

Information Seeking for Musical Creativity: A Systematic Literature Review

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This paper aims to present a systematic literature review of research in music information seeking and its application to musical creativity and creative activities and in particular composition, performance and improvisation, and listening and analysis. A seed set of 901 articles published between 1973 and 2015 was evaluated and in total 65 studies were considered for further analyses. Data extraction and synthesis was performed through content analysis using the PRISMA method. Three thematic categories were identified in regard to music information needs: (a) those related to scholarly activities, (b) musically motivated, as well as (c) those which are related to socializing and communication. In addition, 3 categories of music information sources were connected to musical creativity: (i) those that are related to Internet and media technologies, (ii) those that are related to music libraries, organizations, and music stores, and (iii) those that are related to the subjects' social settings. The paper provides a systematic review, with the aim of showcasing the effect of modern information retrieval techniques in a creative and intensive area of information-dependent activity such as music making and consumption.

Introduction

Over the past two decades the increase in the amount of information available, combined with advances in information retrieval technology, has provided broader access to various information resources (Hunter, 2006). Accordingly, information management has become a primary concern for multimedia-related technologies, with music retrieval becoming a particular focus (Raimond & Sandler, 2008). The development of new technology has promoted the accessibility and production of music in digital form. The demand for music in a digital format is continuously increasing (Orio, 2006) and is driven by a growing interest in listening to, interacting with, and creating music in real-life musical experiences (Watson & Mandryk, 2012). Musicians' information-seeking behavior for conceptualizing, creating, and performing music has also resulted in new ways of information seeking (Hunter, 2006), taking this beyond a keyword-oriented search model. It has been shown that a stimulating music information-seeking environment can offer many opportunities for musical creativity and expression (Ho, 2004).

From a procedural perspective, music information seeking aims to address users' music information needs and uses that arise within specific socioeconomic circumstances. In that context, scholars have explored a broad spectrum of issues such as user information needs, information sources, barriers, and obstacles (Wilson, 2006). Nonetheless, a rather interesting issue that arises relates to the way in which modern information access and retrieval technologies, and

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to a larger extent the Internet, are connected to musical creative activities such as listening, performance, and composition (Orio, 2006). Webster (2002), identified three basic creative activities in an individual's musical behavior: (a) composition (b) performance and improvisation and (c) listening and analysis. Consequently, these music-driven behavioral attitudes can vary according to who is interpreting them (e.g., the composer, a performer, and/or a listener) and has a significant effect on the development of an individuals' music information-seeking process (Inskip, MacFarlane, & Rafferty, 2008a). Our motivation for this review was driven by the desire to answer the questions (i) on what level does music information seeking relate to this musical behavior? and (ii) what themes has existing research in music information seeking identified that can be aligned with the aforementioned three creative activities?

What makes music information seeking unique, from an information retrieval perspective, is the availability of music-related material in many different forms (e.g., bibliographic data, genre issues, media files, etc.) combined with various media formats (e.g., music scores, textual biographical material, oral history collections, recordings, photographs, etc.) that are distributed through many channels and methods (Futrelle & Downie, 2002; Laplante & Downie, 2006). In that context, the need for effective consumption of musical information is important for musicians, and relates to all their roles as listeners, composers, performers, etc. Music information-seeking behavior is characterized by the different types of music information sought, the types of music information needs expressed by individuals, and the ways in which musicians describe their information needs, as well as the information resources employed to satisfy these needs (Hunter, 2006; Lee, 2010; Lee & Downie, 2004; Lee, Downie, & Jones, 2007). Musicians employ a combination of information resources and systems, both traditional such as music libraries as well as digital (e.g., Internet, media technology resources) in order to satisfy their information needs (Cunningham, Bainbridge, & McKay, 2007). Therefore, an examination of individuals' information needs and use provides an opportunity to understand their behavior that is directly connected with creative activities (Brown, 2002).

Our aim is to provide a systematic overview of the literature regarding this complex domain. We will identify and explore the interrelation of topics, trends, and perceptions relating to music information seeking in conjunction with creative activities such as listening, performance, and composition. The primary motivation behind this study is to amalgamate peer review research for music information needs and sources with those related to musical creativity in order to identify how information-seeking patterns impact musical creativity. Specifically, this study focuses on investigating the individuals' music information needs and sources employed for musical creative activities, such as composition, performance, and improvisation, and listening and analysis, which have resulted in the final creative product. In that context, music information needs and pre-

ferred information resources are identified and their relation to musical creative activities is analyzed and discussed.

The methodological approach of this study, and in particular the data extraction and synthesis methods applied to the literature selected for review, is described in the next section. The Results section provides a classification in terms of composition, performance and improvisation, and listening and analysis. The Discussion section discusses the findings and limitations of this review. Finally, the last section describes the implications of the study and recommendations for future research.

