, pp. 293-301) specification of seven facets of music information, which consists of

pitch, temporal, harmonic, timbral, editorial, textual and bibliographic facets. Coherent to MIR research, these facets approach music-related information mostly from the viewpoint of interacting and utilizing MIR systems, and provide a useful summary of the challenges for MIR system design. However, the typology is not well suited to the examination of behaviour of a person engaged in a music-related complex learning task in which first-hand music playing or varied literature may be of importance. Also semiotic approaches have been used in MIR system design (Inskip, MacFarlane and Rafferty, 2007).

Because the content of the different modes of representation within the domain of music are hard to derive from the previous research, the present study draws on the ideas developed by Tarasti (1994). What follows is a development of the content for Bruner's (1966) original concepts of different modes of representation through Tarasti's (1994) work. This development results in an information typology ranging from enactive music information representations to abstract ones. This typology can be used as a basis while categorizing different information sources within instruments of data collection. When applied to longitudinal studies, the typology opens a novel window into the roles of different music information types.

Musical knowing and semiotics

The problem with musical knowing, i.e., what it means to know about music, presents itself in a complex and problematic manner. According to Bengtsson (1977) the *concept of tone* (our italics) may refer to a notated tone, a measurable frequency or an aural experience. Tarasti (1994, p. 4) adds to the latter also the gestural language, which is needed to transform a notated tone into both a measurable frequency and an aural experience. Musical knowing therefore transpires also within sign systems, which are inherently non-conceptual (Ibid.). Bengtsson (1977, p. 18) stresses the importance of keeping the different systems of description as separate categories. We cannot assume that the possibility of direct transformation between these sign systems exists (ibid.). Yet, according to Tarasti (1994, p. 4) and Bengtsson (1977, p. 23), it is insufficient to state that musical knowledge is merely transmitted through the musical non-conceptual sign systems. As no sign system works in a vacuum, but in interaction with other systems, also verbal sign systems have had an important role in transmitting musical tradition (Tarasti, 1994, p. 4). Due to the detached nature of the different sign systems, it is important to take into consideration the process of translation, with its imperfect nature, taking place between the systems (Bengtsson, 1977, p. 18). According to Tarasti (1994, p. 4), the most radical translation occurs when a person is trying to explicate his or her aural experiences into conceptual information. Acknowledging the problem of transformation between the representation types is essential in gaining further understanding about their perceived roles

within information seeking. However, the mere multitude of differentiated information representations relevant to music pose a challenge to approaching them in information-seeking research.

Another problem related to approaching music information is the ability of music per se to form symbioses with other forms of humane self-expression. A melodic line that weaves with a vocal text creates structure, which is more than the mere melodic line. The latter kinds of symbioses can also be seem to be produced with for example music and dance and music and theater. (Bengtsson, 1977, p. 5.)

Tarasti (1994) strives to create an improved method of musical semiotics that takes into account the procedural and developing nature of music. One of the procedural traits of his method is that it accounts also for the musical happenings 'in absentia', that is unrealized but possible musical solutions. Tarasti (1994) thus creates a method for studying the semiosis created by musical discourse[ii]. His comprehensive theory provides a fertile ground for the purposes of present study, since it also examines musical discourse's relation to the conceptual models that influence its formation. It seems necessary to clarify that although our study is influenced by Tarasti's (1994) work, in the present article no individual pieces of music will be analyzed. Tarasti's (1994) work is used as a point of departure in creating a synthesized information typology. Respectively, even though Bruner's (1966) theory of instruction is used as a starting point for the framework, the goal of the present study is not to create a theory of musical instruction. What follows is the juxtaposition of Bruner modes of representation with concepts used by Tarasti to classify sign systems relevant to music and to define the manifest level (i.e. conceptual) models used in forming a musical discourse.

Science of gestures and ideological and technological models of musical communication

Tarasti (1994, p. 4) affirms that the concept of tone may also transpire through a tactile mode of knowing, that is, through gestural language of muscular movements and touches that a performer translates, for example, a score into an aural experience. According to a French school, piano playing could be referred to as "a science of gestures" (Ibid.). When attempting to posit the science of gestures into the Bruner's modes representation, the following remarks can be made. As Bengtsson (1977, p. 17) states, the performing musician also receives the aural experience generated through his or her instrument. This creates a system of simultaneous feedback, which continuously affects the musician's performance (Ibid). Research on how music making effects the human brain states that this interaction is diverse, ranging from, for example, hearing, interaction with memory (and thus with e.g. expectations related to cultural intonations), gestures to visual interaction (Levitin, 2007). The present article differentiates this mode of enactive information of music making from the mere receiving or listening of music, as this mode provides

means of control over the sonic reality. The former mode of enactive information will later on be referred to as the 'first enactive' mode, whereas mere receiving or listening will be referred to as the 'second enactive' mode. This naming is used purely for distinguishing between the modes. As also music receiving and listening incorporates a myriad of possible interactions, it would not seem appropriate to define these concepts respectively as for example 'multi-enactive' and mere 'enactive'[iii]. Whereas the term 'music making' may in its common use refer to either playing or composing music, here it is used in a broader meaning to illustrate the information resided in all sequences of actions that aim to produce sounds for musical purposes.

Tarasti's (1994) theory of musical semiotics bears also two other concepts, which this study finds meaningful for the creation of a typology of musical information. These concepts are technological and ideological models of musical communication, which have the function of guiding and influencing the formation of the musical discourse (Tarasti, 1994, p. 15). With technological models of musical communication, Tarasti (1994, pp. 16-17) refers to the manifest (i.e. conceptual) information mediating structural aspects of music, such as studies of harmony, counterpoint and composition. According to Tarasti (1994, p. 17), some of this technological knowledge is in some cultures transferred orally, such as music's interpretation in western music tradition. Therefore, the concept of technological models examines the structures of both tonal organization, for example harmony, thematicity and counterpoint, and the sonic formulae, for example orchestration and interpretation. As this technological knowledge strives to translate the structures and qualities present music per se into symbolic representations, this work considers it as the 'first symbolic' mode in its information typology.

Ideological models of musical communication Tarasti (1994, pp. 16-17) defines as "formed by models of thought which determine all symbolism related to music". In all musical societies one can also find rules and norms, which evaluate music accordingly (Tarasti 1994, p. 16). As presentations of these ideological models, Tarasti (ibid.) presents for example tracts, critiques and manifestos of schools of composing. From Tarasti's concept of ideological models, the present article derives its most abstract mode of information representation. These representations of information function outside mere structural qualities of music per se and links and negotiate music concerning conceptual symbolisms with other systems of conceptual symbolic representations. In other words, they negotiate the relationship of e.g. conceptual systems of 'western classical music' and 'history' or 'music' and 'aesthetics' or 'western classical music' and 'education'. The relationship of these conceptual systems may be discussed and negotiated without reference to actual structures and qualities of music per se. This mode of representation will be later on

referred to as the 'second symbolic' mode and it may be seen as a derivative of Tarasti's (1994) original concept of ideological models of musical communication.

The derived first symbolic mode, which examines for example harmony and counterpoint, and the second symbolic mode, which reviews, for example, aesthetics and history of western classical music, are no separate entities. For example, the technological models of harmony and counterpoint are closely weaved with the history of western music, which is evident in concepts such as 'Palestrina style counterpoint'. Thus, the same sources can very well include both types of information. In some cases, it is only through the information-seeker's need of either one of the information types that this separation transpires and can be examined. Also Tarasti (1994, p. 17) stresses in his examination of the original concepts that "the technological and ideological models can cooperate in several ways" and develop independently of each other.

As the present study has now defined both the enactive and symbolic ends of its typology, the next task is to fill out the remaining mode of representation presented by Bruner (1966), that is, the iconic mode. The in essence differentiated nature of graphical notated and conceptual symbolic musical representations are discussed, for example, by Adorno (2006, p. 168) as follows.

> "[…] in fact, one could even see musical notation as no more than a pseudomorphosis towards the realm of verbal terms. The fact that it has to borrow its signs from verbal writing shows how alien it is to its terms […] The name 'A' can be removed from the note A without the slightest loss of musical definition; it would be a futile undertaking, however, to attempt a separation of the letter a and the vowel *a*."

A detailed definition of iconic musical signs in the semiotic sense is a complex task (see e.g. Tarasti, 1994, pp. 54-57) and way beyond the scope of the present article. This task also becomes more complicated due to the intermingling of signs, which often renders it difficult to distinguish a pure iconic sign, for example (Tarasti, 1994, p. 58; see also Petrilli and Ponzio, 2005, p. 30). An important aspect in our approach to the definition of iconic representations of music is Bruner's (1966, pp. 44-45) idea of iconic representations as "graphics and diagrams, which describe a concept without defining it fully". Different systems of music notation seems to fit well with Bruner's definition of iconic representations, as different technological structures can be derived[iv] from the same notation (Tarasti 1994, p. 31). Also notation can be interpreted, or modalized in Tarasti's (1994, p. 39; also Adorno, 2006, p. 163) terms, in various ways, allowing for the performer great power over the musical message. The present study thus approaches iconic representations of music as graphic illustrations presenting music-related information, of which different

notations, such as modern staff notation, function as an example. The above semiotic simplification is also present in the ways our study approaches the concepts of enactive and symbolic modes musical information. As Tarasti (1994, pp. 53-58) states, music per se, which we classify as enactive information, can be seen to articulate indexes, icons and symbolisms both in relation to its surroundings and in relation to itself. Even though Tarasti's (1994) theory of musical semiotics influenced the typology presented below, it is not semiotic in nature, but builds on Bruner's (1966) ideas of modes of representation.

A typology of musical information

As a synthesis derived from the studies discussed above, a typology of musical information is presented. The typology's purpose is not to exhaustively classify phenomena as belonging to one information type alone. The position and needs of the information seeker play a crucial role in providing the angle through which the different modes of representation transpire. We argue that this approach can be used to gain understanding about the perceived roles of various information types present in music-related information seeking

Music making as the first mode of enactive representations

This mode of representation refers to concrete action to produce sounds for musical purposes. This action may appear in varied forms, such as playing the violin, singing or creating electronic music with a computer. This mode is close to the concept of 'science of gestures' (Tarasti 1994, p. 4). Whereas the term 'music making' may in its common use refer to either playing or composing music, here it is used in a broader meaning to illustrate the information resided in different sequences of actions that aim to produce sounds for musical purposes.

Receiving music as the second mode of enactive representations

This mode refers to receiving musical performances of others, whether being present in the moment of the creation or through a recording, but without the possibility of control over the sonic results. The lack of this control is seen to produce a distinction between the level of interaction present between this mode and the first enactive mode. This information mode, as also the first enactive, should be conceptualized broadly enough to encompass also situations where music is present as a part of a symbiosis, as discussed by Bengtsson (1977, p. 5).

Iconic representations of music

Iconic representations of music refer to the graphic illustrations presenting music-related information. Different notations, such as modern staff notation, function as an example of these kinds of representations.

Technological models of music as the first mode of symbolic representations

This mode of representation is derived from Tarasti's (1994, pp. 16-17) concept 'technological models of musical communication'. It refers to the structures of both tonal organization (e.g. harmony and counterpoint) and sonic formulae (e.g. orchestration and interpretation), and strives to translate these structures to symbolic representations. In contrast to the mode that follows, the structures examined transpire in the enactive information modes.

Ideological models of music as the second mode of symbolic representations

The typology's most abstract mode of representations is an extension of Tarasti's (1994, pp. 16-17) original concept of 'ideological models of musical communication'. This second mode of symbolic representations addresses music but not directly the qualities that transpire in the enactive modes of representation. It functions as information that negotiates music concerning conceptual symbolism with other fields and their conceptual representations. For example, it is possible to produce narratives on concepts such as 'western classical music' and 'history' or 'music' and 'aesthetics' without reference to actual phenomena present in music per se. Both the first and second symbolic modes appear in the forms of spoken and written language. Information sources that incorporate both the first and second modes of symbolic representations are, for example, textbooks of harmony and counterpoint. Examples of information sources that can be more geared towards the second symbolic mode include monographs on philosophy of music and some texts concerning the history of music, such as some biographies of composers. The two symbolic modes are not separate entities and it is often only through the information seeker's need that this division into these two levels of abstraction transpires (see also Tarasti 1994, p. 17).

Discussion

The present article developed a novel music information typology that encompasses broadly different music information facets by categorizing music information sources according to their level of abstraction. In the development of our typology we utilized Tarasti's (1994) *Theory of musical semiotics* to derive the content for Bruner's (1966) modes of representation within the context of music information. The result

is a continuum ranging from the enactive music information representations to the abstract ones as follows: music making as the first mode of enactive representations; music listening as the second mode of enactive representations; iconic representations of music; technological models of music as the first mode of symbolic representations; and ideological models of music as the second mode of symbolic representations.

The typology can be used to restructure research of music-related information seeking. Previous studies on information seeking among music scholars, for example, have not defined separate types of music information as information in their own right, subject to diverse interpretations and roles in information seeking. With the help of the typology, research questions may now be posed at the level of individual types of music information. For example, coherent to Kuhlthau's (2004; see also Nahl, 2007) ISP model, the emotional dimensions of individual music information types affecting the overall attitude towards an information-seeking task can be examined through empirical research. Longitudinal studies can be designed to examine various developments at the level of individual music information types as the information-seeking task progresses. For example, it can be examined how the perceived role and importance of music listening change at diverse stages of information seeking. Furthermore, using the typology as a starting point, the relations of the different types of music information within an information-seeking task can be examined. This broader approach to music information is more coherent with the notions of knowledge present in music semiotic works (Tarasti, 1994) and also Kuhlthau's (2004) ISP model.

What follows is a set of example questions that can be generated via approaching music information through the typology presented in this paper. Are there emotional dimensions linked to, for example, music making or ideological models of music, which affect the overall attitude towards an information-seeking task? How are music making, notation-based analyses and writing connected in an information-seeking task? Does the perceived role of music listening change, when such tasks commence? Does the perceived importance of individual music information types undergo change as the information-seeking task progresses? What task affecting decisions are made by listening others perform a piece? Finally, how is music-related literature seen to affect performing of pieces?

When using the above typology in empirical research, the following addition can be made. For example, university level music students might also have other than music-related information needs, such as information needs about academic writing. In order to get a more holistic view of, e.g., music students' information-seeking behaviour, a sixth information type titled 'other symbolic information' could be added to the five types of music information presented in the typology. The latter is supported by Brown's

(2002, p. 82) finding, that over 85% of the music scholars who participated in her research used sources from other than music-related disciplines.

When music information sources are approached at their varying levels of abstraction, the breadth of sources in examination becomes larger than used in previous research. Especially information sources concerning the enactive modes of representations of music come to fore in studies having a broader scope. Examples of sources of the first mode of enactive music information representations include private rehearsing and rehearsals in an educational institution. The perceived roles of such representations in information seeking should be examined in future studies.

As discussed previously, it is hard to strictly classify phenomena solely belonging to a single music information type. This becomes an issue if a researcher strives to pre-classify information sources according to the typology. For example, being present at musical performance could be considered both as a source of both first enactive representations, that is, a study of the twofold interaction of the performer creating the music, and the second enactive representations, that is, a study of the mere audible qualities the performed musical piece. A musical performance could also be approached as a manifestation and an example of an interpretative device, and thereby an example of a technological model in action.

There are, however, some arguments that we find to support pre-classification of sources when the typology is applied into empirical research. As stated by Tarasti (1994, p. 4), it is very difficult it explicate musical experiences into conceptual wordings. It is thus reasonable to presume, that this difficulty is also faced when an information seeker strives to describe their rationale behind acquiring, for example, first or second modes of enactive musical representations. This task is not helped by the typology that is very abstract in nature. Therefore, even a rudimentary pre-classification of sources might help the interviewee to understand the concepts of differentiated music information modes. Even though the pre-classification of sources results in simplification, it could still provide a preliminary structure of research.

The functionality of the typology will be verified by applying it into empirical research. It is only through longitudinal empirical studies possible to examine, for example, Kuhlthau's (2004) statement about the developing nature of the interpretations of information sources at different levels of abstraction. Key factors in successful empirical applications include sufficient time between the observations of a longitudinal study and the use of detailed qualitative methods, such as interviews and questionnaires with open-ended question types. University level music students are one of the optimal target groups for empirical applications, as through their training they have a high readiness to explicate how they see diverse information types affecting the procedure of writing a dissertation proposal, for example.

Even though the focus of our study is in the domain of music, the principle of categorizing information sources according to their level of abstraction can be applied to any domain of knowledge. As stated by Bruner (1966), any domain of knowledge can be approached through the modes of representation. This approach could be particularly useful while examining information-seeking behaviour in domains where the enactive information representations play a significant role in learning.

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[i] With the possible conceptual symbioses included (see e.g. Bengtsson, 1977, p. 5)

[ii] The concept of musical discourse is understood in Tarasti's (1994, p. 16) theory as a discourse in a broad sense, including music per se, i.e. its tonal realization, and also its perception in the collective musical consciousness and its notation.

[iii] Even though this study draws from semiotics, the epithet 'first' should not be confused the semiotic Peircean 'firstness', which is present in both first and second enactive modes of this study (see e.g. Petrilli and Ponzio, 2006).

[iv] One of the Brown's (2002, p. 86) examples stated by a music scholar also illustrates this multitude of possible interpretations. "What happens is, you have an [notated] example, then go to the word processor and you write it up, and the example sort of fades into the background [...] Then you read it and look at the example and say, 'Wait a minute, this isn't exactly what happened.' You go back to the example and look at it and realize you have to rewrite the passage [...] This constant going back and forth is a real feature of writing about music."

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PUBLICATION II

The modes of music information in a compositional process. A case study

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Journal of Documentation, Vol. 74 No. 5, pp. 987-1007
https://doi.org/10.1108/JD-10-2017-0141

This is a post print version of an article in Journal of Documentation, available online: https://doi.org/10.1108/JD-10-2017-0141

The modes of music information in a compositional process: a case study

Abstract

Purpose - The aim of the present article is to demonstrate an actual compositional process that entails a diversity of music information modes and describe the way these modes contribute to the creative aspirations of a composer.

Design/methodology/approach - The music information typology proposed by Rousi, Savolainen and Vakkari is used as a point of departure for defining the different modes of music-related information. First, relevant music information modes are identified from the composer-informant's verbal description of a compositional process. Then, their proportions and dynamics are examined.

Findings - The findings suggest that the music information typology may be applied within the context of musical composition, that is, all of its five modes of music information could be identified from the composer's verbal description of the compositional process. However, two additional significant information modes were identified: shaping music as the third mode of enactive representations and genuine iconic representations.

Originality/value - This study introduces a new mode of music information indicative of the artistic capacity of expressiveness: shaping musical structures as the third mode of enactive representations was the means whereby the composer made musical structures work for himself and hence created performative power in his music.

Limitations - The purpose of this case study is not to claim that the results regarding the significance of individual music information modes apply to all compositional processes within diverse genres of music.

Keywords – Information representations, Music, Musical composition, Music information, Musical semiotics

Introduction

For centuries the act of professional music composing has been held as pinnacle of creative music behaviour within the Western cultural sphere. Moreover, knowledge production 'in, through, and with art' (Borgdorff, 2011, p. 44) has been under an intensive debate in the recently emerged discipline of artistic research. However, little is known regarding the information substance of the act of musical composition. In his work on musical semiotics, Tarasti (1994) examines the different systems of description relevant to musical communication. According to Tarasti (1994, p. 4), musical knowing transpires within diverse sign systems of which some are inherently non-conceptual, such as gestural language of music making and aural experiences of music. It is not self-evident how these modes of music information should be defined when examining the information substance of professional music composing. Studying the information substance of musical composition could help to understand the complex creativity behind this quintessential music behaviour. Prior to the present article, studies focusing on information substance of musical composition have been scarce (see, however, Zembylas and Niederauer, 2018).

The present article examines the modes of music information reflected in contemporary classical music composer's verbal description of a compositional process. We define information in its broadest sense as various kinds of entities that are being learnt in a social context and are conveyed or represented by a particular arrangement or sequence of different kinds of things, which again may be objects, actions, events, or thoughts. The aim of the article is to demonstrate an actual compositional process that entails a diversity of the pivotal music information modes and describe the way these modes contribute to the creative aspirations of a composer. To this end, an explorative case study was conducted by drawing on the music information typology proposed by Rousi, Savolainen and Vakkari (2016) in order to examine the roles of music information of different kinds in one compositional process by a composer. The typology identified five modes of music information: music making as the first mode of enactive representations; music listening

as the second mode of enactive representations; iconic representations of music; technological models of music as the first mode of symbolic representations; and ideological models of music as the second mode of symbolic representations. Once relevant music information modes have been identified from the composer-informant's verbal description of a compositional process, their proportions and dynamics are examined. The informant of the study was an academically trained Finnish composer engaging in modernistic aesthetics within the Western art music tradition. The data of the case study consist of interviews and manuscripts that were employed to track one compositional process of a professional composer in the studies of Pohjannoro (2008; 2014; 2016). These studies also enable the process approach of the present article by providing a framework for the review of the compositional process as comprising of three stages.

The findings of the present article suggest that the above typology is fairly specific for the needs of examining a real-life compositional process in that all five modes of information could be identified from the composer's verbal description as relevant constituents of the compositional process. The findings revealed, however, that the typology is not sufficient within this context as two additional modes of music-related information relevant to musical composition were identified from the empirical data. In the composer's verbal description, the enactive modes were reflected not merely as the corporeality of playing an instrument and as mental representations of musical sounds but also as inventing and shaping musical passages, which proved to be the pivotal form of information in the compositional process. Moreover, the reflections of the iconic mode may comprise visual perceptions and drawings. The reflections of the symbolic modes may comprise not only the verbal manifestations of musical tradition, such as analytical texts of aesthetics and music history, but also as the whole notational work of creating several manuscript versions and the final notated score of the piece.