Methods

A systematic literature review was conducted; this followed the procedure for data collection and analysis described by Petticrew and Roberts (2006). First, an electronic literature search was performed according to the proposed research questions and inclusion criteria. Second, research papers that met the inclusion criteria were selected. Third, data from selected papers were extracted and, finally, qualitative and semiquantitative analysis was performed. We discuss both the search strategy and data synthesis in the following sections.

Search Strategy and Selection Criteria

The literature search was performed using online resources via the OPAC query interface of the Ionian University library (part of the HEALINK Consortium of Greek University Libraries) consisting of the following sources: (a) bibliographic databases (e.g., OCLC First Search, Scopus, Wilson Web), (b) publishers (e.g., Association for Computing Machinery [ACM]; American Institute of Physics [AIP]; American Psychological Association; PsycARTICLES, Blackwell Publishing, Cambridge University Press, Elsevier; ScienceDirect, Emerald, Institute of Electrical and Electronics Engineers [IEEE]; Institute of Physics [IOP]; Lippincott Williams & Wilkins [LWW]; Oxford University Press, Sage, Springer Link, Taylor & Francis, Wiley, Wilson), and (c) organizations that provide open access to all or some of their journals (e.g., Directory of Open Access Journals [DOAJ], High Wire Press, Hikari Ltd., Manchester University Press, Project Euclid, NUMDAM). Also, for this particular study the online database and paper proceedings of a significant number of international conferences, symposiums, and workshops related both to music information seeking, retrieval, and technology and to computer science were used and proved to be a very useful source of information. A detailed list of the proceedings venues can be found in the Appendix.

Query terms addressed the title and abstract of the papers using combinations of the following search terms and keywords in two dimensions: (a) music* AND "information" AND ("seeking," "research," "retrieval," "technology," "needs," "resources," "user," "system," "project," "aspects," "behavior," "process," "communication," "model"), and (b)

music* AND creat* AND (“composer,” “performance,” “listen,” “analysis,” “improvisation,” “work,” “product,” “record,” “composition,” “thinking,” “scores,” “ontology,” “process,” “innovation,” “skills”). All potentially relevant citations were screened, using the same fields and by configuring additional relevant search terms in order to further refine the inclusion and exclusion criteria for the literature set.

Papers published in English during the time period 1973 to 2015 were collected in the initial set. There was no limitation on the specific time range that the articles were chosen from, as music information seeking is a research field that has experienced rapid growth during the last few decades. To avoid publication bias, there was no specific limit on the publication type for example, research paper, conceptual paper, or review paper. Articles from sources such as peer-reviewed journals and proceedings of international conferences, symposiums, and workshops were included; while editorials, correspondence, and commentaries were excluded. In addition, there was no limitation on the country of origin of the selected papers. In order to avoid the risk of excluding potentially relevant studies and reducing the validity of the results, inclusion and exclusion criteria were clarified subsequently and were not narrowly defined (Petticrew & Roberts, 2006). Specifically, a paper was included in the initial corpus only if the search terms were mentioned in the title or abstract and their content referred to music information-seeking needs and sources employed for musical creative activities.

The reference lists of all studies included in the qualitative analysis were examined manually to identify additional studies that would meet the inclusion criteria. A screening process then took place where the abstracts were read independently by two experts to decide which papers would be included based on the aforementioned inclusion criteria. Next, the full texts of the studies were assessed for eligibility for further analysis based on the inclusion criteria. For studies where a decision between the two experts could not be reached, two external reviewers were consulted, and when necessary, discussion among the four researchers took place in order to reach a final decision.

Data Extraction and Synthesis

Literature was extracted and categorized under the following three categories: (a) information needs and information sources employed for composition, (b) information needs and information sources employed for performance and improvisation, and (c) information needs and information sources employed for listening and analysis. After examining the titles and abstracts of the selected papers in more detail, irrelevant articles were excluded. Following this categorization and additional selection process, the full text of the chosen papers was thoroughly read and data synthesis performed with the use of content analysis, as recommended (Downie & Cunningham, 2002). According to content analysis, text segments such as sentences,

phrases, or paragraphs, which were relevant to the aim of the study and met all inclusion criteria, were identified and extracted.

Corresponding text segments were coded under the aforementioned three categories. By identifying multiple text segments containing similar data, meaningful concepts common to the selected studies were found. The following publication metadata were also sourced: author, title, journal, year, publisher, country, type, aim of the study, main findings, included information needs and sources, outcome assessment and its level of relation with creative activities such as composition, performance, and improvisation, and listening and analysis. These data were placed into a spreadsheet for further analysis. One expert conducted the data extraction and coding process and each extraction and theme was then checked for accuracy independently by a reviewer. When a disagreement occurred, the same two external reviewers were again consulted to reach the final decision. All papers included in the current study were also semiquantitatively analyzed based on the frequencies of the characteristics of included publications and metadata were extracted and categorized under three publication types: (a) research paper, (b) conceptual paper, and (c) review paper.

Results

The search process returned 896 publications in total. Five relevant publications were identified through the reference lists of the included studies, making the total sample 901 publications. Figure 1 shows the flow chart of the selection process that was used in accordance with the PRISMA method (Moher, Liberati, Tetzlaff, & Altman, 2009). After applying the inclusion criteria, 65 studies were considered eligible for further analysis. The frequencies of the characteristics of the papers selected are also presented in Table 1.

As shown in Table 1, throughout the period of 2002–2013 there has been a significant number of scientific publications on the music information-seeking needs and sources employed for creative activities. The majority of publications were recorded in 2012 (~16.9%), with publications in the other years averaging ~10%. Out of the included studies, ~81.5% were classified as original research papers, ~16.9% as conceptual papers, and a very small percentage of ~1.5% as review papers. Review of the country of origin of the research papers as well as the country of the affiliation of the first author of the conceptual and review papers revealed that the majority of papers originated from the USA (~29.2%), followed by Canada and the United Kingdom (~16.9% each). Additional countries are also depicted in Table 1.

A major number of the selected studies were published in the International Society for Music Information Retrieval (ISMIR) Proceedings (~33.8%), followed by the Conference on Human Factors in Computing Systems (SIGCHI) Proceedings (~6.2%), the Joint Conference on Digital Libraries (JCDL) Proceedings (~4.6%), and the journals: *Music Reference Services Quarterly* (~4.6%), *British Journal of Music*

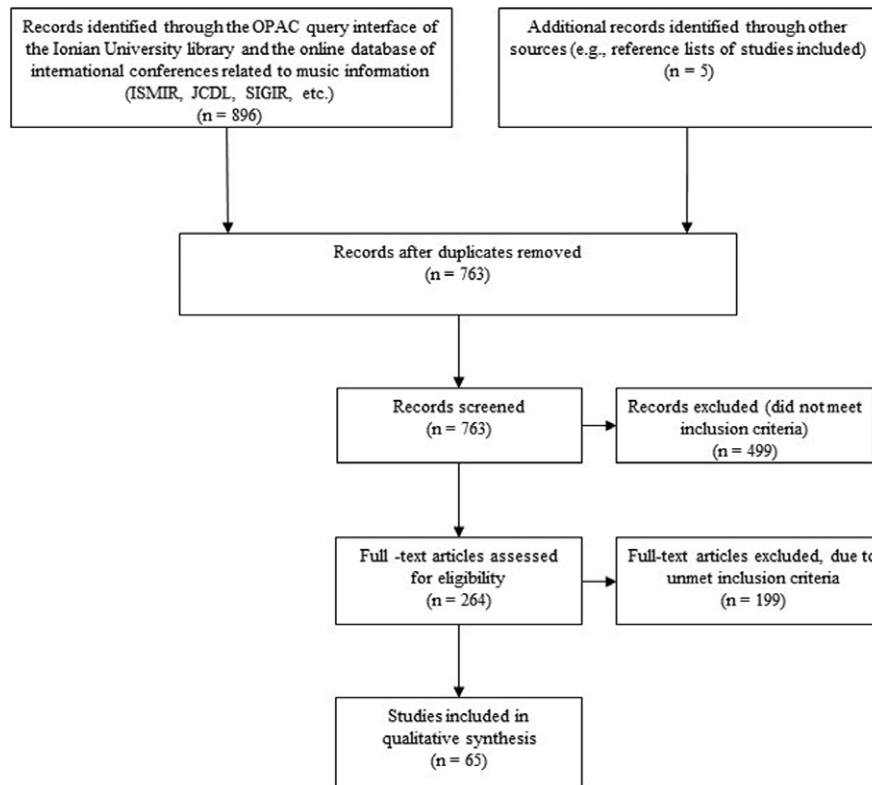


FIG. 1. Flow chart of the literature selection process based on the PRISMA approach (Moher et al., 2009).

Education (~3.1%), *Journal of Documentation* (~3.1%), *Journal of the Association for Information Science and Technology* (~3.1%), *Library & Information Science Research* (~3.1%), *Journal of Academic Librarianship* (~3.1%), and *Proceedings of the Association for Information Science and Technology* (~3.1%). Excluding the *International Society for Music Information Retrieval* (ISMIR), which was ranked first from the perspective of publishers (~33.8%), a major number of the selected studies were published by the following publishers: Association for Computing Machinery (ACM) (~13.8%), Elsevier-ScienceDirect (~10.8%), Taylor & Francis (~7.7%), John Wiley & Sons (~7.7%), Emerald Group Publishing (~6.2%), SAGE Publications (~4.6%), and Cambridge University Press (~3.1%). We should note however that ISMIR acts also as a forum for researchers and practitioners in the field and, as such, its role is both as a publisher and a venue for new research discussion. As shown in Table 2, three of the authors (Cunningham, Inskip, and Laplante) appeared at least six times as first authors in the selected studies. One author, Lee, appeared five times and another author, Ho, appeared twice. The remaining authors of the selected studies appeared as first authors only once. Data on music information-seeking needs and sources employed for composition activities were extracted from 23 of the publications (~35.4%). Subsequently, data on music information-seeking needs and sources employed for performance and improvisation activities were extracted from 33 of the publications

(~50.8%), and data on music information-seeking needs and sources employed for listening and analysis were extracted from 64 of the publications (~98.5%).