The rest of this article is structured as follows. First, the problem of what constitutes as music information is discussed and the music information typology developed by Rousi, Savolainen and Vakkari (2016) is introduced. Second, a literature review of related studies is presented and the research design of our investigation is specified. What follows is the findings section where both the specificity and sufficiency of the above music information typology are examined. Additional modes of music information are presented and proportions of identified information modes within the compositional process are also examined in the findings section. The concluding section presents a revised music information typology for musical composition and discusses the findings and their significance.

Music information typology

In their works on musicology and musical semiotics, Bengtsson (1977) and Tarasti (1994) examine the different systems of description relevant to musical communication. According to Bengtsson (1977), the concept of tone may refer to a notated tone, a measurable frequency or an aural experience. Tarasti (1994, p. 4) adds also the gestural language (i.e. performing music with instruments), which is needed to transform a notated tone into both a measurable frequency and an aural experience. Musical knowing therefore transpires within varied sign systems, some of which are inherently non-conceptual (Ibid.). Yet, according to Tarasti (1994, p. 4), it is insufficient to state that musical knowledge is merely transmitted through the musical non-conceptual sign systems. As no sign system works in a vacuum, but in interaction with other systems, also verbal sign systems have had an important role in transmitting musical tradition (Tarasti, 1994, p. 4). The mere multitude of differentiated information representations relevant to music poses a challenge to approaching them in research focusing on information behaviour.

The typology of music information (Rousi, Savolainen and Vakkari, 2016) used as a point of departure in the present study was created by integrating Tarasti's (1994) music semiotic ideas with Bruner's (1967) approach to modes of knowledge representations introduced in Bruner's book *Toward a theory of instruction*. According to Bruner, any domain of knowledge and every single problem within that domain can be presented to the learner through using the following modes of representation. *Enactive mode* of representation refers to sequences of activities for creating desired results. *Iconic mode* of representation refers to presenting a concept through a graph without exhaustively defining it. Most abstract of the modes is the *symbolic mode* where through a system that defines rules of expression, a set of arguments is created for describing a concept. (Bruner, 1966, pp. 44–45.) The proposed typology further defined the content of

Bruner's modes within the domain of music by positioning sign systems relevant to music presented by Tarasti (1994) in *Theory of musical semiotics* into them, which led into altogether five following modes of music information (Rousi, Savolainen and Vakkari, 2016).

- *Music making as the first mode of enactive representations* refers to information resided in different sequences of actions that produce sounds for musical purposes. This action may appear in varied forms, such as playing the violin, singing or creating electronic music with a computer.
- *Receiving music as the second mode of enactive representations* refers to listening to musical performances, while being present at a live performance or through a recording, without the control over the performance's sonic results.
- *Iconic representations of music* refer to graphic illustrations presenting music-related information, such as a piece of music presented in modern staff notation.
- *Technological models of music as the first mode of symbolic representations* refers to examining structures of music, i.e., tonal organization of harmony and counterpoint and sonic formulae of orchestration and interpretation through symbolic means such as written language.
- The most abstract category of the typology is *ideological models of music as the second mode of symbolic representations*. This mode addresses music at a symbolic level but not directly the qualities that transpire in music *per se*. In this mode conceptual symbolism regarding music are negotiated with other fields and their conceptual symbolic representations. For example, it is possible to produce narratives on concepts such as 'western classical music' and 'history' or 'music' and 'aesthetics' without reference to actual phenomena present in sonic reality of music.

The typology's purpose is not to exhaustively classify phenomena as belonging to one category alone, since the position of approach plays a crucial role in providing the angle through which the different categories transpire. For example, the first symbolic mode, which examines harmony and counterpoint, and other musical parameters, and the second symbolic mode, which reviews aesthetics and history music, are no separate entities. The technological models of harmony and counterpoint are closely weaved with the history of Western art music, for example (Tarasti 1994, p. 17). As the above typology was originally intended to be used to categorize information sources in studies of information seeking, its modes of music information need to be further operationalised for the purposes of this study. These operationalisations are presented later in the research design section of this article.

Related studies

So far, Information Science lacks studies examining musical composition processes from the viewpoint of information substance. Information behaviour of professional composers has also been rarely investigated, with few exceptions, such as Hunter's (2006) study of electroacoustic composers. As with latter studies and those regarding information seeking of music scholars (Brown, 2002) and performing musicians (e.g., Kostagiolas *et al.*, 2015), the approaches so far have been based on second hand information sources, such as literature and audio recordings of music. Source-based approaches are often limited as they do not reveal how previously acquired knowledge and musical experiences affect creative musical processes. Moreover, the notions of information of previous studies are one-dimensional in that they omit the roles of the diverse modes of music information in these processes.

In composition research, the focus has usually been on the musicological and behavioural aspects. Each discipline has their specific targets: musical parameters and sketches (musicology; Donin, 2009; Donin and Féron, 2012; Roels, 2016), individual or group processes of novices or experts (music education; Barrett, 2006; Burnard, 2012), thinking processes and problem solving (psychology and cognition; Collins, 2005; McAdams, 2004), and divergent behaviour, insight, and imagination (creativity research; Bailes and Bishop, 2012; Hargreaves, 2012; Katz and Gardner, 2012; Wiggins, 2012). Few studies have concentrated on the actual information substance of composition by asking: what is being tackled when composing, what kind of information is being processed and created? The substance of composition is mostly reduced to concern the (notated) musical materials and structures on the one hand and the composers' impetus, and sources of inspiration at the beginning of the process on the other hand, whilst the compositional process in its totality, and the ways in which the different kinds of impetus is utilized are more or less overlooked.

Katz and Gardner (2012) found two sources of inspiration in compositional thinking: 'within-domain' processes comprised musical ideas and 'beyond-domain' processes, which were inspired by extra-musical metaphors and associations. Mountain (2001), based on composer's interviews and writings, categorized different sources of composers' inspiration and musical imagery into auditory, visual, multi-modal, kinaesthetic (e.g. dance), cross-modal, sound effects, and mixed metaphors that may sometimes attain 'the real world'. Roels (2016) organized the compositional ideas of eight professional composers into four levels of musical abstraction, the first three of which were musical (from structures and pitch systems to pitch, harmony and timbre) and the highest abstraction level being extra-musical (emotion, philosophical ideas, actions and theatrical ideas, visual images). Pohjannoro (2008) demonstrated the ideatic work of both musical and extra-musical ideas that incorporated all source types of inspiration identified by Mountain's (2001) study: audial, visual, auditive-structural, and philosophic-conceptual. Zembylas and Niederauer (2018) establish a system of compositional knowledge that encompasses practical and discursive knowledge, based on a collective case study of five composers. However, the interview data of their ethnographic study only partly covered compositional thinking as the focus was on the professional conditions of composers' artistic agency.

Research Design

Research questions

To investigate the modes of music information in one of the quintessential forms of musical behaviour, composition, the present paper addresses the following research questions.

- RQ1. To what extent is the music information typology presented by Rousi, Savolainen and Vakkari (2016) specific and sufficient enough in describing the modes of music information present in a composer's verbal description of his compositional process?
- RQ2. What are the proportions of identified music information mode instances per stages and phases of the compositional process and what are the roles and dynamics of such modes within the process as a whole?

By *specific* (in RQ1), we mean the extent to which the above music information typology is capable of describing the musical compositional process. Moreover, by the phrase *sufficient enough* (in RQ2), we refer to the extent to which there is a need to elaborate the typology by adding, modifying or deleting elements for the purpose of more detailed and apt description of the modes of information present in the compositional process examined in this article.

Data collection, handling and coding scheme

Our study utilizes empirical data to track one compositional process of a professional composer reported by Pohjannoro (2008; 2014; 2016). This rich data was considered yielding answers to the research questions of the study at hand. The informant of the study was an academically trained Finnish composer engaging modernistic aesthetics, whose professional career in the national and international Western classical music scene continues to be active since for over 30 years. The data were collected in the composer's studio between December 2004 and March 2005. The interviews were made using the informant's manuscripts as memory triggers to enhance his ability to remember the thinking process that produced them. This kind of *stimulated recall interview* technique is widely used in order to track thinking on action, without *thinking aloud* procedure that would disturb the process, especially the lengthy ones (Perkins, 1977, 1981, pp. 13–18, 36–37; Ericsson and Simon, 1993[1984], p. 106; Lyle, 2003; Collins, 2007). To minimize memory-related biases (Schwarz, 2007), the interviews in this study were conducted within a fortnight of the actual events. Further, the informant's reactive behaviour was carefully monitored (Nisbett and Wilson, 1977; Ericsson and Simon, 1993 [1984]) during the interviews, the composer's attention to the concrete manuscripts and to their specific points of interest was steered to avoid accounts of how he typically operates or how he thinks he should operate.

The verbal data comprise 12 interviews (406 minutes and 29,000 words of verbatim transcripts). The manuscripts include 4 material matrices, 11 sketches, and 17 score versions. All of the data, including the copies of the manuscripts, are in the possession of the first author, with the consent of the composer-informant.

The composition that was completed during the research process exemplifies a typical professional task of composing a commissioned instrumental piece without text or any extra-musical reference. The piece is a 15 minutes' quartet in three movements for percussion instruments. The movements of the complete composition are as follows:

First movement: T_1–S_1, T_2–S_2;
Second movement: T>S, T>S, T+S;
Third movement: m_0–m_1–M.[1]

The first movement is formed in a classical periodic ABAB structure, where the basic materials (called *T* and *S*, see findings) are introduced and developed. The second movement introduces transitions between *T* and *S*, culminating in the total fragmentation of both. The third movement is a coda-like contemplative progression of *S*'s melodic element, *m*, into the full melody, *M*.

The operationalisation of the music information typology in the verbal data, before redefining the typology (see findings section) has been done according to the following guidelines. The guidelines were constructed during the process of analysis and consummated together with the established new information modes, which is described in the Data analysis section. The new information modes identified from the empirical data are presented later in the Findings section.

- *Music making as the first mode of enactive representations*. The composer ponders about instrumentation or the playing technique of a musical instrument or speaks about a musician playing that instrument. How is this musical figure or section going to be played, how does the musician execute the composer's intentions indicated in the notation?
- *Receiving music as the second mode of enactive representation*. Because of the sensual character of this category, which is difficult or even impossible to verbalize, instances with a persuasive suggestion of involving a sound image are coded in this category. The category is most evidently present when the composer listens to his music in his 'mind's ear', or takes the stance of the listener. He may also refer to the tone colour of a tone or a passage, speak about the character of the music, or about how 'things distinguish themselves' (how a particular musical gesture may be perceived as a whole, distinguishable from its surroundings). Utterances about how a passage 'appears', 'takes shape' or shapes usually are interpreted as conveying sound images. However, when 'taking shape' refers to a larger unity or gestalt, the utterance is not coding in this category but in the new category of the third enactive mode (see findings section).
- *Symbolic-iconic representations of music.* The original *iconic representations of music* category presented in Rousi, Savolainen and Vakkari (2016) has been renamed as the symbolic-iconic representations of music. According to Goodman (1968), musical notations have strong symbolic elements, and only part of western art music notation is iconic. This category is all about writing musical notes (including rehearsal numbers of the score, performance instructions of different kinds, be they visual crescendo or diminuendo wedges or verbal expressions), or operating with the computer program. Many of the utterances in this category include episodes where the composer gives explanations to the scholar about the practical decisions on how to organize the space in the bars or which passages have been moved into where.
- *Technological models of music as the first mode of symbolic representations.* In this category, music is considered within music analytic-theoretic setting, in terms of musical structures or parameters (rhythm, melody, harmony, timbre, dynamics). The composer speaks about music that has already been composed (either into the score or intellectually in the composer's mind though not necessary written down yet), and the composer inspects what has been done, mostly without specific analytic terminology.

- *Ideological models of music as the second mode of symbolic representations.* The composer refers to conceptions or individuals in music history: what has been done in music before, or is done concurrently, which composer has been doing things alike, or how does the piece at hand, or a section of it relate to a certain aesthetic principle. When the composer refers to a common aesthetic principle, such as minimalistic aesthetics, or organic growth of the thematic material, the ideological model applies. The ideological category was differentiated from the technological category regarding their level of abstraction: utterances conveying ideological models refer to music as a psychological, sociological, historical, aesthetic phenomenon, whereas the technological category bears a closer relationship to notated or performed music. In the context of the modernistic (post-serial) disposition of the composer of this study, the compositional techniques of the past are coded into the second symbolic mode.

The compositional process

The present article utilizes the framework of the compositional process comprising three compositional stages that form altogether 18 compositional phases (substages), established through data-oriented approach in Pohjannoro's studies (2008; 2014; 2016). In the first compositional stage ('ideas'; phases I–V) the composer created the germinal ideas, materials and the formal structure of the piece and embarked on the score writing process by writing the first sections of the first movement. The second stage ('crisis'; phases VI–XI) was the active period of artistic ventures with proliferating compositional problems, a crisis and its resolution, the third stage ('adjustment'; phases XII–XVIII) being a smooth but tiresome endeavour of completing the piece. The details of the compositional phases and stages, their dates and the respective manuscript data are presented in Appendix 1.

Data analysis and validity issues

As noted above, the empirical data were gathered in 2004–2005, that is, about 13 years ago. However, the data are valid for the particular needs of the present investigation. All the empirical material was available in its entirety for re-coding and re-analysis. The empirical data are not outdated because each creative (art) process on the one hand produces an original and unique output thus being totally non-repeatable and on the other hand creative processes tend to change slowly as well as in an unpredicted way (Gruber and Wallace, 1999). Moreover, it is evident that due to their generic nature, the modes of music information identified by Rousi, Savolainen and Vakkari (2016) are relevant to the analysis of the compositional process, independent on a particular date when empirical material about this process was collected. The qualitative content data analysis was conducted as follows. First, the verbal data were segmented into data units and identified according to the modes of the coding scheme by the first author, within the framework of the compositional stages and phases (established in Pohjannoro, 2008; 2014; 2016). Here, the cross-validation of the verbal and manuscript data, each of which were unintelligible without the support of the other, was crucial. Next, the preliminary coding was assessed together with the composer-informant and the first author. As a result of the member check validation performed by the composer, the theoretical framework was modified by adding two new modes of music information to the original typology, which again prompted resegmenting and recoding, as well as identifications of previously problematic utterances. These additional information modes will be discussed later in the findings section. The coding scheme was also amended respectively. Finally, clarifications to the coding scheme were made on the basis of the second author's comments about the correctness, congruency and intelligibility of the comprehensive coding decision lists of all information modes. The length of the identified utterances varied from a couple of words to several sentences. Eventually, a total of 718 of the composer's utterances were identified to reflect a mode of music information.

Musical composition, combines a manifold set-up of sources, types, and operation modes of information (Donin, 2009; Donin and Féron, 2012; Pohjannoro, 2008; 2014; 2016; Roels, 2016; Zembylas and Niederauer, 2018, pp. 80–110). Identifying and discriminating the different information types in the verbal data is challenging, first due to the complexity of the phenomenon with the theoretical overlaps in its conceptual-theoretical frame, already mentioned. Second, the nature of the verbal data inducing artistic creation is bound to encompass multifarious information that is difficult or even impossible to verbalize.

Thus the problems of ineffability may have reduced the amount of sensory and other experimental aspects of compositional information (Pohjannoro, 2011). In summary, despite the manuscript data cover all of the composer's sketches and manuscripts (according to the testimony of the composer-informant), the verbal data are to include but a fraction of the compositional thinking during the whole process. The fractions most likely left uncovered are the thoughts that simply were forgotten or were for another reasons not discussed during the interviews and thoughts and experiences that could or would not have been verbalized. Furthermore, the fact that the piece under scrutiny represents music without text, program notes or such (often referred to as 'absolute music', i.e., music in its most abstract and non-referential form) may highlight the instances in the compositional process that reveal the use of any extra-musical and symbolic information.

Consequent to the above reservations, the qualitative content analysis process, regarding both the original and the established new modes of information, was neither linear nor equivocal, but cyclical and iterative. Within one sentence the composer might picture a visual image attached to audial ideas that again were verbalized with music theoretical terms, maybe even within a historical context. The manifoldness of the data induced further segmentation of the utterings and overlaps between the data units, apart from the continuous differentiation and delineation of the operational definitions and the coding scheme. Overall, a consensus between the researchers and the composer was pursued regarding the coding of utterances.

In order to examine the proportions of music information modes per stages and phases of the compositional process, the information mode instances identified in the data were placed into the compositional process framework (Pohjannoro, 2014; 2016) based on their location in the timeline of the verbal data (see Appendix 1). Although the number of observations was 718, there were not enough cases per cell for statistical testing. Therefore, and because of the qualitative case study design, descriptive statistics are given with the different compositional acts as variables according to the identified compositional stages and phases, under the support of the qualitative analysis of the critical compositional episodes within each phase. The micro level (phase-wise) analysis is included because of the inner versatility between the information modes within each stage (see findings) that nevertheless supported and substantiated the macro level (stage-wise) conclusions.

The purpose of this case study is not to claim that the results regarding the proportions of individual music information modes apply to all compositional processes within the diverse genres of music – even within this particular genre or within the different processes of the informant in this particular study. The proportions of these qualities may vary in proportions with regard to different genres and traditions (e.g. jazz or popular music with their little use little written notation), compositional purposes (absolute vs programme music, *Gebrauchsmusik*, *etc*.), individual characteristics and preferences (e.g. different typical sources of inspiration, synesthesia), just to name a few instances. However, in terms of analytical generalization (Yin, 2009, 38–39), this study demonstrates an actual compositional process that entails a diversity of the music information modes and describe the way these modes contribute to the creative aspirations of a specific composer. Acknowledging the rareness of previous studies, this approach is thought to yield compelling results which adds to understanding of the complexity behind the information formation in musical composition.

Findings

The enactive modes: Playing and listening to sounds

From the standpoint of a composer, music must be notated and instrumented in a way that the musicians know how to use their instruments to convert the score into live sounds. As stated in the coding scheme, the composer's consideration over how a certain musical passage could be executed, or his pondering about the instrumentation, instrumental techniques or idiomatic playing indicated the *first enactive mode* (music making). The data showed that musicians actually possess a virtual presence in the composer's studio, as the utterances reflecting the first enactive mode comprised 7.1 percent of the total verbal data.

The next citation exemplifies the composer using his knowledge about tom-tom playing technique. The target was the actual playing actions of the percussionist and how the very fast tempo makes it impossible for

him or her to change the mallets and again how this state of affairs prohibits the composer to change the tone colour (through changing the mallets), unless he would add some rests to the tom-tom part:

> Composer (C): Except that this first movement will continuously run so fast that there will be no time [for the percussionist] to change the mallets. Unless one somehow gets a break.[2]

Keeping in mind that the composer intends his music to be received, listened to, it is not surprising that 15.6 percent of the data represent *the second enactive mode* (receiving music). In order to anticipate how his music sounds before it is rehearsed or performed, the composer envisioned sound passages, both imaginary and already notated ones, in his 'mind's ear' (i.e. with inner hearing). Reading or writing notes may induce the respective sound image into a professional composer's mind due to education and experience. Apart from using his mind's ear, it is known to the interviewer outside the data that the composer also used MIDI playback to create an approximation of the sound image. The data suggest that musical imagination, where novel sounds and passages may pop into the composer's mind, may work unexpectedly in quite mundane circumstances, as in the next citation where the composer reported about the appearance of one of his germinal ideas of his percussion piece (emphasis added):

> C: For example, the other night I was late at work and went to take a shower. Suddenly, an idea about a *dense repetitive field of sounds with rhythms diverging* out of it popped into my head for the percussion piece. *It came with an image of a tone colour*. It was an *idea with a kind of sonic image attached to it.*

The following citations exemplify the composer's common work with sounds and sound images, which often were aspired to create a certain kind of character, impression, mood, or tone colour. Also, the style in which the composer verbalizes his perceptual experiments with musical instruments (the first enactive mode) and analytical accounts (first symbolic mode) can be discerned:

> Interviewer (I): Were you about to say something else about those images of tone colours?
> C: One is, for instance, these… Like tom-toms played with different kinds of stick. [1st enactive mode] Like, sort of like a basic drum sound. [2nd enactive mode] What kind of variations one can find out of it… [1st symbolic mode] Somehow I take interest in those kind of sounds that are only partly sonorous… … [2nd enactive mode]
> I: Like between a noise and a tone?
> C: Yes. In the way that there is no exact pitch. [1st symbolic mode] But there is some kind of sonorous element in it… … Somehow in-between. I just find those kind of sounds beautiful… [2nd enactive mode]

The symbolic modes: The symbolic-iconic mode, the first symbolic mode, and the second symbolic mode

The verbal data included 12.1 percent utterances manifesting the *symbolic-iconic mode* (notating music), which is the third frequent information mode. Here, the focus was on the utterances regarding the notational apparatus of the composition at hand. In quite many cases, the composer merely explained practical things about the whereabouts of a certain passage that he was elucidating, about the layout of the score ('I don't know if that space for one second is too small, I mean graphic-wise, those bars might be too narrow for this group of notes. One cannot show such quick things within that space.') or about the notation program he was using (emphasis added):

> C: First *I wrote like this* [shows] and then I noticed that there was *too little space there and I wrote it again here like this* [shows]. Basically, it *has the same rhythms but in a different time signature. Finale* [notation software] *helps* within these kind of issues because one can *copypaste everything and then change the time signature*.

The data suggest that notating seldom seems to be elementary for the composer. Instead, rather than being mere notational information notation encompasses other information modes. First, as already discussed, writing musical notes induces the sound that the notes stand for and even the instrumentalist the notes are addressed to. Second, with their role of externalizing musical ideas and thoughts musical notes facilitate the

compositional process. Whenever the composer wrote something down, he was persuaded to rethink his ideas and many times the passage that was written down was somewhat different from what it had been before:

> C: This is typical for me in a way so that when I write this kind of handwritten thing with the computer the BEGINNING [louder tone] stays as it was more or less.
> I: Yeah, these three gestures.
> C: And then the rest of the passage gets going and becomes different.

By the operational definition, *the first symbolic mode* (technological models) refers to the composer's analytical renderings and interpretations of musical passages that have already been composed. A total of 10.6% of the data were interpreted as including utterances regarding the first symbolic mode. The composer seldom used music theoretical vocabulary *per se* in the verbal data. However, many of the analytical observations of the piece at hand were described in more mundane terms. The first citation exemplifies the first symbolic mode with analytical terminology while the next one holds to everyday expressions (emphasis added):

> C: *There are two* [rhythmic] *inversions*, as analogous to melodic inversions. In the way that there is a *value indicating the amount of semi-quavers given to every duration*. A semi-quaver equals one, a quaver equals two, and so on. *A rhythmic inversion doesn't work* [may not be perceived] *like a melodic one*, of course. So, all this all is speculation, really.

> C: [Sigh.] These two sections [pointing to the first two versions of the second and third movement of the piece in a manuscript depicts the outline of the whole piece] and nothing else. They are *in a way reverse to each other*. They really do not end, however, in the meaning of *going back to the beginning or to returning to some original thing or something that has been there before*, to some normal situation. The differences between the second and the third options are that in the second one *both of two sections begin with the same time that it ends*. But in the third one *they end in a different way than what they began with.*

The second symbolic mode (ideological models) comprises but 5.0 percent of the data. The data discloses traces about discursive knowledge about philosophy and music history (e.g. names of composers, such as J. S. Bach and John Cage, stylistic features, such as the medieval compositional technique called 'hoket', which he employed in the third movement of the piece); the composer even revealed that he occasionally writes poetry concerning concurrent compositional ideas. One of the key compositional endeavours of the composer establishing an extra-musical or music philosophical agenda was the investigation of musical time and the different ways time can be experienced through music. The two contrasting conceptions of time are represented through the two basic materials of the composition, the material *T* representing linear time and the material *S* representing space time (i.e. cyclic time). The expressions that articulated an aesthetic principle, were seen to reflect the composer's affiliation to various artistic tenets and thus representing the second symbolic mode. The next citations display the aesthetic principles of material coherence, the organic development of material and form and finally the rationalizing principle of the nature (emphasis added):

> C: One aims to stick to sort of *cohesive thinking*.

> C: These ideas sort of have to be in some kind of... Or not just in some kind of but they HAVE TO be *connected with the idea of the whole piece,* to the overall progression in the piece. And to the Identity Idea of the piece, what this is all about.

> C: *Nature is not so very simple*, either. It looks simple, but all the way it escapes any defining.

The modes added to the model: The iconic mode and the third enactive mode

The analysis of the empirical data revealed that the typology proposed by Rousi, Savolainen and Vakkari (2016) is not sufficient to cover all modes of music-related information used in the compositional process.

Therefore, based on the empirical findings, the typology was substantiated by incorporating two new modes of music-related information: the *iconic mode* and the *third enactive mode*. The iconic mode of the original typology of Rousi, Savolainen and Vakkari (2016) was renamed as the symbolic-iconic mode. This is due to music notations comprising mainly symbolic and only partly iconic elements (Goodman, 1968). Moreover, the empirical data of the present article were thought to include more genuine iconic representations, which are described next.

The utterances that reflected the new iconic mode were fourfold. Firstly, many of the germinal ideas of the composition were visual. The composer described characters (e.g. tone colour) of the future piece at a very early stage in the process, when not yet a note had been written, with the expressions 'whiteness', 'glacier', 'sculpture', 'like a fresco'. Secondly, the visual faculty provided metaphors of comprehension or aesthetic evaluation for the composer. The composer sometimes used the verbs 'seeing' or 'looking like' in the sense of making compositional decisions or assessments: 'I really couldn't say how it helps. It's like it looks like ok.' 'Seeing' could also refer to understanding something, usually grasping a big picture. Thirdly, mental visualisation was a tool for memorizing things. In the next citation, the composer reminisced about his germinal idea of a fresco and pointed out its purpose of remembrance. 'Perhaps it [the visual image of a fresco] is more to help to remember the idea than in to transform some visual thing or occasion or place or some other matter into music.' While preparing to write the final third movement of the piece, the composer spread the printed paper sheets of the whole manuscript so far over his large work surface to apprehend a whole picture of what had been done and what was more there to be done (emphasis added):

> C: It is because I want to *see the whole picture*. And how these passages differ from each other, if they do so. Somehow I think it's easier to *comprehend the whole thing when I see it*. Of course, when one *looks at it when sitting this far away* the table, one *can't see very precisely without reaching out*. But one can *recall it*. And on the other hand, one also can *see what's missing*.

Fourthly, the composer used drawings to visualize the formal structure of the piece, as illustrated in Figure 1, or to design some other musical parameter, such as melodic contours or dynamic changes. Nearly all of the sketches and many of the score versions contain drawings other than musical notes. The composer also reported that he sometimes even tries to paint his visions and moods that entail them, but that they never work out quite as expected. Drawings were used both to design or restructure musical structures and progressions and to help to comprehend and memorize the big picture, as already discussed concerning mental imaging.

< insert Figure 1 about here >

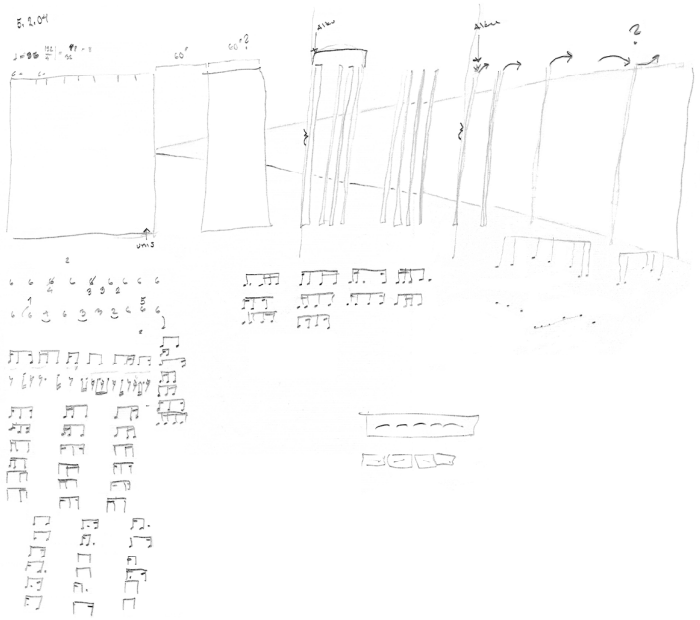

Figure 1. This very first manuscript of the piece exemplifies the function of visualizations in shaping the formal structure of a piece. The composer outlined the formal structure of the whole piece, which was at the time perceived as a one-movement structure.

In the member check validation procedure, the composer consistently refuted certain utterances to represent any of the modes of information in the original typology. Though these expressions often concerned music-analytical issues, they were, according to the composer, neither analytical apprehensions about the parameters or structures of musical events and passages, nor deliberations about the notational issues of how to transcribe sounds and musical ideas into notation, or aesthetical judgements. Instead, these utterances were identified as the composer shaping musical ideas and structures and experimenting how the music should proceed and what kind of impact it would make: 'I'll put in this thing and see how it looks like.' Further, this mode incorporated the composer organizing his compositional actions in terms of metacognitive acts: evaluating ('is this ok', or 'does this passage belong to this piece'), setting musical goals (how a certain passage should sound or develop), or making operative plans (e.g. expressions related to problem solving or planning what to do next, exemplified in utterances such as 'What I will do is that… First I will outline the beginning and then the ending and after that what comes in between'). These kind of utterances conveying the habitual compositional gestures of expressive aspirations and metacognitive actions ('This is what I do when I compose', as expressed by the composer himself) were seen to establish a new mode of information, *the third enactive mode*, which was prevalent in the verbal data: 44.6% of all utterances.

The utterances representing the third enactive mode often included vocabulary that is motivated through the expressions of motion and movement, departure and arrival, transition and transformation. Indeed, the composer wanted the music actually to do something: he was shaping the performative power of music. In the following citation, the composer utilizes the third enactive mode of information to realize his aspiration to make the music work through its performative power (emphasis added):

> C: It's just an experiment like this. It is one *starting point* chosen for this piece.
> I: Why*?*
> C: It's because… I just don't want it that way. It acts against this space-time idea. Or I feel it is. I just have these kind of things with different durations, which *come about.* It's there just to articulate… I have these concurrent incidents that in a certain way create an image or an occasion of *getting* to some point and *leaving* from there. They are those where a gesture *ends* and another gesture *begins* and where a single sound that is different from those two other gestures has been added to the moment of an

> *encounter*. I mean that certain *continuity* was about to in the *movem*… in the *transition*, where one gesture *comes after another*. An empty space took shape and I was not happy about it. Something was missing.

It should be pinpointed that aesthetic decision making as an important compositional device is most often coded into the third enactive mode, instead of the second symbolic mode: then the aesthetic scheme is but vaguely expressed ("this is ok"; "this works"; "it feels fine"), and targeted on a definite section or passage in the emerging piece. Only when the composer refers to a common (discursive) aesthetic principle (such as minimalistic aesthetics, or organic growth of musical material) the ideological mode applies.

Dynamics of the modes

From the viewpoint of the modes of music information identified in the composer's verbal data, the compositional process of this study is not a monolithic entity, but shows interesting variety. All of the three compositional stages form a distinct profile in terms of their distributions of the information modes (see Figure 2). The stage-wise and phase-wise percentages of the information modes were segmented according to thought units and coded to identify information mode instances which varied from a couple of words to a couple of full sentences. The different distributions of the information modes between the various stages and phases reflect the distinctness of the compositional acts by the composer during the different points of the compositional process, as represented in the verbal data.

< insert Figure 2 about here >

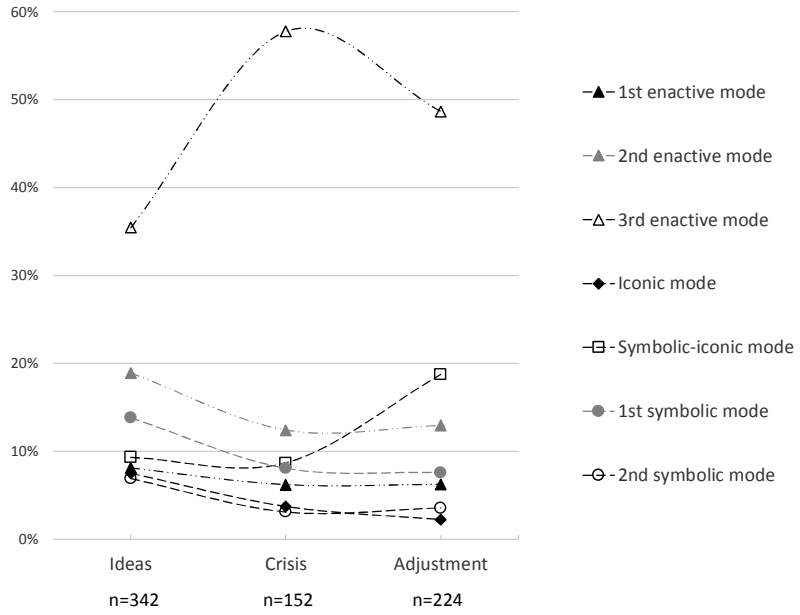

Figure 2. Proportions of modes of representation within 3 compositional stages (n=718; the lines between the discrete observations are drawn only as illustrative points.)

During *the first stage* (ideation) the composer created the germinal ideas of the composition, consolidated a loose conception out of his germinal ideas, then created the main musical materials of the piece, systematically explored this material, and finally begun the concrete composing by writing the first section of the first movement of the piece (T_1–S_1). Although the proportion of the third enactive mode prevails all over the compositional process, it is the least dominant during the first compositional stage. Respectively, the proportions of all other modes, with the important exception of the symbolic-iconic mode, are at their highest in the first stage, their proportions afterwards being descending.

The second stage (crisis) is characterized by accumulated problems, which the composer was unable to resolve. Nonetheless, the composer continued to proceed with the first movement of the piece, leaving unanswered questions and empty bars behind, until a crisis arose during the composition of the second movement. After a lengthy incubation and deliberation period, the composer was able to settle the crisis by solving one problem after another in a fairly straightforward way. In the second stage the proportion of the third enactive mode reaches its top, while the other modes become less significant.

During *the third stage* (adjustment) the composer refined and completed the work in an effortless and nimble way, without anguish. In the adjustment stage the third enactive mode becomes less significant though retaining its prevalence over the other modes. The proportional curve of the symbolic-iconic mode reaches its top during the third stage, making the trends of these two modes contrasting to each other. The fact that the curves of all the other modes either pretty much remain the same or decrease (iconic mode) accentuates the growing significance of the symbolic-iconic mode. This growing significance of the symbolic-iconic mode at the final stage comes as no surprise, as the notation of the piece is often considered as the primary outcome of a compositional process and a prerequisite for the orchestral performance of the piece.

In the next, the interconnections between the proportional trends of the different modes will be examined more closely, in terms of the different compositional phases (substages). First, a parallel trend between the first and the second enactive modes can be observed (see Figure 3). As already discussed, a natural explanation to this is that the information about a musical instrument quite naturally implies the sound image of this instrument for the composer, and vice versa. Whenever the one is utilized the other is induced, more or less.

Another parallel trend can be detected with the second symbolic mode and the collateral first and second enactive modes (Fig. 3). This matching trend is especially evident after the compositional phase IX where issues regarding the singular, far-reaching aesthetic-ideological choices, have been done. After these fundamental aesthetic-ideological choices at the beginning of the process, more cognitive space is released in the later parts of the process for ‘smaller size’ aesthetic-ideological questions that entail the first and second enactive mode: ‘how this would sound’ and ‘is this playable’. These kinds of considerations would be particularly eminent when refining and completing unfinished sections in the late phases of the process.

< Insert Figure 3 about here >

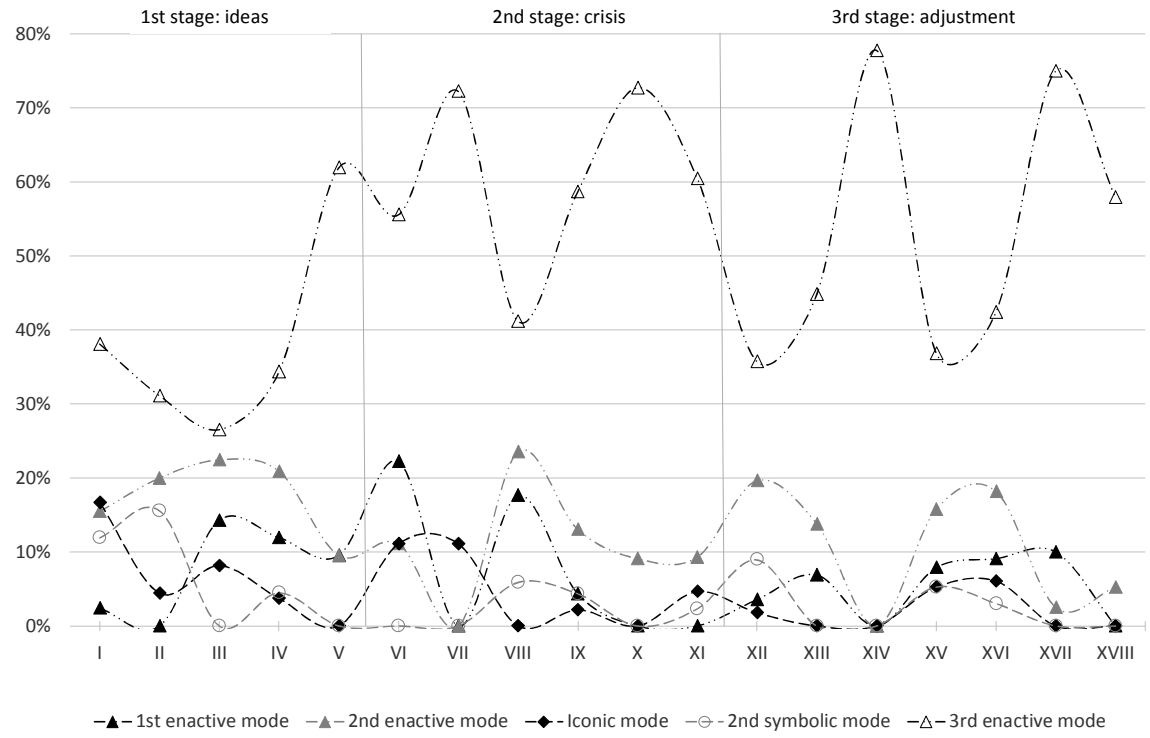

Figure 3. Proportions of the first and second enactive modes (making and receiving music, respectively), iconic mode, second symbolic mode (ideological models), and the third enactive mode (shaping music) of representation within 3 compositional stages (n=555; the lines between the discrete observations are drawn only as illustrative points.)

Whilst the third enactive mode appears proportionally as the paradigmatic device for the compositional process, its function in compositional information has not yet been elaborated in terms of the compositional phases. The average of the proportional third enactive mode within each 18 compositional phase (substage) is 51.3 percent. However, the ratio of the third enactive mode compared with the combination of the other modes varies remarkably over the process. At the beginning of the process, the significance of the third enactive mode seems to be low. However, from the end of first 'ideas' stage onwards, it starts to prevail in a highly volatile way. This fluctuation of the third enactive mode bears indicative relations to the previously discussed modes of information: the iconic mode, the first and second enactive mode, and the second symbolic mode. The proportional trends of these modes on the one hand and the third enactive mode on the other hand seem to follow interdependent dynamics: whereas the former four trends roughly parallel each other, the third enactive mode more or less contrasts them all (Fig. 3). Whenever the 3rd enactive mode prevails the other modes become lesser and vice versa, when the 3rd enactive mode was not appropriate the other modes came to rescue. The moments when the 3rd enactive mode seemed not to suffice were those when the composer formed the basic concept and germinal ideas of the piece and when he stopped to ponder what had already been done in order to aspire to a new section in the piece. Interestingly, these instances mark the pivotal moments in the creative process, where something is to be invented out of more or less nothing.

< Insert Figure 4 about here >

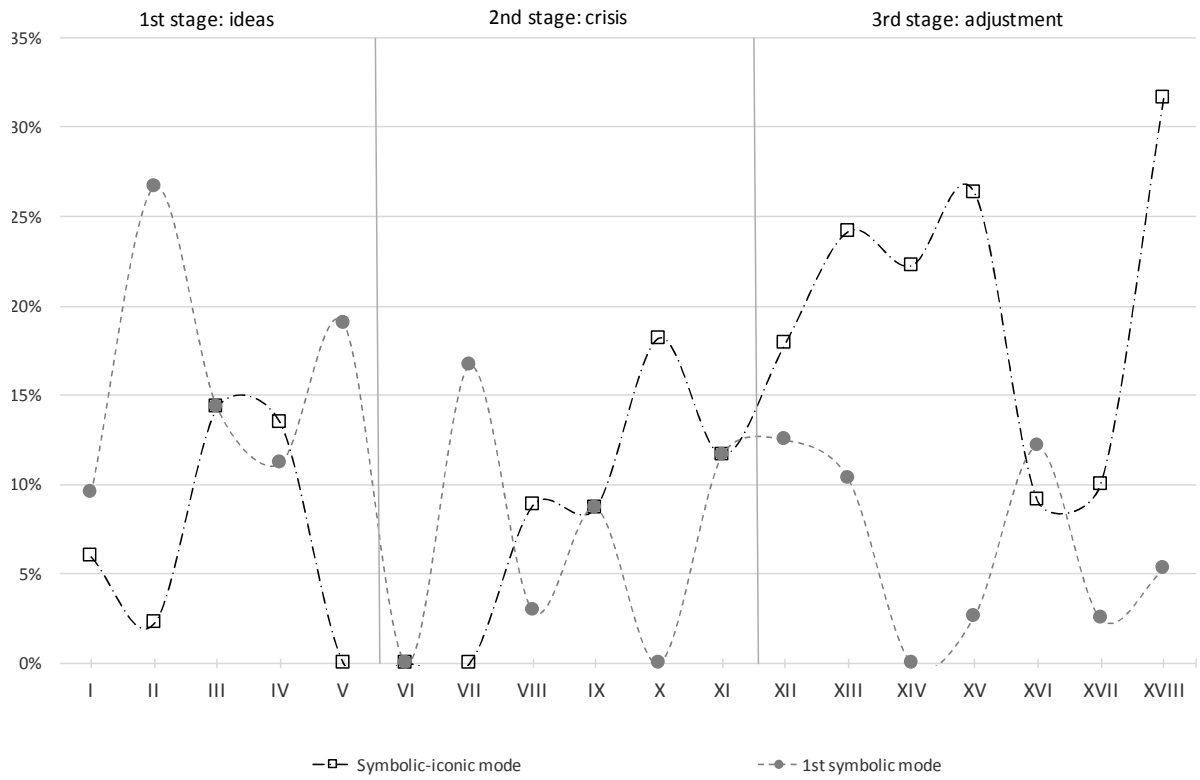

Figure 4. Proportions of symbolic-iconic mode (notating music) and first symbolic mode of representation (technological models)) within 18 compositional phases (n= 112; the lines between the discrete observations are drawn only as illustrative points.)

A contrast can also be perceived between the proportional curves of the symbolic-iconic mode and the first symbolic mode (see Figure 4). Notational and theoretical questions thus seem to supersede each other: when more information about the one is needed information about the other seems less important.

Discussion

Specificity and sufficiency of the music information typology in the context of musical composition

The empirical data of the present article representing a typical compositional task and collected in the composer's studio amid of the actual creative endeavour demonstrate that the music information typology developed by Rousi, Savolainen and Vakkari (2016) is fairly specific within the context of musical composition, that is, all of its five music information modes could be identified from the composer's verbal description of his compositional process. The findings revealed, however, that the typology is not sufficient within this context as two additional modes of music-related information relevant to musical composition were identified from the empirical data: shaping music as the third mode of enactive representations and iconic representations (the iconic representations of the original typology being renamed as symbolic-iconic representations).

Based on the case study, the article at hand presents the following revised music information typology to include information types relevant to musical composition, too. Here, definitions to only additional or renamed modes are included.