Having provided the classification of the final sample, we categorized the papers with respect to the dimensions of the creative process, namely (a) composition, (b) performance and improvisation, and (c) music listening and analysis. We outline our insights in the subsequent sections.

Information Needs and Information Sources for Music Composition Activities

According to the study of Hunter (2006), which investigated the information-seeking behavior and common information needs among the composers of electro-acoustic music, there are knowledge and learning information needs related to digital signal processing (e.g., software, hardware, and programming), to aesthetic issues, such as needing inspiration, and to the aesthetic qualities of a piece of music. Principally, Hunter's study mostly concerned professional needs, suitable for particular usages and related to musical creative activities (Inskip, 2007; Inskip, MacFarlane, & Rafferty, 2008b; Inskip, Macfarlane, & Rafferty, 2012; Orio, 2006). The task of finding music for knowledge and learning is considered in the studies of Inskip et al. (2008a), Kim and Belkin (2002), and Wöllner, Ginsborg, and Williamon (2011) as an important need with regard to the research engagement relating to musical composing activities.

TABLE 1. Frequencies (N; %) of the characteristics of the papers included in the review.

	Frequency	
	N = 65	%
Country		
Belgium	1	-1.5
Canada	11	-16.9
China	4	-6.2
Finland	1	-1.5
France	1	-1.5
Greece	1	-1.5
India	1	-1.5
Italy	2	-3.1
Korea	1	-1.5
Netherlands	1	-1.5
New Zealand	6	-9.2
UK	11	-16.9
UK, Austria, Germany, Norway, Australia, USA	1	-1.5
UK, New Zealand	1	-1.5
USA	19	-29.2
USA, Canada	1	-1.5
USA, China	1	-1.5
USA, Korea	1	-1.5
Year of Publication		
1973	1	-1.5
1992	1	-1.5
1994	1	-1.5
1995	1	-1.5
1999	1	-1.5
2000	1	-1.5
2002	4	-6.2
2003	2	-3.1
2004	7	-10.8
2005	1	-1.5
2006	8	-12.3
2007	4	-6.2
2008	5	-7.7
2009	2	-3.1
2010	5	-7.7
2011	7	-10.8
2012	11	-16.9
2013	2	-3.1
2015	1	-1.5
Publication Type		
Research paper	53	-81.5
Conceptual paper	11	-16.9
Review paper	1	-1.5
Publishers		
Academy Publisher	1	-1.5
ACM (Association for Computing Machinery)	9	-13.8
ALA (American Library Association)	1	-1.5
BCS (British Computer Society)	1	-1.5
Cambridge University Press	2	-3.1
Canadian Science Publishing	1	-1.5
Elsevier-ScienceDirect	7	-10.8
Emerald Group Publishing	4	-6.2
IEEE (Institute of Electrical and Electronics Engineers)	1	-1.5
ISMIR (International Society for Music Information Retrieval)	22	-33.8
Johns Hopkins University Press	1	-1.5
Now Publishers	1	-1.5
SAGE Publications	3	-4.6
Springer	1	-1.5
Taylor & Francis	5	-7.7
John Wiley & Sons	5	-7.7
Publication Titles and Proceedings		
<i>American Behavioral Scientist</i>	1	-1.5
<i>British Journal of Educational Technology</i>	1	-1.5
<i>British Journal of Music Education</i>	2	-3.1
<i>College & Research Libraries (C&RL)</i>	1	-1.5
<i>Computer Science Review</i>	1	-1.5
FDIA Future Directions in Information Access Proceedings	1	-1.5
<i>Foundations and Trends® in Information Retrieval</i>	1	-1.5
<i>Information Processing & Management</i>	1	-1.5
<i>International Journal on Digital Libraries</i>	1	-1.5
ISMIR (International Society for Music Information Retrieval) Proceedings	22	-33.8
JCDL Joint Conference on Digital Libraries Proceedings	3	-4.6
<i>Journal of Documentation</i>	2	-3.1
<i>Journal of Information Science</i>	1	-1.5
<i>Journal of Software</i>	1	-1.5
<i>Journal of the Association for Information Science and Technology</i>	2	-3.1
<i>Journal of the Canadian Health Libraries Association (CHLA)</i>	1	-1.5
<i>Library & Information Science Research</i>	2	-3.1
<i>Library Trends</i>	1	-1.5
MIRUM Workshop on Music Information Retrieval with User-Centered and Multimodal Strategies Proceedings	1	-1.5
<i>Music Reference Services Quarterly</i>	3	-4.6
<i>OCLC Systems & Services: International digital library perspectives</i>	1	-1.5
OZCHI Australia Conference on Computer-Human Interaction: Design: Activities, Artefacts and Environments Proceedings	1	-1.5
<i>Poetics</i>	1	-1.5
<i>Popular Music and Society</i>	1	-1.5
Proceedings of the Association for Information Science and Technology	2	-3.1
<i>Psychology of Music</i>	1	-1.5
<i>Reference Services Review</i>	1	-1.5
SIGCHI Conference on Human Factors in Computing Systems Proceedings	4	-6.2
<i>The Journal of Academic Librarianship</i>	2	-3.1
<i>The Reference Librarian</i>	1	-1.5
Workshop on Music Recommendation and Discovery (WOMRAD) Proceedings	1	-1.5

TABLE 2. Data extracted under the three categories of contents from selected studies.

An "X" indicates that the criterion has been met

Author(s), Year	Information needs and sources employed for:		
	Composition	Performance and improvisation	Listening and analysis
Ahmed et al., 2012		X	X
Bainbridge et al., 2003			X
Barthet & Dixon, 2011		X	X
Bentley et al., 2006			X
Bonardi, 2000			X
Brown, 2002	X	X	X
Casey & Taylor, 1995			X
Caw, 2004	X	X	X
Chung & Yoon, 2012			X
Clarke, 1973			X
Cunningham, 2002			X
Cunningham et al., 2003	X	X	X
Cunningham et al., 2004		X	X
Cunningham et al., 2007			X
Cunningham & Nichols, 2008			X
Cunningham & Nichols, 2009		X	X
Dogan, 2012	X	X	X
Duggan, 1992	X	X	X
Downie & Cunningham, 2002		X	X
Gottlieb, 1994		X	
Ho, 2004	X	X	X
Ho, 2007	X	X	X
Hunter, 2006	X	X	X
Inskip, 2007	X	X	X
Inskip et al., 2008	X	X	X
Inskip et al., 2008a	X	X	X
Inskip et al., 2008b	X	X	X
Inskip et al., 2010			X
Inskip et al., 2012	X	X	X
Kamalzadeh et al., 2012			X
Kaminskas & Ricci, 2012			X
Kim & Belkin, 2002			X
Kim et al., 2006			X
Kostagiolas et al., 2015		X	X
Kumar et al., 2011		X	X
Kuyper-Rushing, 1999	X	X	X
Lai & Chan, 2010	X	X	X
Lam, 2011	X	X	X
Laplante & Downie, 2006			X
Laplante, 2010a		X	X
Laplante, 2010b			X
Laplante, 2011			X
Laplante & Downie, 2011	X	X	X
Laplante, 2012			X
Lee & Downie, 2004	X	X	X
Lee et al., 2005			X
Lee et al., 2007			X
Lee, 2010			X
Lee & Waterman, 2012			X
Leong & Wright, 2013	X		X
Lesaffre et al., 2008		X	X
Liew & Ng, 2006		X	X
Liu et al., 2012			X
Matson & Shelley, 2013			X
Nettamo et al., 2006			X
Orio, 2006	X	X	X
Richardson & Giustini, 2004			X
Salavuo, 2006	X	X	X
Stowell & Dixon, 2011	X	X	X
Taheri-Panah & MacFarlane, 2004			X
Tepper & Hargittai, 2009			X
Vignoli, 2004			X
Watson & Mandryk, 2012			X
Woelfer & Lee, 2012			X
Wöllner et al., 2011	X	X	X

Knowledge and learning information needs may include different types of music information sought (e.g., bibliographic data, genre issues, media files, etc.) as well as information regarding artists, files, song titles, song lyrics, and related music information (Duggan, 1992; Richardson & Giustini, 2004). Information needs concerning the specific properties of musical instruments, musical scores (e.g., full, vocal and miniature printed music scores) and audio-visual recordings in a multitude of formats (Stowell & Dixon, 2011). Additional sources such as academic journals, consumer magazines and trade journals, books, personal collections of recordings, memorabilia, and collections of scholarly essays, biographies, and discographies are also considered as important for use in musical composing activities (Brown, 2002; Kuyper-Rushing, 1999; Lai & Chan, 2010).