- *Music making as the first mode of enactive representations*
- *Receiving music as the second mode of enactive representations*

- *Shaping music as the third mode of enactive representations* refers to composer shaping musical ideas and structures into expressive forms and organizing his compositional actions in terms of metacognitive acts of evaluating, setting musical goals, or making operative plans.
- *Iconic representations* refer to describing visual images and graphic illustrations presenting music-related information, such as landscapes, matter, pictures, sketches or drawings depicting a musical idea, passage or a whole composition.
- *Symbolic-iconic representations of music* refer to presenting musical ideas through use of modern staff notation
- *Technological models of music as the first mode of symbolic representations*
- *Ideological models of music as the second mode of symbolic representations*

While the established new iconic mode and the renamed symbolic-iconic mode represent mainly conceptual modification of the typology, the third enactive mode substantially framed the typology with new particulars specific to compositional knowledge not present in the original model. However, further studies within other genres of musical behaviour, such as Western popular music, jazz, and the vast number of different genres within non-Western musical cultures, classical or popular, may produce a more comprehensive understanding about musical information behaviour in its entirety.

Dynamics of the modes within a process of musical composition

The way music sounds must satisfy the aesthetic-ideological criteria as well as fulfil the expressive aspirations of the composer. In order to achieve this, the composer needs to know how to create music that meets these criteria, renders the idiomatic standards of musical language (in terms of musical syntax and notation) and instrumental practice, sounds right, and maybe even satisfies the listener – at least the musicians on whose reception the performances of compositions largely depend. The role of the musician and instrumental techniques in a compositional process can be read in the studies of Donin (2009; Donin and Ferón, 2012) and Roels (2014; 2016). These studies also recognize the significance of listening and visual faculties as well as noticed the music theoretical and notational aspects in the composer's knowledge.

This study was able to introduce the new information mode indicative of the artistic capacity of expressiveness: the third enactive mode (shaping musical structures) was the means whereby the composer made musical structures work for himself and hence created performative power in his music. The mode of the third enactive mode can be collated with the significant role of metaphor in music (Spitzer, 2004). Musical metaphors are often used to describe the expressivity of musical passages in music analytical discourse. The findings of this study show the way in which this expressivity in music is being created by utilizing the third enactive mode concomitantly with selected other modes of information. Especially, the way in which the composer concurred his body-based metaphors of motion and transformation with metaphoric speech regarding the physical actions of a musician on the one hand and the sounds produced by these actions (or passages notated, for their part) on the other hand. This compositional fabrication demonstrates the physical roots of human cognition, exemplified in body-based metaphors (Johnson and Larson, 2003, among others).

However, despite being the encompassing and the most common mode in this study, the third enactive mode did not establish the only scheme of creative output. The parallel modes of the first two enactive modes, iconic mode and the second symbolic mode (ideological models) can be interpreted as constituting the perceptual-ideological, or the aesthetic frame of compositional information that occasionally replaced the third enactive mode.[3] Paradoxically, the critical moments where the composer preferred the third enactive mode to the aesthetic frame of information were the moments of his most significant creative initiations: undertaking a new work, deploying novel materials, embarking on new sections or addressing structural issues. Thus, a significant, though lesser part of compositional creativity seems to be 'non-compositional', even extra-musical. The aesthetic frame of compositional work can be seen as the *momentous* creative device whereas the third enactive mode of information may be seen in the light of *everyday practice* in compositional endeavour.

The roles of the symbolic-iconic mode (notation) and the first symbolic mode (technological models, i.e.

music theory and analysis) with their contrasting trends, are complementary in the information architecture of the compositional process in this study. The informant is an academically trained and analytically disposed composer within a highly notation and music theory -oriented culture. Overall, in practice, notational expertise surely includes theoretical understanding and vice versa, music analysis usually builds upon a notated score, as stated by Lupton and Bruce (2011) model of the core academic substance areas in the education of a professional composer. These two information modes also provide a common language for musicians and composers to talk about music. However, the composer of this study also analysed virtual music, that is music that had not (yet) been notated and only existed in the composer's mind. The role of technological information may not be restricted to only instrumental and supportive purposes. Instead, technological and symbolic-iconic information may attach any other music information mode, in the same way that images of sound anchor to more or less to nearly any compositional deed.

Conclusion

This study examined the modes of music information present in a professional composer's verbal description of a compositional process. The current frameworks of music related information were revised to more accurately reflect information entities relevant to musical composition. New knowledge regarding the nature and dynamics of the music information modes within different stages of the compositional process were created. The core compositional knowledge proved to be processual, perceptual (audial, visual), and embodied. The study demonstrated the pivotal but partly inadequate role of the third enactive mode (shaping music) of music information. While being the crucial information mode and the driving force in generating the performative power in the musical structures, the facilitation of the aesthetic frame of information (first and second enactive modes, iconic mode, second symbolic mode) was required to create the germinal ideas and to design the formal structure of the piece. Moreover, in order to fix the compositional ideas and structures into a permanent record prolific notational work (symbolic-iconic mode) was needed. The ability to shape sounds into appropriate and meaningful musical structures charged with performative power that are fixed into a score indicative of a musical performance is the core know-how of a composer. It is learnt by doing, by practising the enaction of composing. Further studies are needed to both validate relevant information entities for various knowledge-intensive musical processes within different genres and to further understand the information behavior of professional composers in general.

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Appendix 1: 18 phases of the compositional process (Pohjannoro, 2008; 2014; 2016))

1. Creation and exploration of the germinal ideas. Dec 5–27, 2004.
Sketches 1–3; Material matrices A and B; Score versions nr. 1–3.

I. Creating and consolidating the germinal ideas, outlining the musical form of the piece and the first movement, creating the basic materials
II. Systematic creation, elaboration and investigation of the material T.
III. Detailed scheme of the first movement's form structure.
IV. Rudimentary inscribing of first movement's passages T_1 and S_1.
V. Issue of procedure in the contrapuntal material of T_1 and T_2 in the first movement; working on S_2.

2. Evolution to crisis. Dec 27, 2004–Jan 6, 2005.
Sketches nr. 1, 3–5, and 6 A–C; Material matrix C; Score versions nr. 4–9.

VI. Issues about the procedure T_1–T_2 in the first movement.
VII. Scrutinizing and restructuring the form structure of the whole piece.
VIII. Issues about the procedure S_1–S_2 and about the role of the first movement; initial consideration about the fading effect between T and S in the second movement.
IX. Creating different options to deciding about issues emerging in the phases VI and VIII; the proliferation of the issue into a question for the whole piece.
X. Sketching the fading effects of the second movement; first idea of the third movement.
XI. Crisis; solving the crisis.

3. Adjustment stage. Jan 7–31, 2005.
Sketches nr. 6–9: Score versions nr. 10–15.

XII. Re-examining and elaborating the material *T*; the idea of the third movement.
XIII. The fading effects of *T* and *S* in the second movement.
XIV. Completing the *T*-passages in the first movement.
XV. Working out the fading effects of the second movement.
XVI. Starting to write the third movement.
XVII. T1, T2, second and third movements; ideas about new pieces; recalling of the creation of the germinal ideas.
XVIII. Completing performing instructions, instrumentation, finding and fixing mistakes, etc

[1] In the formal scheme the sections and subsections of the movements are marked with hyphen and comma, the fragmentation of the materials S and T (explained in the Results Section) with plus sign and the transitional relations with greater-than sign, respectively.
[2] All of the translations of the verbal data from Finnish into English have been approved by the composer-informant of this study.
[3] This is not to designate aesthetic information in terms of its evaluative aspect only to the second enactive and second symbolic modes. Aesthetic value is an important component of the iconic mode and the third enactive mode as well.

PUBLICATION III

Situational relevance of music information modes: An empirical investigation among Doctor of Music students

Rousi, A.M., Savolainen, R., Harviainen, M. and Vakkari, P.

Journal of Documentation, Vol. 74 No. 5, pp. 1008-1024
https://doi.org/10.1108/JD-10-2017-0149

Received 24 October 2017
Revised 15 March 2018
Accepted 20 March 2018

Situational relevance of music information modes

An empirical investigation among Doctor of Music students

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Abstract

Purpose – The purpose of this paper is to elaborate the picture of situational relevance of music information from a performing musician's point of view by delving into its diverse layers within the context of Doctor of Music students' information seeking.
Design/methodology/approach – Music-related information is approached through six modes that categorize music information sources based on their levels of abstraction. Situational relevance of the modes of music information is examined in relation to the situational requirements of accomplishing a dissertation on music task consisting of both a series of concerts and a written thesis. The empirical material was collected by interviewing Finnish doctoral students in the field of music performance.
Findings – A set of situational relevance types related to each mode of music information were identified. As a whole, the differences between the perceived importance of the modes varied a little.
Research limitations/implications – The goal of the present paper is not to create a generalizable list of situational relevance types suggested by modes of music information, but to show that the modes may suggest diverse situational relevance types of their own when evaluated by performing musicians.
Originality/value – The present paper provides a rare account on performing musicians' vocational and school-related information seeking. For studies of music information retrieval, the present paper offers new contextual facets explaining why diverse music information could be relevant to musicians. For studies of music-related information seeking, the present study offers new insights on why performing musicians have information needs regarding certain types of music information sources.

Keywords Music information, Information seeking, Relevance, Music, Musical semiotics, Performing musicians
Paper type Research paper

Introduction

Music is a domain where information resides not in mere written language. In their works on musicology and musical semiotics, Bengtsson (1977) and Tarasti (1994) examine the different systems of description relevant to musical communication. According to Bengtsson (1977), the concept of tone may refer to a notated tone, a measurable frequency or an aural experience. Tarasti (1994, p. 4) supports Bengtsson's (1977, p. 18) claim that different systems of description relevant to musical communication should be held as separate. It cannot be assumed that unequivocal translation between the diverse systems of musical communication

The authors would like to thank the anonymous reviewers for helping us to improve the manuscript.

Journal of Documentation
Vol. 74 No. 5, 2018
pp. 1008-1024
Emerald Publishing Limited
0022-0418
DOI 10.1108/JD-10-2017-0149

exists (Bengtsson, 1977, p. 18; Tarasti, 1994, p. 4). The previous problem of translation is also reflected in Kuhlthau's (2004, p. 112) information search process (ISP) model. It suggests that information types at varying levels of abstraction have differentiated interpretations, and that these interpretations can undergo change as the information-seeking process progresses. The above accounts suggest that situational relevance of music information of various kinds may vary in information seeking. When juxtaposing the above notion of music information with previous research on relevance of music information, an anomaly becomes apparent. These studies have left open a significant question; what are the situational relevance types suggested by diverse modes of music information for performing musicians' information seeking?

Previous studies of music information retrieval (MIR) have approached relevance of music information objects most often through matching string search queries with textual metadata representations or through matching music similarity of audio data examining rhythm and melodies humming (e.g. Casey *et al.*, 2008; Kim, 2015). These approaches to relevance are, by necessity, more system than user oriented and the contextual factors affecting users' relevance inferences regarding diverse modes of music information often receive little attention within such studies. Studies describing and modeling information seeking and needs of musicians and music scholars confirm that both groups have information needs spanning to diverse information sources representing music information at varying levels of abstraction (Brown, 2002; Hunter, 2006; Liew and Siong, 2006; Kostagiolas *et al.*, 2015; Lavranos *et al.*, 2015; Lavranos *et al.*, 2016). However, these studies have not devoted due attention to the particular nature of these types of music information and the ways in which performing musicians evaluate their situational relevance.

To elaborate the issues above, the present paper utilizes a novel music information typology that encompasses broadly different music information facets by categorizing music information sources according to their level of abstraction. The term "music information mode" refers to a set of information sources that are seen to represent music information at a certain level of abstraction. In other words, the concept of music information mode is used to group information sources based on their method of representation, be it gestural language, non-conceptual aural experiences of music or symbolic written representations, for example. The modes of music information were first presented in our previous work (Rousi *et al.*, 2016). Six modes were identified: music making as the first mode of enactive representations; music listening as the second mode of enactive representations; iconic representations of music; technological models of music as the first mode of symbolic representations; and ideological models of music as the second mode of symbolic representations.

In general, studies on situational relevance examine the relationships between information and the user´s information problem situation (Schamber, 1994, p. 8; Saracevic, 2007a, p. 1930). The present paper approaches the situational relevance of the modes of music information in relation to situational requirements of accomplishing a dissertation on music task consisting of both a series of concerts and a written thesis. Situational relevance types related to the modes of music information are identified through the question of why Doctor of Music students consider the individual modes important to their dissertations. Situational relevance types are thus the situational factors that make above modes of music information relevant for the Doctor of Music students working on their dissertations on music. The empirical material was collected in 2013 and 2014 by interviewing Finnish doctoral students in the field of music performance.

Since the present study deals with sign systems other than written or spoken language, the following clarification of terminology is needed. The grounding concept of the paper is music-related information seeking, and it encompasses as object of seeking all music-related information, be it in audible, written or notated form. When referring to the audible non-conceptual information types of performing and listening to music, for example, the concept of music *per se* is used.

The rest of the paper is structured as follows. First, a literature review is presented starting with the introduction of the modes of music information. Then, the research questions and the empirical research design are specified. The main part of the paper focuses on the report of the empirical findings. The concluding section discusses the findings and reflect their significance.

Literature review

Modes of music information

The way music information is defined affects greatly on how this phenomenon appears in studies of information seeking. The validity of our music information notions should be from time to time tested with theories of knowing and information emerging from music-related domains such as musicology and music semiotics. According to Bengtsson (1977) the *concept of tone* (our italics) may refer to a notated tone, a measurable frequency or an aural experience. Tarasti (1994, p. 4) adds to the latter also the gestural language, which is needed to transform a notated tone into both a measurable frequency and an aural experience. Musical knowing therefore transpires also within sign systems, which are inherently non-conceptual (Tarasti, 1994, p. 4). Bengtsson (1977, p. 18) stresses the importance of keeping the different systems of description as separate categories. We cannot assume that the possibility of direct transformation between these sign systems exists (ibid.). A piece's staff notation can be interpreted, or modalized in Tarasti's (1994, p. 39) terms, in various ways, allowing for the performer great power over the musical message, for example. According to Tarasti (1994, p. 4), the most radical translation occurs when a person is trying to explicate his or her aural experiences into conceptual form. Yet, according to Tarasti (1994, p. 4) and Bengtsson (1977, p. 23), it is insufficient to state that musical knowledge is merely transmitted through the musical non-conceptual sign systems. As no sign system works in a vacuum, but in interaction with other systems, also verbal sign systems have had an important role in transmitting musical tradition (Tarasti, 1994, p. 4).

Acknowledging the problem of translation occurring between modes of music information is of importance in order to gain further understanding about their relevance within information seeking. As stated in the introduction, the above problem of translation is also reflected in Kuhlthau's (2004, p. 112) information-seeking process model. It suggests that information types at varying levels of abstraction can have various interpretations and that these interpretations can undergo change as the information-seeking process progresses. In order to elaborate the issues above, the present paper approaches music information through a typology comprising of six modes that categorize music information sources based on their levels of abstraction. This typology was first presented in our previous work (Rousi *et al.*, 2016).

The typology of music information was built upon juxtaposing Bruner's (1966) modes of information representation – introduced in his book *Toward a theory of instruction* – with the sign systems relevant to musical communication presented by Tarasti (1994) in *Theory of musical semiotics*. According to Bruner, any domain of knowledge, and every single problem within that domain, can be presented to the learner through using three modes of representation. Enactive mode of representation refers to sequences of activities for creating desired results. Iconic mode of representation refers to presenting a concept through a graphic without exhaustively defining it. Most abstract of modes is the symbolic mode where through a system that defines rules of expression, a set of arguments is created for describing a concept (Bruner, 1966, pp. 44-45). The above juxtaposition resulted in a continuum ranging from the most enactive to most abstract music information categories as follows (Rousi *et al.*, 2016):

(1) Music making as the first mode of enactive representations refers to information resided in different sequences of actions that produce sounds for musical purposes.

This action may appear in varied forms, such as playing the violin, singing or creating electronic music with a computer. Whereas the term "music making" may in its common use refer to either playing or composing music, here it is used in a broader meaning to illustrate the information resided in different sequences of actions that aim to produce sounds for musical purposes.

(2) Receiving music as the second mode of enactive representations refers to receiving musical performances, while being present at a performance or through a recording, without the control over the performance's sonic results. Audio recordings played using either home audio devices or mobile online music streaming services function as examples of sources incorporating this second mode of music information.

(3) Iconic representations of music refer to the graphic illustrations presenting music-related information. Different notations, such as modern staff notations, function as an example of sources incorporating this mode of music information.

(4) Technological models of music as the first mode of symbolic representations refer to examining structures of music, i.e., tonal organization of harmony and counterpoint and sonic formulae of orchestration and interpretation, for example, through symbolic means such as written language. Information sources that incorporate the first mode of symbolic representations are, for example, textbooks of harmony and counterpoint.

(5) Ideological models of music as the second mode of symbolic representations addresses music at a symbolic level but not directly the qualities that transpire in music *per se*. In this mode conceptual symbolism regarding music are negotiated with other fields and their conceptual symbolic representations. For example, it is possible to produce narratives on concepts such as "Western classical music" and "history" or "music" and "aesthetics" without reference to actual phenomena present in sonic reality of music. Examples of information sources that can be more geared towards the second symbolic mode include monographs on philosophy of music and some texts concerning the history of music, such as some biographies of composers.

(6) As Doctor of Music students might also have other than music-related information needs, such as information needs about academic writing, a sixth information category titled other symbolic information was added into examination. This sixth category of other information was defined to include all symbolic, i.e., conceptual, information sources from other than music-related disciplines, such as conventions of scientific writing.

The typology's purpose is not to exhaustively classify phenomena as belonging to one mode alone. The position and needs of the information seeker play a crucial role in providing the angle through which the different modes of music information transpire. For example, the technological models of harmony and counterpoint are closely weaved with the history of Western music, which is evident in concepts such as "Palestrina style counterpoint" (see also Tarasti, 1994, p. 17). Thus, the same information sources can very well include many of the modes of music information. Also, being present at musical performance could be considered both as a source of first and second enactive representations. While attending a music performance, it is possible to study of the mere gestural language of the performer creating the music or mere audible qualities of the performed musical piece, for example.

Situational relevance

Whereas systems or algorithms create relevance by retrieving documents based on the query, people derive relevance from obtained information objects (Saracevic, 2007a, p. 1919).

Situational relevance refers to examining relationships between information and the user's information problem situation (Schamber, 1994, p. 8; Saracevic, 2007a, p. 1930). Relevance inferences depend not only on the features of the information in document, but also on user's context, user's previous knowledge and specific qualities sought (Barry, 1998, p. 1302). Situational relevance approach differs from topical relevance approach where the focus is on relation of the topic expressed in a search query and topic covered by resulting information objects (Saracevic, 2007a, p. 1929; 1931). Concepts such as success dimensions, criteria categories and factors influencing selection have been used to describe the outcomes of previous research examining situational relevance (Schamber, 1994, pp. 24-25). The concept of situational relevance type was seen as most descriptive of the outcomes of the present paper.

Even though the present paper is the first attempt to study situational relevance through theoretical constructs of modes of music information, parallels with previous research may be found. The present study has the same exploratory and descriptive nature as the set of studies named user criteria studies by Schamber (1994, pp. 23-25) and also weaves with the concept of utility. In addition, parallels to the group of studies coined by Saracevic (2007b) as relevance clues approach may be seen. According to Saracevic (2007b, p. 2127), the focus of the previous studies was on "relevance criteria users employ while contemplating what is or is not relevant, and to what degree it may be relevant."

Music information objects and relevance

The issue of music information objects and relevance has predominantly been discussed within the field of MIR. MIR studies have examined relevance of music information objects through context-based approaches matching string search queries with textual metadata representations and through content-based approaches matching music similarity of audio data examining rhythm and melodies, for example (e.g. Downie, 2003, 2004; Casey *et al.*, 2008; Kim, 2015). In MIR, the approaches to relevance are, by necessity, more system than learner oriented. This is reflected in Downie's (2003, pp. 293-301) specification of music information for MIR, which consists of pitch, temporal, harmonic, timbral, editorial, textual and bibliographic facets. Coherent to MIR research, these facets approach music-related information mostly from the viewpoint of interacting with MIR systems, and provide a useful summary of the challenges for MIR system design. However, this conceptualization of music information may not be sufficient from the viewpoint of a person engaged in music information seeking to whom gestural language of music making (see e.g. Godøy and Jensenius, 2009) and diverse literature (see Brown, 2002, p. 82) may also be relevant.

Currently, there are users' situational or contextual factors incorporated into MIR techniques, too. For example, context-aware music recommender systems utilize the following contextual data when suggesting content. User's mood or emotion (e.g. Kim *et al.*, 2010); daily activities, such as working, sleeping and running (e.g. Wang *et al.*, 2012); user's location (e.g. Cheng and Shen, 2014); and time of day (e.g. Su *et al.*, 2010). However, these factors are general in their nature, and do not tell why, for example, musicians and music scholars see the different modes of music information relevant for their information-seeking tasks. The general nature of the above situational factors is partly explained by how the above studies approach the notion of user. Most often the term "users" refers to the vast audience utilizing current online music streaming services (see e.g. Wang *et al.*, 2012; Cheng and Shen, 2014). While utilization of users' contextual factors is still limited in MIR, they are becoming increasingly important (see Inskip *et al.*, 2007; Weissenberger, 2015). Situational relevance of the diverse modes of music information should be further examined with the focus group of performing musicians to gain a more detailed understanding of this phenomenon.

Studies describing and modeling information seeking and needs of musicians and music scholars confirm that both groups have information needs spanning to diverse information

sources representing music information at varying levels of abstraction (Brown, 2002; Hunter, 2006; Liew and Siong, 2006; Kostagiolas *et al.*, 2015; Lavranos *et al.*, 2015; Lavranos *et al.*, 2016). For example, music performances, recordings, notations and music-related literature are identified as information need types, albeit amongst many, by previous studies (e.g. Kostagiolas *et al.*, 2015, p. 7). Brown's (2002, p. 82, 86) findings suggest that music scholars utilize, for example, audio recordings and music notations while conducting research. However, these studies have not devoted due attention to the particular nature of the modes of music information and the ways in which performing musicians evaluate their situational relevance. Without approaching music information through its many layers, its diverse situational relevance types cannot be systematically examined. The branch of research primarily focusing on the source preferences and user satisfaction among music scholars and students (e.g. Lai and Chan, 2010; Dougan, 2012, 2015; Matson and Shelley, 2013) often examines the frequency of use of pre-categorized sources of information. While these studies are very usable in collection development, neither from this branch of research one finds systematic attempts to examine how performing musicians evaluate the situational relevance of information sources representing diverse modes of music information.