To meet the music information needs of the plurality of the aforementioned topics, a variety of information sources are used. Internet-based online reference services and databases are considered as invaluable sources of information for music composition activities (Hunter, 2006; Lam, 2011; Richardson & Giustini, 2004). Online search tools and music search engines using electronic music information hardware and software take advantage of the capabilities of modern information technology (Caw, 2004; Ho, 2004, 2007; Leong & Wright, 2013; Stowell & Dixon, 2011). Internet music services may include websites, message boards, wikis, blogs, newsletters, electronic mail, electronic discussion lists (listservs), online streaming audio, networked databases, journals, periodicals, and conference proceedings (Duggan, 1992; Inskip et al., 2008a; Salavuo, 2006). Public music libraries, academic music libraries, archives and their provided services and facilities, including librarians who can help set up effective search strategies and provide interlibrary loan services for items not held locally in their collections (Caw, 2004; Richardson & Giustini, 2004), are considered very important sources of music information related to compositional activities (Brown, 2002; Dougan, 2012; Kim & Belkin, 2002). Professional organizations, music owners such as record companies and music publishers, and these organizations' respective conferences and festivals institutions libraries can also be included in the same category (Hunter, 2006; Inskip et al., 2012). A different but equally important and preferred source of music information for the majority of the subjects mentioned earlier are colleagues, professors, performers, and friends (Brown, 2002; Dougan, 2012; Hunter, 2006).

Information Needs and Information Sources for Performance and Improvisation Activities

Music performers are interested in the development of music collections (i.e., performance repertoire) in physical and digital form with additional information more specific to their work role, such as contact details of new groups or specific sound recordings of performances and improvisations (Ahmed, Benford, & Crabtree, 2012; Cunningham,

Jones, & Jones, 2004; Inskip, MacFarlane, & Rafferty, 2010; Lee & Downie, 2004). These music collections may consist of materials of various text and audio formats, such as scores of musical works, books, sound recordings, and video and archival materials (Downie & Cunningham, 2002; Gottlieb, 1994; Kostagiolas, Lavranos, Papavasopoulos, Korfiatis, & Papadatos, 2015). Music practice-related reasons are the most significant motives for most of the performers who seek to find, share, and perform music. Preferences that are related to a music genre, such as classical, world, ethnic, pop, rock, jazz, blues, folk, rap, hip-hop, new age, dance, house, techno, etc., are used for building up a musical database (Cunningham, Reeves, & Britland, 2003; Lesaffre et al., 2008). In addition, information needs with respect to music performance and improvisation activities can be based on social interaction (Inskip, Butterworth, & MacFarlane, 2008), recreational (Cunningham et al., 2003; Downie & Cunningham, 2002; Inskip et al., 2008) and enjoyment purposes (Cunningham & Nichols, 2009; Cunningham et al., 2003; Kumar, Singh, & Parikh, 2011; Laplante & Downie, 2011).

According to the study of Gottlieb (1994), which investigated the information needs of performing musicians, there are three main categories for the sources of music information: (a) library catalogs and other sources, (b) sources for the study of musical scores (e.g., critical editions, facsimiles of manuscripts, reprints of first editions), and (c) research using sources for contextual and background research including the whole monographic and periodical literature. Public music libraries, archives, and music stores are considered as basic information sources related to performance and improvisation activities and are definite preferences when performers physically go to seek music information (Barthet & Dixon, 2011; Cunningham & Nichols, 2009; Laplante, 2010b; Lee & Downie, 2004). In addition to these information sources, Internet-based music services, collaborative activities on online communities (e.g., web-based online reference services, music-related websites, and social networking sites) constitute sources of particular importance for the performing musicians who prefer online resources for extra-musical information and value online music reviews, ratings, recommendations, and suggestions (Inskip et al., 2008; Lee & Downie, 2004; Lesaffre et al., 2008; Stowell & Dixon, 2011). Also, social settings such as festive occasions, events, and people as sources of music recommendations (relatives, friends, colleagues, and other acquaintances) play a primary role in performers' information provision (Inskip et al., 2008b; Laplante, 2010a).

Information Needs and Information Sources for Music Listening and Analysis Activities

It is particularly important that often seekers wish to locate new music or music for certain occasions and events—thus exploiting specific creative activities such as listening and analysis (Bentley, Metcalf, & Harboe, 2006; Clarke, 1973; Cunningham et al., 2007; Laplante, 2011,

2012; Tepper & Hargittai, 2009; Watson & Mandryk, 2012). Music information needs employed for listening and analysis activities have both a utilitarian (e.g., acquisition of music and information about music by increasing knowledge and enriching listening analysis) and a hedonic (e.g., entertainment and enjoyment reasons) basis (Cunningham, 2002; Kostagiolas et al., 2015; Laplante & Downie, 2011; Liew & Ng, 2006; Nettamo, Nirhamo, & Häkkinen, 2006). Information needs regarding music listening and analysis are often related to certain uses of music, such as for recreational reasons, to renew a personal music collection, satisfy an insatiable craving for new music, or to fulfil a particular function such as the analysis of the music heard (Inskip et al., 2010; Laplante & Downie, 2006; Taheri-Panah & MacFarlane, 2004). For example, people listening to music to identify and analyze a particular musical work or artist may locate a recording, obtain the lyrics of the song and bibliographic entities by searching for a known item or song, find new and old songs from the same or a different music genre, or use the titles of songs, the artist's name, music pitch, and/or rhythm (Bainbridge, Cunningham, & Downie, 2003; Inskip et al., 2010; Lee et al., 2007). Also, important information needs related to music listening and analysis were found to be based on both popular and Western music of all descriptions as well as different types of media content, such as video and audio (Casey & Taylor, 1995; Kaminskas & Ricci, 2012).

In order to satisfy their information needs to do with music listening and analysis, people use a variety of formal sources as well as informal channels (Laplante & Downie, 2006). In particular, the use of the mass media (e.g., magazines, newspapers, radio, TV shows, commercials, movies, and music videos) seems to be a major source of information for the majority of people who are interested in music listening (Chung & Yoon, 2012; Cunningham & Nichols, 2008; Cunningham et al., 2007; Kim, Burnett, & Ding, 2006; Lee, Downie, & Cunningham, 2005; Tepper & Hargittai, 2009). Furthermore, people prefer to use public libraries, archives, personal collections, and music stores to find the music that they want to listen to (Casey & Taylor, 1995; Cunningham, 2002; Liew & Ng, 2006; Vignoli, 2004). Internet technologies and information access services, such as web-based online reference services and databases as well as other computer-based systems (which may or may not specialize in music) are considered as another important source of information for music listening and analysis activities (Bainbridge et al., 2003; Bonardi, 2000; Laplante & Downie, 2006; Lee & Waterman, 2012; Lesaffre et al., 2008; Matson & Shelley, 2013). In that context, the use of music identification software (e.g., Shazam, Soundhound), cloud music services (e.g., Spotify, Grooveshark, GoogleMusic), video sharing sites (e.g., YouTube), as well as online recommendation systems (e.g., iTunes, Last.fm) has gained much popularity for music listening and management (Kamalzadeh, Baur, & Möller, 2012; Lee & Waterman, 2012). A different, but equally important and preferred source of music information for the

plurality of the subjects mentioned earlier is the social communication for which social networks are used as sources of music recommendations (e.g., relatives, friends, colleagues, and professors) (Laplante, 2011, 2012; Liu, Yang, & Tan, 2012; Woelfer & Lee, 2012). These play a primary role in the information provision (Clarke, 1973; Lee, 2010; Liew & Ng, 2006).

Discussion

This systematic review explored individuals' music information-seeking behavior in relation to creative activities such as listening and analysis, performance and improvisation, as well as composition. The primary focus of this study was directed at investigating the interaction between music information needs, sources, and musical creative activities. This was achieved by analyzing the findings and the connections of existing research for individuals' music information-seeking behavior. The approach included studies of a number of different needs, resources, and activities. However, all were related to music access and creative activity. It was found that there are several common information needs and information sources that are employed for peoples' creative activities.

As shown in Table 3, the music information needs that relate to creative activities from the selected references could be grouped into three thematic categories: (a) those that are knowledge and learning related, such as learning about music, obtaining information on software and hardware, reviewing others' music, and comparing one's own music to that of others, etc., (b) those that are musically motivated, for example finding new music, distributing and publishing music, having one's own material listened to by others, getting feedback for one's own music, reading music-related entertaining messages, etc., and finally (c) those that are related to social communication, which may include listening, contributing and reviewing music, interaction and communication, meeting new people to make music with, social contacts, finding musicians with similar interests, publishing and receiving sound files over the Internet, etc.

Apart from the findings regarding music information needs, attention should be placed on the findings concerning music information sources that emerged from the current review. Music information is transferred to the public through music information sources (Lee, 2010; Lee & Downie, 2004). This is important since it has a particular effect on peoples' music information-seeking behavior. The present study also contributes to identifying common information sources employed for music creative activities (e.g., composition, performance and improvisation, listening and analysis). This set of information resources is of particular importance for individuals' music creative activities and, as shown in Table 4, these could be divided into three general categories: (a) those that are related to Internet and media technology, such as web-based online reference services and

TABLE 3. Music information needs that were exported from the studied reference set.