The context of everyday life music information seeking differs from the settings of vocational and school-related information seeking. Everyday life music information seeking and needs constitute not so much a goal-oriented activity, but are often initiated by hedonistic, social and cognitive needs, such as identity constructing, mood managing, maintaining interpersonal relations and alleviating monotony (Cunningham *et al.*, 2003; Laplante, 2008; Laplante and Downie, 2011; see also Bourdieu, 1984 and DeNora, 2000). DeNora (2000) provides a detailed account on how music is used for the above purposes in different everyday situations. Performing musicians may certainly utilize music also in the aforementioned ways. However, with reference to the previous sections of this literature review, there currently is a greater lack of studies examining how musicians view the situational relevance of music information in their vocational or school-related contexts.

Methods

Research questions

The present paper seeks to offer new empirical findings regarding situational relevance of music information of various kind in the context of performing musicians' information seeking. To this end, this paper approaches situational relevance types of the modes of music information through the question of why Doctor of Music students consider the individual information modes important to their dissertation on music tasks. There might not be unequivocal translations occurring between the modes of music information (Bengtsson, 1977, p. 18; Tarasti, 1994, p. 4), making it problematic to rely solely on concepts that imply a direct relation or utility between the modes. The concept of importance was thought as broader one that includes the aspect of utility, too. To examine the above issues in greater depth, the present study addresses the following research questions:

RQ1. What kind of types of situational relevance can be identified from diverse modes of music information sought for dissertation projects by Doctor of Music students?

RQ2. How does the perceived importance of music information of diverse modes vary from the viewpoint of situational relevance?

It should be noted that the goal of the present paper is not to create a generalizable list of situational relevance types suggested by modes of music information, but to show that the modes may suggest diverse situational relevance types of their own when evaluated by performing musicians.

Methodology

Participants. The participants of this study were six Doctor of Music students from Sibelius Academy, Helsinki University of Arts in Finland. The dissertation projects of all participants focused on music performance and included both a series of five concerts and a written part. All of the participants were instrumentalists with a background in the Western art music tradition. In order to protect the anonymity of the participants, their instruments are not revealed. The participants were recruited from an information retrieval course arranged for the Doctor of Music students by Sibelius Academy Library. Prior to the interviews, the participants had submitted their final dissertation proposal for examination, which they had worked on during the previous year. In their proposals, both the concert programs and the topic of the written part of the dissertation were defined. Sibelius Academy is the only organization in Finland providing Doctor of Music programs. The Finnish Doctor of Music program consists of 4 years of full-time study and its length is 240 European Credit Transfer System study points. Within the period of 2011-2015, on average five Doctors of Music focusing on music performance have graduated per year.

Data collection. The empirical data were gathered using audio-taped recordings and an additional questionnaire filled during the interviews. First, background information concerning the participants and their dissertation projects were gathered. Second, in the interview, the definitions of the music information modes specified above were presented to the participants. In addition, examples of information sources per information mode were provided. The participants were asked to indicate on a four-point scale how important they consider each music information mode for their dissertation on music. Thereafter, they were asked to further explain and elaborate these answers. The interview data consist of 305 minutes of audio-taped records. The data of this study were collected during the years 2013 and 2014.

Coding and data analysis. The questionnaire data were summarized by calculating mode-specific averages of perceived importance. The transcribed interview data were scrutinized through qualitative content analysis. The open-ended answers explaining the perceived importance assessment of an information mode were interpreted to indicate its types of situational relevance. In other words, an information mode was considered important by Doctor of Music students because of diverse reasons A, B, C, etc. and these reasons were considered as the information mode's situational relevance types in this study. The types were identified from the transcribed data by means of constant comparative method (Silverman, 2005, pp. 213-214). A preliminary inductive coding was done during the transcription process. This coding was further enhanced through comprehensive data treatment until no new situational relevance types could be formed. Even though there were cases where the same situational relevance type could by identified from the answers of several participants, a single occurrence was sufficient for the type to be included in the analysis.

To improve the validity of this study, all situational relevance types presented next are accompanied by quotes taken from the interview data. The quotes were translated from Finnish into English by the first author. Care was put into preserving the quotes as close as possible to verbatim form during the translation process. Additional notes in italics were in some cases added if the context of the quote would otherwise be vague for the reader. The italicized notes were also used to replace a specific section of the quote with a more general expression in cases in which the specific part contained an indirect identifier that would compromise the anonymity of the participant.

Findings

The present study elaborates the picture of situational relevance by focusing on the perceived importance of different modes of music information. To this end, an empirical

study was carried out by interviewing six Doctor of Music students about their ways to seek information for the needs of ongoing dissertation projects. A summary of findings is presented in Table I.

As Table I indicates, a total of 21 types of situational relevance could be identified from the interview data. A set of situational relevance types was identified from each mode of music information. The answers on the importance of individual information modes were examined on a four-point scale where 0 = not at all important, 1 = not that important, 2 = important and 3 = very important. Most types of situational relevance are linked to modes I-III and these modes on average were perceived as the most important for the dissertation. As a whole, the differences between the perceived importances of the modes varied little with the exception of the mode IV, which received the lowest average score on a scale from 0 to 3. All modes received at least an indication from one of the participants of being very important for their dissertation. Respectively, none of the participants considered any of the modes as being "not at all important." All of the information modes were seen to include situational relevance types that were related to performing the concert pieces of the dissertations. Respectively, all of the modes also included situational relevance types that were seen to relate to the written part of the dissertation. What follows is a more detailed presentation of the identified situational relevance types per music information mode presented in Table I.

Iconic representations of music

Notations as the foundation of gestural language. Music notations and scores were considered important by the Doctor of Music students and were sought by them to be used in familiarizing with the gestural language of the concert pieces. Notations were not only seen important by the participants because they included information used for gaining

Music information mode	Perceived importance (avg.)	Situational relevance types
III Iconic representations of music	Very important (2.7)	III.1 Notations as the foundation of gestural language III.2 Utilizing notations in creating arrangements III.3 Utilizing notations in music analyses III.4 Notated traditions of performance
I Music making as the first mode of enactive representations	Very important (2.5)	I.1 Gestural language of the concert pieces I.2 Models of gestural language as the focus of written examination I.3 Own interpretation as the focus of written examination
II Receiving music as the second mode of enactive representations	Very important (2.5)	II.1 Selecting the concert pieces II.2 Thematic material of the concert pieces II.3 Complementing the aural experience of the piece II.4 Interpretations of other musicians II.5 Recorded traditions of performance
V Ideological models of music as the second mode of symbolic representations	Important (2.4)	V.1 Ideological models of the concert pieces V.2 Music history as a framework V.3 Familiarizing with terminology
VI Other symbolic information	Important (2.2)	VI.1 Cultural history of the concert pieces VI.2 Multidisciplinary approaches to dissertations topics VI.3 Conventions of scientific writing
IV Technological models of music as the first mode of symbolic representations	Important (1.7)	IV.1 Technological models of the concert pieces IV.2 Previous analyses of the concert pieces IV.3 Analyzing music of difference eras

Table I.
Summary of findings

control of the gestural language of the pieces but also because they include clues regarding their interpretation:

> They [*music notations*] are of course where the playing and studying starts. All or most information comes from them, forming your foundation.

Utilizing notations in creating arrangements. The Doctor of Music students that created their own arrangements of the concert pieces saw notations of the previous arrangements important for the process. These participants modified notations and scores of the original arrangements through experimentation into new notations and gestural language:

> It is material for my arrangements. It is very important that I have what exists […] I need the material from which to start arranging, from which to start playing. […] Like how would I arrange the dots and how would I play these on my instrument.

Utilizing notations in music analyses. The Doctor of Music students also investigated the music theoretical aspects and structures of the concert pieces through acquiring and examining their notations. The participants thus interpreted and translated information resided in musical notations into written language that examined the technological models thought to reside in the pieces. These extractions of technological models could influence their gestural language of the played pieces, i.e., they could bring forth thematic material in their interpretation as a result of these analyses. Participants could also use these extracts of music theoretical analyses in the written part of their dissertation:

> I will do analyses on how twelve-tone technique have been used in the piece, or serialist methods or I use other means of analysing this style of music […] I have already acquired the notations and presented analysed passages in seminars. It was very important to find the notations at that point.

Notated traditions of performance. The participants also saw musical notations as important documents of traditions of performance. Besides transmitting information regarding the gestural language of the pieces, the Doctor of Music students elaborated that music notations also transmitted information regarding their interpretation of through articulation marks. These presentations of suggested interpretations were seen to differ between editions of different eras. Even though formulas of interpretation may be regarded as technological models of music (see Tarasti, 1994, p. 17), the present paper differentiates this situational relevance type from the previous one due to its possible gearing towards ideological intertextual models of music which is exemplified through use of concepts such as "narratives" by the participants:

> When studying narratives, or the element of narratives in the chamber music literature, it is based substantially on music notations and articulation marks. They also guide the interpretation, or how to approach the piece emotionally.

Music making as the first mode of enactive representations

Gestural language of the concert pieces. The Doctor of Music students rehearsed in order to gain control over sequences of actions required by the concert pieces, which was considered important for the dissertation tasks. Within the interviews, the discussion with the participants regarding this situational relevance type ranged from examining different solutions of playing a single passage to rehearsing entire pieces to be played from memory. Most often the Doctor of Music students mentioned private rehearsing as a key mean of studying and gaining this control within the enactive realm. A participant who created his own arrangements stated that the boundaries of his ability with the gestural language of his instrument had a defining power over the musical material he could include in his re-arrangements and that there were no substitutes for experimentation with gestural language to be found from any other mode of music information. Even though the notion of considering gestural language as information

appears as somewhat new to studies of information seeking, gestural language is considered as an integral part of music behavior in other music-related disciplines (see e.g. Godøy, 2003; Godøy and Jensenius, 2009; Luck *et al.*, 2010):

> This is very important because I am a performing musician. […] Complex [*music*] theoretical structures or similar are very difficult as such to express for the audience. […] Actually, this motoric aspect is very important because most composers of modern music write their music in a very uncompromising manner.

Models of gestural language as the focus of written examination. Doctor of Music students saw studying models of gestural language present in other musicians' playing as important for their dissertation tasks. Whereas within the previous situational relevance type their focus was on seeking control within the enactive realm of gestural language, it was here on translating how to gain this control into written language. Within the interviews, the discussion with the participants regarding this situational relevance type ranged from sets of specific techniques, such as the angle of the arm in the act of playing, to studying the more general factors that were seen to create appealing performances. A participant stated that currently there is not much information available regarding gestural language of professional musicians and acknowledged the problem of translating this information into written language:

> Right now I am examining that how much can I see, based on both the visual and aural experience [*of a person performing music*], through my professional experience or through intuition. I would say that there are great many things that a professional can see that are both really interesting and useful. Right now I am interested on how [*players of a certain instrument*] use their arm.

> There doesn't really exist that much information regarding professional musicians that would have been somehow verbalized. […] It is a different story then how much you can translate into textual form, but some of it can be translated.

Own interpretation as the focus of written examination. Also the following issue of gestural language of music making was seen of importance by a Doctor of Music student: how to study own interpretative power through means of written language? There was an intertextual element present in this participant's description of her musical interpretations, which was displayed via use of terminology such as "narratives." The initial information of her interest resided in her own gestural language. She then explained that she attempts to study these phenomena at the level of written language in the written part of her thesis:

> Each of my concerts has a different theme. I have a different position as a narrator in all of them. This allows me to study my role as a narrator [*as in the act of performing music*] from different perspectives [*in the written part of the dissertation*].

Receiving music as the second mode of enactive representations

Selecting the concert pieces. The Doctor of Music students stated that listening to potential concert pieces was important for selecting the concert programs included in the dissertations. They also stated that emotional connection with the potential pieces affected these decisions. The piece selection naturally influenced the gestural language requirements of the concerts and the written part in which some of the students included analyses and background information of the concert pieces, for example:

> It's important to get to listen to the pieces. How do they sound like? Are they something you want to play?

Thematic material of the concert pieces. The Doctor of Music students considered the examination of the musical themes of their concert pieces by listening to audio recordings as

important for their dissertation projects. To this end, the participants focused on what is heard through polyphonic musical textures. They saw this "prioritizing of material" to complement the translation from studying music notations to form the gestural language of playing the pieces:

> I read the score and see that okay these kinds of things are happening. […] Then I listen to the music and notice the things that are heard through. What are the main things and what are subordinate. […] It is like prioritizing material. Giving them different roles. It is so much easier, when you hear the music.

Complementing the aural experience of the piece. Doctor of Music students saw listening to audio recordings as important because of the interest to hear all the different voices of the concert pieces, their balance and details to the full extent. This was especially mentioned by orchestra and chamber music players, who stated that the aural experience which they receive while playing differs greatly from that of a person sitting in the audience. A participant also stated that he was doubtful whether anyone performing music at any given setting was essentially able to listen to the details of their own playing to the extent of a person listening that performance. The same participant also recorded his own solo playing to compare the aural experience he had heard while performing to the audio recording:

> In this case of chamber music, it would be of much relevance because you frequently run into these problems of balance. And these are something that you as a player might not even be aware of because you hear what you hear. It is impossible to know what the person sitting in the fifth, second or third row is hearing.
>
> I believe that a person is unable to hear everything from what they are doing [*in the act of performing music*]. Actually even so that if you play with a piano, some of the layers of sound [*from the instrument played*] end up unheard, some of the layers of sound get trampled by the piano.

Interpretations of other musicians. Interpretations of the concert pieces made by other musicians were also regarded as important by the Doctor of Music students. The participants reflected their own interpretations of the concert pieces by examining previous interpretations made by other musicians found from audio recordings. One of the participant further classified her analyses of previous interpretations into dimensions of dynamics, phrasing and agogics (i.e. the theory that accent within a musical phrase can be produced by modifying the duration of certain notes rather than by increasing dynamic stress). Two participants intentionally avoided hearing audio recordings of the pieces they were working on, which seems to underline the suggestive nature of interpretations made by other musicians:

> My methods regarding this, or the background work I will do for creating this interpretation, is first an analysis of recordings. I will analyse six […] previous recordings of the piece and I will examine their agogics, dynamics and phrasing.
>
> Every time I hear an interpretation of a piece, it affects me somehow. And I wish to avoid it. […] I have a principle that I should work on [*a piece of certain genre by a certain composer*], I will listen other pieces of the genre made by the composer. So I am in this world of music and listen to different pieces of different styles, and I am able transfer various things into my interpretation. But what comes to the piece I am working on, that's the interpretation I wish to create and solve myself.

Recorded traditions of performance. Doctor of Music students also saw audio recordings as important documents of era-specific traditions of performance. Whereas the participants' saw the previous situational relevance type of interpretations of other

musicians to affect their own gestural language of music making, here their focus was more on translating this aural information of era-specific performance traditions into written language:

> Now a new era has become of interest. And those records that were once laughed at, that were made fun of twenty years ago, all of a sudden they are of interest. What was then horrid is now interesting because it is an example of a tradition of performance.

Ideological models of music as the second mode of symbolic representations

Ideological models of the concert pieces. Doctor of Music students indicated that there is a link between studying literature regarding music historical context and aesthetic schools of the concert pieces and the interpretations of the concert pieces they would eventually form. Traditions of performance and aesthetics were seen as music historical entities by the participants that were related to the cultural history of a specific era. The Doctor of Music students saw this type of literature to include both information regarding the key elements of the concert pieces and information regarding period-correct traditions of performance, for example. As stated in the presentation of the typology of modes of music information, ideological models are here defined broadly as all music-related literature that does not examine sonic qualities and structures present in music *per se*. The theme of studying music within the context of its society is of major importance within the field of ethnomusicology (e.g. Hood, 1963). The findings of the present paper suggest that this understanding about the contextual frame of musical works is also one of the aims of a performing musicians working within the Western art music tradition:

> History and aesthetics are relevant because […] This Russian school and the background of the composer, he's influences. Why has he composed as he has? What key in his music? How did he play his music, being a pianist himself? […] In that sense history, culture and aesthetics are relevant.

> Traditions of performance are history. During a certain period in time, there has been a certain tradition of performance. It is wise for us to know about history and about the certain tradition of performance, and hopefully one can hear these from our playing, that we play in a certain way.

Music history as a framework. Some Doctor of Music students used writings on music history as a structuring framework for their dissertations, both the concert programs and written parts. The structuring units could be based on notions of eras of styles or literal decades. Also knowledge of the historical usage of one's instrument in different genres of music was mentioned by a participant as important in making decisions about concert programs:

> Yes, music history […] it's clearly visible. I have a principle that in the first concert a played pieces and premieres from the sixties and in the previous pieces and premieres from the seventies.

Familiarizing with terminology. Doctor of Music students found music-related literature concerning their dissertation topic important for the purposes of familiarizing with the terminology of their topic. Many of the participants felt a need to improve their ability to produce texts that are scientifically sound. Also, the problem of translation referred to by Tarasti (1994, p. 4) was touched; one participant mentioned the difficulty of translating the experience of first-hand playing of music into written language:

> I am hoping that by getting acquainted with works on philosophy of music and psychology of music performance I would be able to use a terminology that is scientifically sound. […] Even though I know, or I mean experience, the phenomena that are discussed in these works, I might not know how to describe them just yet.

Other symbolic information

Cultural history of the concert pieces. The discussion within the interviews on the importance of non-music-related literature revealed that written texts examining the specific era during which the participants´ concert pieces were composed on increased the Doctor of Music students´ understanding about the cultural context of the pieces. Both fictional and academic texts were mentioned as important in this sense by the participants. The participants believed that the knowledge of cultural history can affect the interpretation of the pieces and such knowledge may provide useful background information for the written parts of the dissertation:

> If you think of the fiction that you read, for example a significant classic fiction work, it may date to the same era as the music that I am playing. So it kind of provides a description of that era. It gives perspective on how the music you are playing should be approached.

Multidisciplinary approaches to dissertation topics. Some Doctor of Music students stated that the written part of their dissertation included multidisciplinary approaches combining elements from non-music related domains. Domain of acoustics was mentioned by a participant, for example:

> I have now observed that I am going deeper into acoustics […] I really would like to study it more to gain a deeper understanding of what we are measuring.

Conventions of scientific writing. Many of the participants stated that as being initially trained in music performance, they felt that they needed to strengthen their scientific writing. The Doctor of Music students mentioned both instructional works and previous dissertations as examples of important information sources on these conventions:

> I have noticed that it is really useful just to read previous dissertations, as I am not acquainted with the matter, I mean the format, as such. It helps to understand how your thoughts should be formulated for it to be academically credible.

Technological models of music as the first mode of symbolic representations

Technological models of the concert pieces. The Doctor of Music students indicated that the examination of the concert pieces through music theoretical analysis helped them to understand the structure and details of the pieces, which in turn could influence their interpretation. Whereas the participants found that music notations provided the foundational material for analyses, this activity of analysis as such appeared to rely mostly on their previously acquired music theoretical expertise. As discussed above, related to situational relevance type of utilizing notations in music analyses, the participants stated that technological models derived from the pieces could influence their interpretation. Moreover, the participants could use extracts of analyses in the written part of the thesis:

> Yes, it [*theoretical analyses*] has quite a great influence. One also understands details and the structure of the piece spontaneously, but it is of help here. Then again, in my opinion, the relation of analyses and performance may be problematic because bringing forth the details may be impossible in practice. But it [*analysing of pieces*] has been useful and will continue to be so.

Previous analyses of the concert pieces. Whereas most Doctor of Music students seemed to rely on their own previously acquired ability of creating music theoretical analyses of the concert pieces, some of them indicated that gaining access to prior analyses is important for obtaining complementary insights and viewpoints to the pieces to be examined and played in their dissertation:

> I would really like to search for works of theorists or experts concerning this music. […] Because each composer has a tonal language of their own, that is, they utilize these things discussed in music theory in different ways. And you can analyse music using different methods.

> There certainly are […] Like harmony, how this specific composer approaches harmony? And these are interpretations, as analyses often are. They are not definitive truths. […] But they provide new points of view.

Analyzing music of different eras. Some participants stated it would be of importance to increase their knowledge of era-specific analysis methods. Their explicated interests included the analysis of baroque and 12-tone music (also dodecaphonic or 12-tone serialist music). Different from the situational relevance types reviewed above, the emphasis of the participants where here on the methodologies of music analysis in general:

> You can't do historical performance without knowledge. […] For example, being a period-correct baroque musician has a lot to do with a harmony-based approach. […] Harmony is theory. The significance of this [*mode of music information*] is thus great.

Discussion

A closer qualitative investigation of the findings reveals some particularities regarding the music information modes and their identified situational relevance types for the Doctor of Music students. Within the situational relevance types linked to the first enactive mode, the sense of touch and muscular memory of gestural language appears primary. Respectively, sense of hearing appears primary within the situational relevance types linked to the second enactive mode. At level of individual pieces, gestural language and the aural experience generated appear simultaneously (see e.g. Godøy, 2003) and this "multi-enaction" may augment the difficulty of translating information within these modes into written language. There appears to be no current common terminology capable of exactly describing and classifying gestural language of music making (see situational relevance type of models of gestural language as the focus of written examinations). Despite the inherent simultaneousness of the enactive modes, both modes also suggested more general situational relevance types, which are not necessarily directly linked to the concert pieces included in the participants' dissertations on music, such as models of gestural language as the focus of written examination and recorded traditions of performance.

The situational relevance types identified from information representing the iconic mode of music information suggest that music notations occupy an important role related to the gestural language of the concert pieces and their interpretation. This mode of music information was seen as on average the most important one by the participants. This suggests that music notations, along gestural language and aural experiences of music, have an integral role in performing musicians' information seeking. The importance of music notations is also evident from some of the quotes presented in the findings section. However, the importance of the individual modes might vary as the dissertation on music task proceeds. It is possible that the importance of music notations decreases (or further increases) in the later stages of the dissertation tasks. Given that theoretical analyses derived from music notations are first and foremost also interpretations (see situational relevance type of "previous analyses of concert pieces"; also Tarasti, 1994, p. 31), the findings of the present study also support the claim that music notations are quite alien to terms of written language (Adorno, 2006, p. 168).

The first and second symbolic modes appear important because they provide frameworks at the level of written language, both theoretical and cultural historical music, for the dissertation on music tasks. Especially the interpretative work concerning the concert pieces seemed to be open to influences from diverse types of literature, both academic and fictional. Written language used in dissertations also needed to be researched and learned. In the quotes illustrating the situational relevance type of familiarizing with terminology, a student explained that she was familiar with the experience of the phenomena, but had yet no means of translating these experiences into written language. The situational relevance types linked to other symbolic information were broadest in their

topics suggesting that the Doctor of Music students joined ideas to their dissertations from various non-music sources.

The first three modes of music information appear difficult to be unequivocally translated into written language. However, diverse situational relevance types were identified from these three modes and they were considered most important ones by the Doctor of Music students. Even though the situational relevance types identified from the interviews are not generalizable, the above traits of these modes of music information should be taken more into account in studies of both information seeking of performing musicians and music-related information seeking in general where music information should be examined in greater detail by delving into its diverse layers. The findings of the present paper reflect the previous accounts of musicology (Bengtsson, 1977), music semiotics (Tarasti, 1994) and ethnomusicology (e.g. Hood, 1963) in a sense that they suggest a separation between symbolic language and enactive music.

It is reasonable to ask, whether situational relevance types identified in the present study reflect real-life information needs or whether they are more of a product of the theoretical framework used. However, the review of studies on music-related information needs reveal parallels between previously identified need types and the used music information modes. Music performances, recordings, notations and music-related literature are identified as information need types, albeit amongst many, by previous studies (e.g. Kostagiolas *et al.*, 2015, p. 7). The present study answers the question why these needs occur for the focus group of Doctor of Music students.

Further research

It is important to acknowledge that also the phase of the dissertation on music projects influenced both the perceived importance of information categories and the identified situational relevance types. As the interviews were conducted in an early phase of their dissertation projects, it is likely that the perceived importance of, for example, information representing music making as the first mode of enactive representations increases as the dissertation work proceeds. Further studies are needed to examine the dynamic nature of the situational relevance types of diverse modes of music information. The previous need for further research is also supported by Kuhlthau's (2004, p. 112) ISP model, which suggests that the interpretations of information types represented at varying levels of abstraction might undergo change as the information-seeking process progresses. The research design used in the present investigation could also be replicated with a different focus group to verify whether it is the users' previous knowledge and background which primarily affects the perceptions of the situational relevance of diverse music information modes (see Barry 1998, p. 1302).

The problem of translation occurring between the modes of music information also suggests different areas of further research that could be useful to MIR design. Future focus of interest could be on tasks where gestural language of music making is examined at a level of written language or in scrutinizing how music notations are used in tasks that aim to both music performances and written reports, for example.

Conclusion

The present paper elaborates the picture of situational relevance of music information from a performing musician's point of view. The findings highlight that the modes of music information may suggest diverse situational relevance types of their own when evaluated by performing musicians. For MIR, the present paper offers new contextual facets explaining why diverse music information could be relevant to musicians. The findings also underline the importance of gestural language within music information behavior, which appears to be a theme of increasing importance in MIR (Godøy and Jensenius, 2009; see also Luck *et al.*, 2010). For studies of music-related information seeking, the present study offers new insights on

why performing musicians have information needs regarding certain types of music information sources, such as audio recordings and music notations (e.g. Kostagiolas *et al.*, 2015). Furthermore, the present paper provides a rare account on performing musicians' vocational and school-related information seeking.

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PUBLICATION IV

Adopting situationally relevant modes of music information at different stages of information-seeking processes: a longitudinal investigation among music students

Rousi, A.M., Savolainen, R. and Vakkari, P.

Journal of Documentation, Vol. 75 No. 6, pp. 1230-1257
https://doi.org/10.1108/JD-12-2018-0210

Received 17 December 2018
Revised 5 April 2019
Accepted 8 April 2019

Adopting situationally relevant modes of music information at different stages of information-seeking processes

A longitudinal investigation among music students

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Abstract

Purpose – The purpose of this paper is to elaborate the picture of situational relevance by examining how modes of music information are viewed as situationally relevant at different stages of information-seeking processes among music students.

Design/methodology/approach – Empirical data of the present longitudinal study were collected in two phases by utilizing questionnaire and interview methods. Informants comprised of 14 university-level music students representing the fields of music performance, music education and music theory and composition. Modes of music information were approached through the information typology presented by Rousi, Savolainen and Vakkari.

Findings – The findings indicate that not only the modes of music information were seen as situationally relevant for different reasons by the three participating music student groups when at the beginning of their tasks, but also that the perceived situational relevance of the information modes underwent changes as their tasks progressed to focus formulation and post-focus stages.

Research limitations/implications – Due to the small number of participants, further research is needed to verify the results concerning the differences in information-seeking processes between diverse music student groups.

Originality/value – The paper showcases that approaching music information through frameworks that classify information sources at diverse levels of abstraction enables an accurate description of information-seeking processes and illuminates context-sensitive development of situational relevance of music information of diverse modes.

Keywords Music, Relevance, Music information, Information seeking, Information search process, Music students

Paper type Research paper

Introduction

Kuhlthau's (2004, p. 112) information search process (ISP) model suggests that information types at varying levels of abstraction may have differentiated interpretations during information-seeking process, and that these interpretations can undergo change as such processes progress. Music is a domain where information resides not merely in written language. In their works on musicology and musical semiotics, Bengtsson (1977) and Tarasti (1994, p. 4) state that musical knowing transpires through sign systems such as

The authors would like to thank the anonymous reviewers for their constructive comments that greatly helped us to improve the manuscript.

Journal of Documentation
Vol. 75 No. 6, 2019
pp. 1230-1257
Emerald Publishing Limited
0022-0418
DOI 10.1108/JD-12-2018-0210

music notations, aural experiences and gestural language of music making. This suggests that the interpretation and relevance of music information of varying kinds may change during an information-seeking process. When juxtaposing the dynamic nature of relevance suggested in the ISP model with the above multifaceted notion of music information of musicology and musical semiotics, an anomaly becomes apparent. Prior studies have left open the following question: which modes of music information are viewed as situationally relevant during the different stages of information-seeking processes?

In general, studies on situational relevance examine the relationships between information and the user´s information problem situation (Schamber, 1994, p. 8; Saracevic, 2007, p. 1930). The present paper approaches the relevance of music information in relation to situational requirements of accomplishing a study-related information-seeking task on music. Prior to the present paper, the issue of music information objects and relevance have predominantly been discussed within the field of music information retrieval (MIR) (e.g. Casey *et al.*, 2008; Kim, 2015). Even though there are situational factors, such as user's location (e.g. Cheng and Shen, 2014) and time of day (e.g. Su *et al.*, 2010), included in MIR's approach to relevance, we lack investigations examining how music students view the situational relevance of music information of varying kinds during the different stages of performing their information-seeking tasks. Neither studies describing and modeling information seeking and needs of musicians (e.g. Brown, 2002; Kostagiolas *et al.*, 2015; Lavranos *et al.*, 2015, 2016) have devoted due attention to the particular nature of the modes of music information and their situational relevance. Even though there are a few studies of information seeking examining the situational relevance of music information (see Rousi *et al.*, 2018), none of these prior studies focus on how the situational relevance of music information of diverse modes is viewed during the different stages of information-seeking tasks.

To fill gaps in empirical research on context-sensitive information-seeking processes, the present paper examines how music students representing different fields and levels of university studies adopt situationally relevant modes of music information during the different stages of performing their information-seeking tasks. The term music information mode refers to a set of information sources that are seen to represent music information at a certain level of abstraction. In other words, the concept of music information mode is used to group information sources based on their method of representation, be it gestural language, non-conceptual aural experiences of music or symbolic written representations, for example. To conceptualize these modes, the present paper utilizes the typology of music information proposed by Rousi *et al.* (2016). Six modes were identified: music making as the first mode of enactive representations; music listening as the second mode of enactive representations; iconic representations of music; technological models of music as the first mode of symbolic representations; and ideological models of music as the second mode of symbolic representations and other symbolic information.

The present paper utilizes a longitudinal research design where the situational relevance of the modes of music information are qualitatively analyzed at two phases during the information-seeking tasks performed by the music students. Furthermore, the progress of the participants' information-seeking task processes was examined from the viewpoint of thoughts, actions and emotions by using a modified process survey instrument of the ISP model (see Kuhlthau, 2004, p. 60). The empirical material was collected in 2013–2015 by using survey and interviews methods. The participants comprised of 14 music students representing music performance, music education and music theory and composition. All the participants were Finnish music students of Sibelius Academy, Helsinki University of the Arts.

The rest of the paper is structured as follows. First, to provide a background, the literature review introduces the typology of the modes of music information used in the present study; this section also describes diverse approaches to situational relevance and

characterizes the main features of studies of relevance of music information objects and Kuhlthau's ISP model. Then, the research questions and the empirical research design are specified. The main part of the paper focuses on the report of the empirical findings. The concluding section discusses the findings and reflects their significance.

Literature review

Modes of music information

The typology of music information used in the present study was created by integrating Tarasti's (1994) music semiotic ideas with Bruner's (1966) approach to modes of knowledge representations introduced in Bruner's book, *Toward a Theory of Instruction*. According to Bruner, any domain of knowledge and every single problem within that domain can be presented to the learner through using the following modes of representation: Enactive mode of representation refers to sequences of activities for creating desired results. Iconic mode of representation refers to presenting a concept through a graph without exhaustively defining it. Most abstract of the modes is the symbolic mode where through a system that defines rules of expression, a set of arguments is created for describing a concept (Bruner, 1966, pp. 44–45). The proposed typology further defined the content of Bruner's modes within the domain of music by positioning sign systems relevant to music presented by Tarasti (1994) in *Theory of Musical Semiotics* into them, which led into altogether six following modes of information (Rousi *et al.*, 2016):

(1) Music making as the first mode of enactive representations refers to information resided in different sequences of actions that produce sounds for musical purposes. This action may appear in varied forms, such as playing the violin, singing or creating electronic music with a computer.

(2) Receiving music as the second mode of enactive representations refers to receiving musical performances, while being present at a performance or through a recording, without the control over the performance's sonic results. Audio recordings played using either home audio devices or mobile online music streaming services function as examples of sources incorporating this second mode of music information.

(3) Iconic representations of music refer to the graphic illustrations presenting music-related information. Different notations, such as modern staff notations, function as an example of sources incorporating this mode of music information.

(4) Technological models of music as the first mode of symbolic representations refer to examining structures of music, i.e. tonal organization of harmony and counterpoint and sonic formulae of orchestration and interpretation, for example, through symbolic means such as written language. Information sources that incorporate the first mode of symbolic representations are, for example, textbooks of harmony and counterpoint.

(5) Ideological models of music as the second mode of symbolic representations address music at a symbolic level but not directly the qualities that transpire in audible music. In this mode, conceptual symbolism regarding music are negotiated with other fields and their conceptual symbolic representations. For example, it is possible to produce narratives on concepts such as "Western classical music" and "history" or "music" and "aesthetics" without reference to actual phenomena present in sonic reality of music. Examples of information sources that can be more geared towards the second symbolic mode include monographs on philosophy of music and some texts concerning the history of music, such as some biographies of composers.

(6) As music students might also have other than music-related information needs, such as information needs about academic writing, a sixth information category titled other symbolic information was added into examination. This category was defined to include all symbolic, i.e. conceptual, information sources from other than music-related disciplines, such as conventions of scientific writing.

The typology's purpose is not to exhaustively classify phenomena as belonging to one mode alone. The position and needs of the information seeker play a crucial role in providing the angle through which the different modes of music information transpire. For example, the technological models of harmony and counterpoint are closely weaved with the history of Western music, which is evident in concepts such as "Palestrina style counterpoint" (see also Tarasti, 1994, p. 17). Thus, the same information sources can very well include many of the modes of music information.

Situational relevance

Whereas systems or algorithms create relevance by retrieving documents based on the query, people derive relevance from obtained information objects (Saracevic, 2007, p. 1919). Situational relevance refers to examining relationships between information and the user's information problem situation (Schamber, 1994, p. 8; Saracevic, 2007, p. 1930). Relevance inferences depend not only on the features of the information in document, but also on user's context, user's previous knowledge and specific qualities sought (Barry, 1998, p. 1302). The situational relevance approach differs from topical relevance approach where the focus is on the relationship between the topic expressed in a search query and topic covered by resulting information objects (Saracevic, 2007, p. 1929; 1931). Concepts such as success dimensions, criteria categories and factors influencing selection of information objects, e.g. documents, have been used to describe the outcomes of previous research examining situational relevance (Schamber, 1994, pp. 24-25). In the present paper, however, the construct of situational relevance type was preferred. This is due to the fact that such types are approached as situational factors that make the seeking of diverse modes of music information pertinent to the performance of ongoing study tasks among students working on their theses and dissertations.

Music information objects and relevance

The issue of music information objects and relevance has predominantly been discussed within the field of MIR. MIR studies have examined relevance of music information objects through context-based approaches matching string search queries with textual metadata representations and through content-based approaches matching music similarity of audio data examining rhythm and melodies (e.g. Downie, 2003; Downie, 2004; Casey *et al.*, 2008; Kim, 2015). In MIR, the approaches to relevance are often more system than user oriented. MIR's conceptualization of music information provide useful summaries for MIR system design (e.g. Downie, 2003, pp. 293-301) but may not be sufficient from the viewpoint of a person engaged in music information seeking to whom gestural language of music making (Godøy and Jensenius, 2009) and diverse literature (Brown, 2002, p. 82) may also be relevant. Currently, there are also users' situational or contextual factors incorporated into MIR techniques. For example, context-aware music recommender systems utilize the following contextual data when suggesting content. User's mood or emotion (Kim *et al.*, 2010); daily activities, such as working, sleeping and running (Wang *et al.*, 2012); user's location (Cheng and Shen, 2014); and time of day (Su *et al.*, 2010). However, these factors are general in their nature, and do not tell why, for example, music students see the different modes of music information situationally relevant in different stages of their information-seeking tasks.

Studies describing and modeling information seeking and needs of musicians and music scholars confirm that both groups have information needs spanning to diverse information sources representing music information at varying levels of abstraction (Brown, 2002; Hunter, 2006; Liew and Siong, 2006; Lai and Chan, 2010; Matson and Shelley, 2013; Dougan, 2015; Kostagiolas *et al.*, 2015; Lavranos *et al.*, 2015, 2016). For example, music performances, recordings, notations and music-related literature are identified as information need types, albeit amongst many, by previous studies (e.g. Kostagiolas *et al.*, 2015, p. 7). Brown's (2002, p. 82; 86) findings suggest that music scholars utilize, for example, audio recordings and music notations while conducting research. In general, the above studies have not devoted due attention to the particular nature of the modes of music information and the ways in which music students evaluate their situational relevance. Currently, there are some studies of music-related information seeking and information behavior that have approached music information's situational relevance through the many layers of music information (Rousi *et al.*, 2018; see also Pohjannoro and Rousi, 2018). However, prior to the present paper, there are no longitudinal studies examining which modes of music information are viewed as situationally relevant during the different stages of information-seeking processes?

ISP model

As stated in the introduction, Kuhlthau's (2004) ISP model enables the process approach by providing a framework for the analysis of the information-seeking tasks of the music students. In a series of empirical studies, Kuhlthau (2004) demonstrated that information-seeking tasks consist of several stages. The ISP model proposes that information-seeking tasks typically consist of six consecutive stages: initiation, selection, exploration, formulation, collection and presentation (Kuhlthau, 2004, p. 44-50). These stages are significant as person's thoughts, actions and emotions typically undergo change as one's information-seeking task progresses from stage to another. According to the model, the formulation is a pivotal stage during which a more focused perspective to the task is gathered. After focus formulation, person's sense of direction and confidence increases and actions change from exploring relevant information to seeking and documenting pertinent information (Kuhlthau, 2004). The ISP model has gained a prominent role among theories of information seeking and has affected theory building in Information science (Vakkari, 2001). It has previously provided a process framework for studies examining the changing relevance criteria of textual documents during information-seeking tasks (Bateman, 1998; Vakkari and Hakala, 2000). Even though music-related information seeking has been described and modeled in previous studies (Lavranos *et al.*, 2016), which situationally relevant modes of music information are adopted by music students during different stages of their information-seeking tasks has not been previously examined through the ISP model or any other process-oriented framework of information seeking.

Methods

Research question

The goal of the present paper is to elaborate the picture of situational relevance by examining how modes of music information are viewed as situationally relevant at different stages of information-seeking processes among music students representing different fields of university studies. To this end, the present paper addresses the following research question:

RQ1. Which situationally relevant modes of music information are adopted during the information-seeking processes of music students representing the fields of music performance, music education and music theory and composition?

Methodology

Participants. All of the 14 participants of the present study were students in Sibelius Academy, Helsinki University of Arts in Finland. The participants of the present paper represented three different music student groups of Sibelius Academy. Six of the participants were Doctor of Music (DocMus) students focusing on music performance. Their dissertation projects included both a series of five concerts and a written part. During the present study, the participating DocMus students had written and submitted their final dissertation proposal for examination. In their proposals, both the concert programs and the topic of the written dissertation were defined. Five of the participants were students of music performance specializing in music education. Their theses were written and no music performances were included in their grading. One of the students who focused on music education was a DocMus student, i.e. PhD level student, and four were working on their Master's theses. Lastly, three of the participants were students of music theory and composition who were also working on their Master's theses. Also, the theses of the students of music theory and composition were written and focused on music analyses; no music performances were included in their grading. Before the first data collection phase of the longitudinal study, both groups of Master-level students had begun their Master's thesis.

These three main student groups were selected as the participants of the present study due to that they were seen to represent three different task types common to music students: preparing music performances, writing academic texts on music education and conducting music theoretical analyses. By including these three participant groups, the present study seeks to elaborate the picture on how music students representing different fields view the situational relevance of music information modes during the different stages of performing their information-seeking tasks.

The participating DocMus students were recruited from an information retrieval course arranged for the DocMus students by Sibelius Academy, Helsinki University of Arts Library. The participating Master-level students of music education and music theory and composition were recruited from their respective Master's thesis seminars. All 14 music students were awarded a sum of €40 for their participation in the longitudinal study of the present paper.

Even though the amount of participants per student group is small, they represent a fairly large sample of all students annually participating in both the DocMus programs and the respective Master-level seminars. Within the period of 2010–2018, on average, six Doctors of Music focusing on music performance have graduated per year from the Sibelius Academy, Helsinki University of Arts. As the recruitment of DocMus students ($n = 6$) spanned from the semesters of 2013–2014 and 2014–2015, it may be estimated that the three participants per semester constitute a significant proportion of all students starting in the respective program on the given year. The DocMus student focusing on music education ($n = 1$) was from the researcher program of the doctoral school of Sibelius Academy, Helsinki University of Arts. Respectively, on average, four Doctors of Music have graduated within the period of 2010–2018 from the researcher program. The Master's level students of music education ($n = 4$) were recruited from two Master's level seminars in which there were circa ten active participants in total. The students of music theory and composition ($n = 3$) were recruited from a Master's thesis seminar with circa five active participants. With both Master's level students focusing on music education and music theory and composition, the data collection was limited to the semester of 2013–2014. This was due to that several students continued in the seminar also in the following semester, which enabled the recruiting of new participants by continuing data collection in semester 2014–2015.

Data collection methods

The data collection methods of the present study included survey questionnaire and interview methods. To examine how the music students progressed in their information-seeking tasks, the present investigation utilized survey questionnaires. In the initial section of the questionnaire, the participants were asked to assess whether they thought their tasks had progressed. During both data collection phases, the participants chose the current stage of their information-seeking task from the three stages identified by Vakkari (2001, p. 47): start of the thesis and identifying its general topic (pre-focus); examining information concerning a general topic and formulating a specific focus (focus formulation); and gathering information pertinent to a focused topic or finalizing the thesis (post-focus). Whereas the rest of the questionnaire used in the present study drew on the process survey instrument developed by Kuhlthau (2004, p. 60), Vakkari's (2001, p. 47) operationalization of the stages of information-seeking tasks was made at a higher level of generality so that it would suit to the examination of tasks incorporating music performances.

To further support the participants' self-assessment of the progress of task performance, as well as the changes in thoughts, actions and emotions, the process survey instrument developed by Kuhlthau (2004, p. 60) was modified for the purposes of the present study as follows. The questions examining the information seeker's current emotions and thoughts were translated into Finnish and used as such in the data collection. The section examining current activities was also modified to include music-related activities. Music listening, performing music and conducting music analyses were added as options among the original actions listed in Kuhlthau's (2004, p. 60) process survey instrument. To include the process aspect in the music-related activities, two options of each of these activities of playing music, listening to music and conducting music analyses were given in the questionnaire. One of the options reflected a more focused approach to the activity, such as "I conduct detailed music analyses related to my topic" while another option exemplified a less focused approach, such as "I conduct preliminary music analyses related to my topic." Both the thoughts, actions and emotions in the original process survey instrument (Kuhlthau, 2004, p. 60), and the added music-related activities were listed in the questionnaire. The participants were asked to choose all that apply during both data collection stages. The questionnaire used is included as Appendix 1 (translated from Finnish to English by the first author).

The third main part of the questionnaire focused on the situational relevance of the six information modes presented in the literature review (Rousi *et al.*, 2016). Each information mode had its own section in the questionnaire. Within these sections, the participants were first asked to indicate on a four-point scale (not at all important, not that important, important and very important) how pertinent each of the modes was for their tasks of either a dissertation or a Master's thesis in music and then to briefly write down the reasons behind these assessments. The information mode-specific sections of the questionnaire also included definitions of the information modes and examples of information sources of individual modes were provided (see Appendix 1).

The use of questionnaires was complemented with interview methods. A thematic interview guide was developed to ask more detailed questions regarding the participants' thesis tasks and to allow the participants to elaborate answers given in the questionnaires. Overall, the interview guide consisted of two main sections: general questions regarding the topic and progress of the participants' thesis tasks and sections examining the situational relevance of the six information modes. Within the music information mode-specific sections, the participants were able to explain in depth why a specific information mode was or was not important for their information-seeking tasks and whether they saw that its situational relevance had changed during the information-seeking process. The interview data consist of circa 630 min of audio-taped records.

Data collection process

The empirical data were collected in two phases. First, during autumn semesters of 2013 or 2014, the 14 participants were asked to fill in the survey consisting of the sections described previously. All of the 14 students also participated in the latter phase of data collection, which took place during the following year's spring semester. During the latter phase, the participants were first asked fill in again the same set of survey questions regarding their thoughts, actions and feelings after which their answers were further elaborated in an interview. Second, the participants were asked to the fill in the sections concerning the importance individual modes of music information as in the previous phase; each of these were complemented with interview questions. Once the individual music information mode sections were covered during the second phase of data collection, the previous answers given in the first phase survey were shown to the participants; thereafter, any differences identified in mode-specific situational relevance assessments were discussed. The average time period between the first and second data collection phases was circa 135 days. The shortest period was circa 100 days and longest circa 160 days. Table I summarizes the data collection process.

Research ethics

The informed consent form was given for the scrutiny of the participants at both data collection stages. The form offers information about the voluntary nature of the study, the participants to right withdraw from the study at any given stage and the anonymized reporting of the results and data. Agreeing to participate in the interviews was interpreted as the informant's consent to participate in the study. If a participant returned the questionnaire during phase 1, but did not participate in the second phase of data collection, their data were discarded and thus not used in the present study. Direct identifiers were collected only as part of the interview data, i.e. the voice of the participant. However, given that the overall music student population is small, the indirect identifiers included in the data become increasingly efficient in identifying the participants. Therefore, the questionnaire data, interview audio recordings and the transcript data will be deleted after they are no longer used for scientific purposes. The participants' anonymity is also protected when reporting quotes from the transcribed data in the findings section. Italicized notes are used to replace a specific section of the quote with a more general expression in cases in which the specific part contained an indirect identifier that would compromise the anonymity of the participant.

Data collection phase 1 Questionnaire 1	Data collection phase 2 Questionnaire 2	Interview guide
Progress in the task performance		
Participants' self-assessments regarding the progress of their information-seeking tasks Current thoughts, actions and feelings	Participants' self-assessments regarding the progress of their information-seeking tasks Current thoughts, actions and feelings	Questions regarding the task of the participants, e.g. What is the topic of your thesis? Do you have a focus in your task? What are you planning to do next? What kind of information are you looking for right now?
Situational relevance of the six information modes		
Situational relevance of the information modes The perceived importance of the mode Description of why the mode was considered as important or not important	Situational relevance of the information modes The perceived importance of the mode Description of why the mode was considered as important or not important	Questions regarding the changing situational relevance of the information modes Has the reason why the mode is important changed? Comparison of mode-specific answers of questionnaires 1 and 2

Table I.
Summary of data collection process

Data analysis and validity issues

To examine the progress occurring in the tasks of the participating music students, their self-assessments regarding the progress of their information-seeking tasks were first summarized. To achieve this, it was examined how the participants were distributed regarding the self-reported stages of the task performance process per phase of data collection. Second, the participants' answers to the modified process survey questionnaire were summarized so that the percentual distributions of participants expressing different thoughts, actions and emotions were examined per phase of data collection. Due to the small number of the participants, no correlations or statistical tests will be conducted. However, descriptive statistics are calculated with regard to the stage of the participants' tasks and thoughts, actions and emotions at both data collection phases to support the qualitative analysis that result in student group summaries. The findings regarding these are presented using descriptive statistics so that they highlight the changes occurred in the participants' thoughts, actions and emotions during the longitudinal study.

With the questionnaire and interview data examining the perceived importance of the music information modes and their situational relevance, the analysis was conducted as follows. First, the questionnaire data were summarized by calculating information mode-specific averages of perceived importance. Second, the interview data were transcribed and scrutinized through qualitative content analysis. More specifically, the open-ended answers explaining the perceived importance assessment of an information mode were interpreted to indicate its types of situational relevance. To this end, an attempt was made to identify reasons by which the participants considered a music information mode important to task performance; such reasons were used as a point of departure to identify the situational relevance types reviewed in the findings section below. To detect the changes occurring in the situational relevance types, the constant comparative method (Tesch, 1990, p. 96; Silverman, 2005) was used to discern conceptual similarities between the open-ended answers obtained during both data collection phases. If a conceptual dissimilarity was observed in the open-ended answers, the full interview data were further scrutinized for more evidence of changing situational relevance of an information mode.

Even though the empirical data are already six years old, it was seen as valid for the particular needs of the present investigation. It examines which situationally relevant modes of music information are adopted during preparing a thesis focusing music performance, music education and music theoretical analyses. Analysis is not conducted on the level of individual information sources *per se*, but on the more general level of music information modes, each categorizing music information at a different level of abstraction. As the processes of giving concerts in the Western art music tradition, writing academic texts on music education and conducting music theoretical analyses are grounded in their cultural traditions (see e.g. Kuhn, 1996; Trehub *et al.*, 2015), their core information elements do not change so rapidly than the quickly developing field of online music information sources and music streaming services, for example.

To improve the validity of this study, the following section incorporates quotes taken from the interview data. The quotes were translated from Finnish into English by the first author. Care was put into preserving the quotes as close as possible to verbatim form during the translation process.

Findings

The findings section is organized as follows. First, the summary of participants' self-assessments regarding the progress of their information-seeking tasks is presented. Second, descriptive statistics regarding the changes of the participants' thoughts, actions and emotions between data collection phases are presented to demonstrate whether they – in line with Kuhlthau's (2004) ISP model – indicated progress in the task performance.

Third, the perceived importance and situational relevance of the music information modes are reviewed. The situational relevance of modes of music information is qualitatively described with illustrative extracts taken from the empirical data. Lastly, the results are summarized per music student group to provide an overview on how situationally relevant modes of music information are adopted at the different stages of information-seeking processes among music students representing the fields of music performance, music education and music theory and composition.

Participants' self-assessments regarding the progress of their information-seeking tasks

The participants' self-assessments revealed that circa half of the participants thought that they had moved to a new stage in their information-seeking at the time of the second phase of data collection. Five participants indicated that they had moved from the focus formulation stage to post-focus stage at the second phase of data collection. Respectively, two of the participants indicated that they had moved from pre-focus stage to focus formulation at the second phase of data collection. Table II specifies how the participants were distributed into various stages of the task performance, based on their self-assessments during the data collection phases I and II.

Thoughts, actions and emotions of the participants

The participants' answers to the thoughts, actions and emotions sections of the modified process survey questionnaire are presented next. The answers were summarized so that the percentage distributions of participants expressing different thoughts, actions and emotions were examined per phase of data collection highlighting the changes occurring between data collection phases. The purpose of the descriptive statistics is to support the qualitative analysis resulting in the student group summaries presented later in this findings section.

The changes in thoughts reported by the participants in both phases of data collection suggest that their information-seeking tasks had progressed. In total, 57 percent of the participants reported they were "recognizing ways to draw the project to close" during the second phase, whereas only 28 percent reported this at the initial phase. Also, the share of participants "seeking information about my specific area of concentration" rose to 64 percent at the time of the second phase from the 43 percent participants reporting this in the first phase. The share of participants who reported to be "identifying possible alternative topics" dropped from 57 percent in the first phase to 29 percent in the second phase. Also, the share of participants reporting they were "becoming informed about the general topic" dropped from 71 to 43 percent during the second phase of data collection. The entire results concerning changes in the category of thoughts are presented in Table AI.

The changes in the participants' actions support the above findings in that their tasks had progressed during the data collection process. The amount of participants reading literature rose from 71 to 86 percent at the second phase of data collection. Writing about themes and ideas rose from 36 to 50 percent and the share of participants trying out music pieces with their instrument rose from 29 to 43 percent. Actions with decreasing shares

Stage of the task	Phase I number of participants	Phase I % of participants (%)	Phase II number of participants	Phase II % of participants (%)
Post-focus	1	7	6	43
Focus formulation	9	64	6	43
Pre-focus	4	29	2	14
Total	14	100	14	100

Note: $n = 14$

Table II. Stage of the task during data collection phases I and II as assessed by the participants

included "making a preliminary search from the library" (from 64 to 21 percent), "conferring with people who know the topic" (from 50 to 11 percent) and "reading over notes for themes (from 43 to 7 percent). The entire results concerning changes in the category of actions are presented in Table AII.

Similar to thoughts and actions, changes in emotions suggest that the participants' tasks had progressed when the changes are examined through Kuhlthau's (2004) ISP framework. Amongst the participants, positive feelings had increased during the second phase of data collection. For example, the share of participants feeling optimistic increased from 66 to 86 percent. Furthermore, 21 percent of the participants reported feeling relieved during the second phase whereas none did so during the initial phase. Respectively, the share of participants reporting negative emotions decreased during the data collection. In sum, 50 percent of the participants reported feeling confused at the first phase and none did so during the second. Furthermore, 36 percent of the participants reported feeling doubtful during the first phase and 14 percent did so during the second. The entire results concerning in the category of emotions are presented in Table AIII.

The changes in thoughts, actions and emotions of the participants suggest that their tasks had progressed during the circa 130 days between the two data collection. Even though the data of the present study do not evidence that the tasks of all of the 14 participants had progressed, the analysis revealed that the tasks of circa half of the participant underwent significant progress between the data collection points. Furthermore, when examined at the level of individual participants, hints of progress were present in the changes of thoughts and actions of altogether four participants who did not report progress in their assessments.

Perceived importance of modes of music information

The scrutiny of the participants' questionnaire answers revealed that the perceived importance of the modes of music information did not undergo major changes between the phases of data collection. However, the information modes seen as important varied between the student groups participating in the present study. DocMus students focusing on music performance saw diverse information modes relevant for their tasks and viewed iconic mode, music making as the first mode of enactive representations and receiving music as the second mode of enactive representations as the most important (see also Rousi *et al.*, 2018). The tasks of the students of music theory and composition were primarily music theoretical analyses of a musical piece or pieces; these students viewed the same information modes as important similar to DocMus students. However, in contrast to DocMus students, the students of music theory and composition saw technological models of music as the first mode of symbolic representations as important. Compared to the above student groups, the students focusing on music education viewed somewhat different information modes as important. Their focus appeared to be to strive to narrow their focus into the most relevant symbolic information mode, which, within the data of the present paper, was ideological models of music as the second mode symbolic representations. See Table AIV for the average perceived importance of modes of music information categorized per music student group.

Situational relevance types of the modes of music information

The open-ended answers explaining the assessment of perceived importance of an information mode were indicative of the types of situational relevance. Furthermore, the qualitative analysis discerning conceptual dissimilarities between the answers specific to a data-collection phase were used to identify how the mode's situational relevance changed as the tasks of the participants progressed. What follows is a section in which the changes in the situational relevance of the modes are examined in more detail per music information mode.

I: music making as the first mode of enactive representations

Among DocMus students, music making as the first mode of enactive representations was seen important in the early phases of their dissertation tasks primarily for the reason of gaining mastery of the gestural language of the concert pieces. One of the DocMus students reported a change in the situational relevance in conjunction with focus formulation: after focus formulation, he had interest in both personal rehearsal of gestural language of the concert pieces, but also in how players of a certain instrument used their arm in certain musical passages. The present study's findings suggest that gestural language of music making is also relevant for music students working on written theses of music analysis and music education. A student of music theory and composition explained how she used own playing to study the details of the analyzed piece and how the importance of this function of her own playing increased after getting initially acquainted with the piece through listening recordings of the piece. A student focusing on music education explained that as the topic of his thesis grew more focused, he realized how much his own approach to his instrument affected his approach to his task:

> Music education student A: "My topic has to do with music education so it is important maintain one's ability with one's instrument." (1st phase, survey)

> Music education student A: "Well, one can approach singing in so many ways and yet […] Yet get the results. […] So in a way it [*thesis*] mirrors my own subjective view of singing which again is based on, as I still study, my teacher's approach. […] So in that sense, my own approach has a great impact on this. Also in a way that through my own approach I contemplate that what are results of this. […] Well, now I have observed that […] in that previous phase I had a more detached approach and were thinking that I just sing and of course I have to know how to sing to be able to do what I am doing." (2nd phase, interview)

II: receiving music as the second mode of enactive representations

Among DocMus students focusing on music performance, the change dynamics within the situational relevance of receiving music as the second mode of enactive representations appeared differently during the task performance process. In the starting phases of the task, listening to audio recordings or using music streaming services was important for the sake of getting acquainted with large amounts of musical material which helped to narrow down the focus of the theses. After focus formulation, listening to audio recordings could gain entirely new situational relevance types and it was used for detailed study and analyses of the pieces chosen to be included, for example. Also, the students of music theory and composition listened to audio recordings and used online music streaming services to get acquainted with the pieces in focus of the analyses. With students of music theory and composition, it was possible that the importance of this music information mode diminished in the later phases of the task, as the students were focusing on finalizing the music theoretical analyses of the pieces. Furthermore, regardless of the music student group, if the focus of the task was redefined between the phases of the data collection, this mode of music information could become of relevance due to new focus in task. The following extracts illustrate how the situational relevance of receiving music as the second mode of enactive representations changed for students of music theory and composition after focus formulation:

> Student of music theory and composition B: "It [2nd enactive mode] is especially important, if the piece exceeds your own capabilities as [a player of a certain instrument], which in turn leaves the audible picture of the piece vague." (1st phase, survey)

> Student of music theory and composition B: "Well, it changes so that once you have gotten acquainted with a piece, you listen to it considerably less." (2nd phase, interview)

III: iconic representations of music

With iconic representations of music, the most prominent changes in situational relevance was again found from the data of DocMus students focusing on music performance. Within the early phases of the task performance, music notations were used to gain familiarity with the gestural language of the concert pieces. However, within later phases of the task, the situational relevance types of music notations could be expanded to the examination of certain traditions of performance based on the interpretational cues included in the notations. Alike DocMus students, students of music theory and composition also viewed music notations as important for their tasks. However, the data of the present paper did not suggest significant changes in the mode's situational relevance during their tasks. Also, as with receiving music as the second mode of enactive representations, if the participant had redefined the focus of his or her task, the situational relevance of iconic representations of music could change abruptly due to it:

> Doctor of Music student D: "It has now occurred to me that it is worthwhile to study editions from the nineteenth century […] It appears they reflect on the traditions of performance of the era […] So that then means this is very important." Interviewer: "Do you feel like this has gotten more important because of this finding?" Doctor of Music student D: "Yes, it has changed! This observation is less than six months old […] As if I have found a whole new territory within last six months." (2nd phase, interview)

IV: technological models of music as the first mode of symbolic representations

With the information mode of technological models of music, the following change dynamics were identified. Among DocMus students, the participants usually saw this information mode as not important before focus formulation. However, after gaining a more focused approach to their topic, several DocMus students found this mode of new relevance. The analysis of the chosen concert pieces could require the DocMus students to gain further understanding and knowledge of analysis method they were previously unfamiliar with, for example. With music education students, the relevance of technological models could diminish, as with other symbolic information, as the participants focused their topics on matters related to ideological models of music:

> Doctor of Music student B: "My approach is not theoretical." (1st phase, survey)

> Doctor of Music student B: "Yeah, I think this is really important. I have still study this and I cannot start studying before September. […] Some were analysed with serialist methods and then there is the twelve-tone row and its use. I have no clue how these are done yet." (2nd phase, interview)

V: ideological models of music as the second mode of symbolic representations

Music performance students focusing on music education viewed the symbolic modes as important for their tasks and focused their theses' subject matter on this information mode of ideological models of music as the second mode of symbolic representations. DocMus students focusing on music performance utilized this mode of information to provide both ideological and historical frameworks for their concert series and found this information mode useful in getting acquainted with the scientific terminology of their field (see Rousi *et al.*, 2018). None of the DocMus students reported changes in these situational relevance types regarding this information mode. In general, the students of music theory and composition did not find this information mode as important for their tasks. Overall, no changes in situational relevance were identified from the participants' answers regarding the importance of ideological models as the second mode of symbolic representations:

> Music education student C: "Well, I will now say that this is really important because in a way that when [*players of a certain instrument*] feel like they are closest to the music is a very abstract thing which has been defined in many different ways. So then I have taken ideas from some music philosophical and

other philosophical texts regarding what kind of an experience this is and how it could be defined. […] Interviewer: "Would you say that there has been any significant changes regarding this?" Music education student C:"I do not think so as I had a clear idea of this from the beginning. I feel like it has gotten more focused and such, but I do not think there has been much change."

VI: other symbolic information

The change dynamics within the situational relevance of non-music-related symbolic information varied among the participants. With DocMus students, it is both possible that new types of situational relevance emerge to non-music-related symbolic information during and after focus formulation. Respectively, especially with the participant group of music performance students focusing on music education, focus formulation could also render once important situational relevance types of other symbolic information irrelevant. As stated previously, the students focusing on music education strived in focus formulation to narrow their examination into the most relevant symbolic mode of information, i.e. ideological models of music. As a result, the situational relevance of other symbolic information modes could diminish after focus formulation occurring within this music student group. Likewise to ideological models as the second mode of symbolic representations, the students of music theory and composition did not find this information mode as important for their tasks either:

> Music education student A: "I guess I have organized my thoughts regarding this so that maybe in that phase I thought that it would be more pedagogical in a certain way […][…] But now it is more clear. It has went to this direction that in the end it has a pedagogical dimension, but it is not really pedagogical […] So that there would be the teaching and its contemplation, but more of contemplation of the physiology of the voice." (2nd phase, interview)

Student group summaries

This sections present summaries of the findings regarding individual participant groups. Summary tables specify important information modes and the identified changes in the situational relevance of the modes examined from the viewpoint of the three stages of the task performance (pre-focus, focus formulation and post-focus).

DocMus students focusing on music performance

The ISP of DocMus students can be described as follows. Within the pre-focus stage, the enactive and iconic modes were most important and were used to explore the topic before proceeding into focus formulation. During and after focus formulation, the importance of the symbolic modes raised for the DocMus students. On the other hand, the importance of the enactive and iconic modes remained constant during the ISPs among these students. See Table III for the summary of findings regarding this participant group.

Music performance students focusing on music education

The ISP of the music performance students focusing on music education could be characterized as focused on the symbolic information modes. During and after the focus formulation, this participant group narrowed its focus to the symbolic or textual mode which was viewed as most relevant, i.e. ideological models of music. See Table IV for the summary of findings regarding students focusing on music performance.

Students of music theory and composition

Finally, the ISP of the students of music theory and composition can be described as follows. The enactive and iconic modes were of importance for this participant group even though the output of their task was a written thesis focusing on music analyses. As with DocMus

Important information modes	
Iconic representations of music	
Music making as the first mode of enactive representations	
Receiving music as the second mode of enactive representations	
Ideological models of music as the second mode of symbolic representations	
Other symbolic information	
Technological models of music as the first mode of symbolic representations (at the 2nd phase, not at the 1st)	
Changes in situational relevance	
Pre-focus	Focus formulation Post-focus
Notations as the foundation of gestural language of the concert pieces (iconic mode)	During and after focus formulation the situational relevance of the iconic mode may expand to other relevance types, such as studying the traditions of performance transmitted in the articulation marks
Own rehearsing as the means to gain control over the gestural language of the pieces (1st enactive)	During and after focus formulation, the situational relevance of the 1st enactive mode may expand to other relevance types, such as studying the gestural language of other performers
Study of the topic and concert pieces through listening of audio recordings (2nd enactive)	During and after focus formulation, the situational relevance of the 2st enactive mode may expand to other relevance types, such as conducting different analysis based on recordings
Pre-focus, the symbolic modes appear as secondary in relevance to enactive and iconic modes	During and after focus formulation, the situational relevance of certain symbolic modes may increase, such as technological models (1st symbolic) and other symbolic information
Note: $n = 6$	

Table III.
Important information modes and changes in situational relevance among Doctor of Music students focusing on music performance

Important information modes	
Ideological models of music as the second mode of symbolic representations	
Other symbolic information	
Changes in situational relevance	
Pre-focus	Focus formulation Post-focus
The symbolic modes most relevant when examining a general topic	The participants focused their works to matters related to ideological models and relevance of the other symbolic modes diminished
During pre-focus, the enactive modes were often seen as not relevant	If own approach to instrument and musicianship was considered significant from the viewpoint of the thesis, the importance of the enactive modes could slightly increase after and during focus formulation
Note: $n = 5$	

Table IV.
Important information modes and changes in situational relevance among students focusing on music education

students, the importance of the enactive and iconic modes remained constant during the ISPs. However, in the interviews, two of the participating music students stated that the importance of music listening as the second enactive mode diminished as the task progressed. The most important symbolic mode for this participant group was technological models of music. See Table V for the summary of findings regarding students of music theory and composition.

Discussion

The most significant factor affecting the situational relevance judgments of music information were the context, namely the nature of the participants' tasks. Music performance students focusing on music education focused on the symbolic information modes and saw the enactive and iconic modes as less important. DocMus students focusing on music performance as well as students of music theory and composition viewed the enactive and iconic modes as important, but for different reasons related to the requirements of their task at hand. Furthermore, especially among DocMus students, the situational

Table V.
Important information modes and changes in situational relevance among students of music theory and composition

Important information modes		
Receiving music as the second mode of enactive representations		
Music making as the first mode of enactive representations		
Technological models of music as the first mode of symbolic representations		
Iconic representations of music		
Changes in situational relevance		
Pre-focus	Focus formulation	Post-focus
Study of the topic and analyzed pieces at more general level through listening of audio recordings (2nd enactive)		The relevance of audio recordings may diminish after the analyses become more detailed
	Once the music analyses get more detailed, own playing (1st enactive) becomes more relevant from the viewpoint of analyzes. Own playing is used to bring forth details of the pieces to be used in the analyses	

Note: $n = 3$

relevance type of the information modes could change significantly after and during the task-stage of focus formulation. This further supports the finding of prior research that it is useful to approach the concept of relevance as a context-sensitive and process-oriented user construct (Bateman, 1998; Vakkari and Hakala, 2000).

Previous research on the changing relevance judgments of textual documents has shown that once information seeker's task progresses, the notion of relevance also becomes more focused. This is due to that the information seeker has more readiness to identify pertinent texts in the later stages of the task, even if with text documents these changes could be subtle (Vakkari and Hakala, 2000, p. 559). The findings of the present paper regarding students focusing on music education suggest a similar dynamic with regard to task progress and relevance of textual documents; during and after the focus formulation, this participant group was able to narrow its focus to the symbolic or textual mode which was viewed as most relevant and in general the changes in the situational relevance of the important information modes were subtle. Within the tasks of DocMus students, the enactive and iconic modes were of most importance during the pre-focus stage topic exploration. During and after focus formulation, the increased ability to discern pertinent information led to the perceiving of the symbolic information modes as important and relevant due to new diverse reasons. This seems to suggest that tasks focusing on enactive outputs such as music performances are more expansive what comes to using the different modes of music information at different stages of tasks. This appears as somewhat contradictory to the music education students working to create a written thesis because they strived to narrow their focus into the most relevant symbolic information mode.

Some of the students of music performance focusing on music education found the enactive modes relevant to the extent that their situational relevance type underwent changes during the period of examination. Thus, the enactive modes may not only be relevant for music students writing written theses, but they also might incorporate several situational relevance types during a task aimed at a written thesis. The situational relevance types of the modes of music information among students of music education and music theory, as well as students of music composition will be examined in detail in forthcoming publications (for DocMus students, see Rousi *et al.*, 2018).

The present paper utilized Kuhlthau's (2004) process survey instrument in order to identify the progress of the task performance. The modified process survey instrument also helped to identify participants whose tasks did not progress during the circa 130 days period of examination. As only half of the participants made significant progress in their task, the period of examination between the phases of data collection could have been longer. This was especially evident with DocMus students' extensive tasks of dissertations

on music. However, with this period of examination, the participants seemed to be able to recall their thoughts when answering the questionnaire in the first data collection phase which helped in identifying changes in the situational relevance of the information modes. Another alternative approach in methodology could have been not to lengthen the time period between data collection phases but to insert a third data collection phase after circa four months from the second one. This would have increased the share of music students making significant progress in their tasks while participating in this longitudinal study and thus likely would have provided more evidence regarding changes in situational relevance of the information modes. However, the methodology currently employed was nevertheless seen to produce results of interest in a topic where previous studies are scarce.

Theoretical and practical implications

The present paper was the first step towards examining how the situational relevance of music information of varying kinds is viewed during the different stages of information-seeking task performance. The findings demonstrate that not only the modes of music information were seen as situationally relevant for different reasons by the three music student groups when they started their tasks. Moreover, the perceived situational relevance of the information modes underwent changes as their tasks progressed to focus formulation and post-focus stages. The findings also showcase that approaching music information through frameworks that classify information sources at diverse levels of abstraction enables an accurate description of information-seeking processes and illuminates context-sensitive development of situational relevance of diverse music information of diverse modes.

With regard to implications on MIR design, it is noteworthy how much the nature of the tasks, i.e. focus on music performance, writing academic texts on music education or conducting music analyses affected the ways in which the participants viewed the situational relevance of the music information modes while performing information-seeking tasks. Conducting similar context-sensitive longitudinal studies examining the relevance of music information could deepen our understanding on how the situational relevance of music information varies in different types of tasks. This could, in turn, influence the MIR system design to better acknowledge the nature and the stage of a music-related task when recommending relevant materials.

Limitations

Due to the small number of the study participants, the findings describing information-seeking processes of students of music performance, music education and music theory and composition are not generalizable to all students representing these fields. For the same reason, it is possible that individual factors such as the student's information-seeking styles and habits have affected the empirical findings. Therefore, further research is needed to verify the results concerning the differences in information-seeking processes of the participating music student groups.

Further research

The situational relevance types of music information modes for students of music education and music theory and composition should be examined in more depth. More research is also needed to verify the present paper's findings regarding the differences in relevance dynamics of tasks aimed at music performances and of those aimed at written theses. Furthermore, similar research should be conducted to information-seeking tasks related to other artistic disciplines, such as other performing arts or visual arts. The previous approaches could prove to be useful in understanding how the situational relevance of various information modes change during information-seeking processes.

Conclusion

This paper presents an account of how situational relevance of diverse music information modes changes in the ISPs of music students representing the fields music performance, music education and music theory and composition. The findings demonstrate that not only the modes of music information were seen as situationally relevant for different reasons by the three participating music student groups at the initial stage of task performance, but also that the situational relevance of the information modes was perceived differently between the music student groups as their tasks progressed to focus formulation and post-focus stages. The findings highlight the potential of context-sensitive approaches to music information seeking and the importance of conducting longitudinal studies elaborating how situational relevance may undergo changes during information-seeking processes.

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Appendix 1. Questionnaire used in the present study

1 Background information

Alias:
(Use the same alias in both questionnaires. Your alias will not be published)

Study program:

Age:

How many years you have studied at the Sibelius Academy:

What is the main topic of your thesis? Choose one of the following

❑ music history ❑ music education ❑ music theory

❑ ethnomusicology ❑ own artistic activity (e.g., composition or music performance) ❑ Other topic, please define _____

2 Phase of the information-seeking task

2.1 What is your primary task concerning your thesis at the moment? Choose one of the following.

- ❑ Start of the thesis and identifying its general topic
- ❑ Examining information concerning a general topic and formulating a specific focus
- ❑ Gathering information pertinent to a focused topic or finalizing the thesis
- ❑ Other, please define? _____

2.2 What are you thinking in the current phase of your task? Choose all options that apply.

- ❑ Organizing ideas and information
- ❑ Identifying possible alternative topics
- ❑ Becoming informed about the general topic
- ❑ Exhausting all possible sources of information
- ❑ Considering alternative topics in light of the requirements of the project
- ❑ Choosing the broad topic that has potential for success
- ❑ Comprehending the task before me
- ❑ Recognizing ways to draw the project to a close
- ❑ Considering alternative topics in the light of the information available to me
- ❑ Confronting the inconsistency and incompatibility in the information encountered
- ❑ Getting more interested and involved in ideas
- ❑ Defining and extending my specific topic
- ❑ Gaining a sense of direction and clarity
- ❑ Recalling a previous project when I searched for information
- ❑ Predicting success of each possible concentration
- ❑ Identifying several possible areas of concentration in the broad topic
- ❑ Considering alternative topics in light of the things that are of personal interest to me
- ❑ Seeking information about my specific area of concentration
- ❑ Other, please define? _____

2.3 What are you doing in the current phase of your task (these musical aspects of your thesis are examined in more detail in the following section of the questionnaire)? Choose all that apply.

- ❑ I am getting acquainted with a music piece related to my topic by trying out different parts with my instrument
- ❑ I am rehearsing a piece for public performance
- ❑ I am performing music in public
- ❑ I am doing preliminary music analyses related to my topic
- ❑ I am doing detailed music analyses related to my topic
- ❑ I am composing music
- ❑ I am listening to music that is broadly related to my topic
- ❑ I am listening to a selected set of musical pieces

❑ Discussing the topic
❑ Making a summary search of the library
❑ Skimming and scanning sources of information
❑ Outlining to organize information
❑ Reading over notes for themes
❑ Making a preliminary search from the library
❑ Conferring with people who know the topic
❑ Writing about themes and ideas
❑ Reading about the topic
❑ Taking detailed notes on facts and ideas
❑ Taking brief notes on facts and ideas
❑ Rechecking sources for information initially overlooked
❑ Recording bibliographic citations
❑ Other, please define? _____

2.4 From the following, choose all adjectives that describe your emotions at the current phase of your task?

_ Sure _ Confused
_ Disappointed _ Doubtful
_ Frustrated _ Optimistic
_ Relieved _ Satisfied
_ Confident _ Uncertain
_ Other, please define?_____

3 Acquired or used sources of information

3.1 Playing or performing pieces yourself and information within this activity

3.1.1 How important it is for you to play or perform pieces in the current phase of your theses task? Choose one of the following.

❑ Not important ❑ Not that important ❑ Important ❑ Very important

3.1.2 Explain your previous answer

3.1.3 What information sources incorporating this information mode have you acquired or utilized during your thesis task? Choose all options that apply. Mark all applying information sources.

❑ Own personal rehearsing

❑ Making music with the academic faculty or in other rehearsals arranged at your university

❑ Making music in concerts arranged by the university

❑ Making music in rehearsals arranged outside the university (networks outside your academic institution)

❑ Making music in concerts or other public performances arranged outside the university (networks outside your academic institution)

❑ Different online and media services (e.g., Youtube, Sibelius Academy's "Do you know enough about rehearsing" [*Tiedätkö harjoittelusta riittävästi*] online material)

❑ Different materials available from the Sibelius Academy Library regarding music performance (e.g. instructional material regarding specific instruments)

(music notations from their own information mode, which is examined in section 3.3)

❑ Other information sources related to playing or performing pieces yourself, please define (music notations from their own information mode, which is examined in section 3.3)?

3.2 Music performances and information received from them (excluding playing or performing pieces yourself)

3.2.1 How important is information received from different music performances (excluding playing or performing music yourself) in the current phase of your task? Choose one of the following.

❑ Not important ❑ Not that important ❑ Important ❑ Very important

3.2.2 Explain your previous answer

3.2.3 What information sources incorporating this information mode have you acquired or utilized during your thesis task? Choose all options that apply. Mark all applying information sources.

❑ Audio recordings available from the Sibelius Academy Library (SACD/CDs, vinyls)

❑ Sibelius Academy Library's electronic databases, licenced or produced by the Library, and audio recordings available through them (e.g., Classical Music Library, Contemporary World Music, Naxos Music Library, Doria)

❑ Audio recordings or suggestions received from the personnel of Sibelius Academy Library

❑ Following concerts and rehearsals arranged by Sibelius Academy

❑ Audio recordings or suggestions received from the teaching and academic faculty of Sibelius Academy

❑ Audio recordings or suggestions received from other students of Sibelius Academy

❑ Following concerts and rehearsals arranged outside of your academic institution

❑ Audio recordings or suggestions received from your networks outside your academic institution

❑ Own personal collection of audio recordings

❑ Retail stores and their online stores that sell audio recordings (e.g. Ostinato)

❑ Chargeable online music streaming services providing digital audio (e.g. Spotify)

❑ Other online and media services providing audio (e.g. YouTube, other social media, radio, online radio)

❑ Audio recordings available from the collections of other libraries

❑ Other information sources related music performances and information received from them (excluding playing or performing pieces yourself), please define?

3.3 Music scores or other music notation types and information received from them

3.3.1 How important are music scores or other notation types in the current phase of your theses task? Choose one of the following.

❑ Not important ❑ Not that important ❑ Important ❑ Very important

3.3.2 Explain your previous answer

3.3.3 What information sources incorporating this information mode have you acquired or utilized during your thesis task? Choose all options that apply. Mark all applying information sources.

❑ Music scores and notations available from the Sibelius Academy Library

- ❑ Sibelius Academy Library's collection of anthologies, collected works of composers, score manuscripts or historically valuable scores
- ❑ Sibelius Academy Library's electronic databases, licenced or produced by the Library, and digital music scores available through them (Classical Scores Library, Doria)
- ❑ Music scores or suggestions received from the personnel of Sibelius Academy Library
- ❑ Music scores, extracts from course materials or suggestions received from the teaching and academic facultyof Sibelius Academy
- ❑ Music scores or suggestions received from other students of Sibelius Academy
- ❑ Music scores or suggestions received from your networks outside your academic institution
- ❑ Own personal collection of music scores
- ❑ Retail stores and their online stores that sell music notations (e.g. Ostinato)
- ❑ Free online services focusing on digital music scores (e.g. American Memory, Bach Cantatas Website, IMSLP/Petrucci Music Library, Musopen.org) and materials available through them
- ❑ Chargeable online services focusing on digital music scores (e.g. Boosey & Hawkes - Sheet music download, Luck's Music Library, Sheetmusicdb.net) and materials available through them
- ❑ Music scores available from the collections of other libraries
- ❑ Other information sources related music scores and other music notation types and information received from them (excluding playing or performing pieces yourself), please define?

3.4 Information examining music theory (e.g. harmony, voice leading, music analysis and orchestration)

3.4.1 How important is information examining music theory in the current phase of your theses task? Choose one of the following.

❑ Not important ❑ Not that important ❑ Important ❑ Very important

3.4.2 Explain your previous answer

3.4.3 What information sources incorporating this information mode have you acquired or utilized during your thesis task? Choose all options that apply. Mark all applying information sources.

- ❑ Sibelius Academy Library's collection of printed books, printed journals and other printed materials
- ❑ Sibelius Academy Library's collection of printed theses
- ❑ Sibelius Academy Library's collection of electronic materials and databases (e.g. RIPM, IIMP), including materials such as electronic journals or theses or electronic encyclopedias
- ❑ Sibelius Academy Library's eThesis database and its electronic theses
- ❑ Materials or suggestions received from the personnel of Sibelius Academy Library
- ❑ Materials or suggestions received from the teaching and academic faculty of Sibelius Academy
- ❑ Materials or suggestions received from other students of Sibelius Academy

❑ Materials or suggestions received from your networks outside your academic institution

❑ Own personal collection of literature

❑ Retail stores and their online stores that sell this literature (e.g. Ostinato)

❑ Free online services focusing on music (e.g.. Aleatori. other open courseware - e.g. MIT, Bach bibliography, Beethoven gateway DOAJ - Journal of Music History Pedagogy, DOAJ - Journal of Seventeenth-Century Music)

❑ Other online and media services (incl. Delicious.com, discussion forums, email lists)

❑ Printed or electronic collections of other libraries or archives

❑ Other information sources examining music theory, please define?

3.5 Information examining music but not directly the qualities manifest in it (such as music history, philosophy of music, aesthetics of music)

3.5.1 How important is Information examining music but not directly the qualities manifest in it (such as music history, philosophy of music, aesthetics of music) in the current phase of your theses task? Choose one of the following.

❑ Not important ❑ Not that important ❑ Important ❑ Very important

3.5.2 Explain your previous answer

3.5.3 What information sources incorporating this information mode have you acquired or utilized during your thesis task? Choose all options that apply. Mark all applying information sources.

❑ Sibelius Academy Library's collection of printed books, printed journals and other printed materials

❑ Sibelius Academy Library's collection of printed theses

❑ Sibelius Academy Library's collection of electronic materials and databases (e.g. RIPM, IIMP), including materials such as electronic journals or theses or electronic encyclopedias

❑ Sibelius Academy Library's eThesis database and its electronic theses

❑ Materials or suggestions received from the personnel of Sibelius Academy Library

❑ Materials or suggestions received from the teaching and academic faculty of Sibelius Academy

❑ Materials or suggestions received from other students of Sibelius Academy

❑ Materials or suggestions received from your networks outside your academic institution

❑ Own personal collection of literature

❑ Retail stores and their online stores that sell this literature (e.g. Ostinato)

❑ Free online services focusing on music (e.g.. open courseware - MIT, Bach bibliography, Beethoven gateway DOAJ - Journal of Music History Pedagogy, DOAJ - Journal of Seventeenth-Century Music)

❑ Other online and media services (incl. Delicious.com, discussion forums, email lists)

❑ Printed or electronic collections of other libraries or archives

❑ Other information sources examining this information, please define?

3.6 Information not examining music (e.g. scientific writing, educational sciences, sociology, philosophy or fiction)

3.6.1 How important is information not examining music in the current phase of your thesis task (e.g. scientific writing, educational sciences, sociology, philosophy or fiction)? Choose one of the following.

❑ Not important ❑ Not that important ❑ Important ❑ Very important

3.6.2 Explain your previous answer

3.6.3 What information sources incorporating this information mode have you acquired or utilized during your thesis task? Choose all options that apply. Mark all applying information sources.

❑ Sibelius Academy Library's collection of printed books, printed journals and other printed materials (literature related to grammar, educational sciences or philosophy, for example)

❑ Sibelius Academy Library's collection of electronic materials and databases, including materials such as electronic journals or theses or electronic encyclopedias

❑ Materials or suggestions received from the personnel of Sibelius Academy Library

❑ Materials or suggestions received from the teaching and academic faculty of Sibelius Academy

❑ Materials or suggestions received from other students of Sibelius Academy

❑ Materials or suggestions received from your networks outside your academic institution

❑ Own personal collection of literature

❑ Retail stores and their online stores that sell this literature (e.g. Ostinato)

❑ Free online services focusing on music (e.g. Sibelius Academy's language center's materials, other open courseware)

❑ Other online and media services (incl. Delicious.com, discussion forums, email lists)

❑ Printed or electronic collections of other libraries or archives

❑ Other information sources not examining music, please define?

Appendix 2

Items constitutive of the category of thoughts	Phase I (%)	Phase II (%)	Change %
Recognizing ways to draw the project to a close	29	57	+28
Seeking information about my specific area of concentration	43	64	+21
Organizing ideas and information	79	93	+14
Confronting the inconsistency and incompatibility in the information encountered	21	29	+8
Defining and extending my specific topic	21	29	+8
Exhausting all possible sources of information	43	50	+7
Considering alternative topics in light of the requirements of the project	21	21	+0
Gaining a sense of direction and clarity	14	14	+0
Identifying possible alternative topics	57	29	−28
Becoming informed about the general topic	71	43	−28
Choosing the broad topic that has potential for success	36	14	−22
Comprehending the task before me	50	29	−21
Recalling a previous project when I searched for information	29	14	−15
Predicting success of each possible concentration	57	43	−14
Considering alternative topics in light of the things that are of personal interest to me	14	0	−14
Identifying several possible areas of concentration in the broad topic	38	29	−9
Getting more interested and involved in ideas	43	36	−7
Considering alternative topics in the light of the information available to me	21	14	−7

Table AI. Changes in the category of thoughts among the participants ($n = 14$) between the data collection points

Appendix 3

Items constitutive of the category of actions	Phase I (%)	Phase II (%)	Change %
Reading about the topic	71	86	+15
Writing about themes and ideas	36	50	+14
I am getting acquainted with a music piece related to my topic by trying out different parts of it with my instrument	29	43	+14
I am doing detailed music analyses related to my topic	14	21	+7
I am rehearsing a piece for public performance	7	14	+7
I am performing music in public	0	7	+7
Skimming and scanning sources of information	57	57	+0
I am listening to music that is broadly related to my topic	50	50	+0
I am doing preliminary music analyses related to my topic	36	36	+0
Taking detailed notes on facts and ideas	29	29	+0
Rechecking sources for information initially overlooked	14	14	+0
Making a summary search of the library	7	7	+0
I am composing music	0	0	+0
Making a preliminary search from the library	64	21	−43
Conferring with people who know the topic	50	11	−39
Reading over notes for themes	43	7	−36
Discussing the topic	86	71	−15
Taking brief notes on facts and ideas	36	21	−15
I am listening to a selected set of musical pieces	50	36	−14
Outlining to organize information	50	43	−7
Recording bibliographic citations	36	29	−7

Table AII. Changes in the category of actions among the participants ($n = 14$) between the data collection points

Appendix 4

Table AIII.
Changes in the category of emotions among the participants ($n = 14$) between the data collection points

Items constitutive of the category of emotions	Phase I (%)	Phase II (%)	Change %
Relieved	0	21	+21
Optimistic	66	86	+20
Sure	0	14	+14
Disappointed	0	0	+0
Confused	50	0	−50
Doubtful	36	14	−22
Uncertain	43	29	−14
Confident	64	57	−7
Frustrated	21	14	−7
Satisfied	21	14	−7

Appendix 5

Docmus students focusing on music performance (n = 6)	Phase I (avg.)	Phase II (avg.)	Change in avg.
Iconic representations of music	Very important (2.6)	Very important (2.6)	+0
Music making as the first mode of enactive representations	Important (2.2)	Important (2.5)	+0.3
Receiving music as the second mode of enactive representations	Important (2)	Important (2.5)	+0.5
Ideological models of music as the second mode of symbolic representations	Important (2.3)	Important (2.3)	+0
Other symbolic information	Important (1.6)	Important (2.2)	+0.6
Technological models of music as the first mode of symbolic representations	Not that important (1.3)	Important (1.8)	+0.5
Music performance students focusing on music education (incl. Docmus Student G) (n = 5)	Phase I (avg.)	Phase II (avg.)	Change in avg.
Ideological models of music as the second mode of symbolic representations	Very important (2.6)	Very important (2.8)	+0.2
Other symbolic information	Important (2.4)	Important (2.4)	+0
Receiving music as the second mode of enactive representations	Not that important (0.6)	Not that important (1.4)	+0.8
Music making as the first mode of enactive representations	Not that important (0.8)	Not that important (1.4)	+0.6
Technological models of music as the first mode of symbolic representations	Not important (0.4)	Not important (0)	−0.4
Iconic representations of music	Not important (0.2)	Not important (0)	−0.2
Students of music theory and composition focusing on music analysis (n = 3)	Phase I (avg.)	Phase II (avg.)	Change in avg.
Receiving music as the second mode of enactive representations	Important (2)	Very important (2.6)	+0.6
Music making as the first mode of enactive representations	Very important (2.6)	Important (2.3)	−0.3
Technological models of music as the first mode of symbolic representations	Important (2.3)	Important (2.3)	+0
Iconic representations of music	Important (2)	Important (2)	+0
Ideological models of music as the second mode of symbolic representations	Not that important (1.3)	Not that important (1.3)	+0
Other symbolic information	Not important (0.3)	Not important (0.3)	+0

Table AIV.
The average perceived importance of modes of music information categorized per music student group

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