	Commonly studied items
Knowledge- and learning-related needs	<ul style="list-style-type: none"> — Music knowledge (vocabulary of music, structures and patterns of music, appreciation of music and cultural-historical contexts). — Books, printed journals, music scores (e.g., solo parts, piano reduction scores and parts, full and mini scores and ensemble parts) and musical genres (solo instrumental music, concerto type work, etc.). — Needs concerning the specific properties of acoustic instruments (orchestration manuals, scores and recordings related to the process of understanding how a given instrument is played and applied). — Bibliographic information (e.g., performer, title, date, orchestration, collection title, composer, label, link, language, etc.) or some type of genre scheme or lyric information in text and audio formats.
Musically motivated needs	<ul style="list-style-type: none"> — Finding music for specific purposes such as recreation and enjoyment, listening to music recordings, discovering new music and artists, obtaining and purchasing music recordings, identifying and verifying a particular song, reading reviews, searching for music recordings, listening to samples before purchasing, obtaining recommendations, watching performances and music videos, sharing music recordings, obtaining ranking and rating information, distributing and publishing music, hearing what kind of music others are making, having one's own material listened by others and obtaining feedback for one's own music. — Collection development and playlists creation — Information in various media formats including scores, photographs, textual biographical material, oral history collections, and recordings.
Social communication-related needs	<ul style="list-style-type: none"> — Interest relating to the social context of the musical material, social communication and collaborating with individuals from other fields. — Communication between listener and composer or performer. — Situations and contexts: social and cultural contexts, everyday situations, presence and absence of others and other ongoing activities. — Contributing and reviewing music, providing advice and help, meeting new people through the community to make music with, making social contacts, and finding musicians with similar interests.

TABLE 4. Music information sources that were exported from the studied reference set.

	Commonly studied items
Internet and media technology resources	<ul style="list-style-type: none"> — Web-based online reference services, databases, and social networking sites. — Music-related websites and applications, that is, Internet music streaming, music management and purchase, dictionary type sources, reviews, video sharing sites (e.g., YouTube), music identification (e.g., Shazam, Soundhound), cloud music (e.g., Spotify, Grooveshark, Google Music), social media, identification and recommendation systems (e.g., iTunes, Last.fm). — Message boards, wikis, blogs, e-mail, listservs, and newsletters. — TV shows, radio, commercials, movies, and music videos. — Primary sources of music (e.g., CD, mp3 player, etc.)
Conventional resources	<ul style="list-style-type: none"> — Music libraries and archives. — Record stores. — Museums. — Professional associations and their associated services and facilities. — Music owners such as record companies and music publishers.
Interpersonal resources	<ul style="list-style-type: none"> — People as sources of music recommendations (e.g., relatives, friends, colleagues, professors, performers, and other acquaintances). — Social networks and communication. — Professional organizations and these organizations' respective conferences and festivals.

databases, (b) conventional resources; related to public and academic music libraries, archives, professional organizations, music stores and their provided services and facilities, and (c) interpersonal resources; these relate to social settings such as festive occasions, events, and relatives, friends, colleagues, and other acquaintances as sources of music recommendations.

As such, the distinction between music information-seeking needs and sources employed for musical creative activities is outlined in the framework depicted in Figure 2.

This aims to encapsulate the three main phases of music information seeking employed for musical creative activities. In the context of that framework, individuals are engaged in music information seeking in order to satisfy specific information needs (e.g., knowledge- and learning-related, musically motivated reasons, and social communication-related needs) and are utilizing the available information resources. These resources may include Internet and media technology resources, conventional, and interpersonal resources that are then employed for musical creative

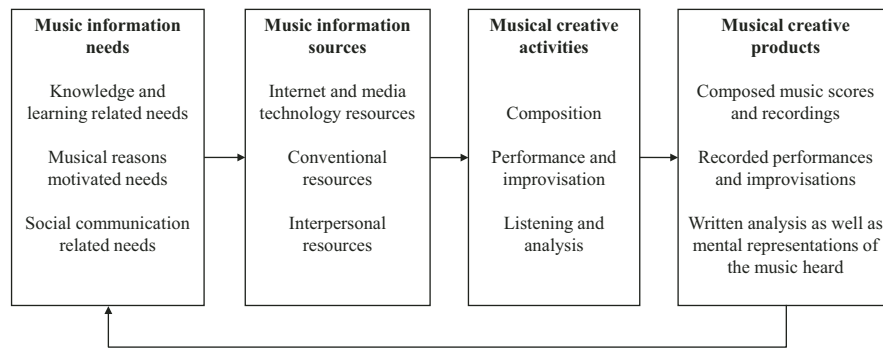


FIG. 2. A generalized framework, relating information-seeking needs and sources employed for musical creative activities.

activities such as composition, performance and improvisation, listening and analysis. Listening is considered a mentally focused experience, in which the listener forms a sense of the music with the aim of recreation or analysis. Performance may include the reproduction of written music or improvisation, and composition is the process of music making, paper imprinted, following formal rules and relations. The outcomes of these processes (see Figure 2) may indeed lead to the musical creative products that according to Webster (2002) include composed music scores and recordings, recorded performances and improvisations, written analysis, as well as mental representations of the music heard.

One of the limitations of the current study is that data relevant to the study may have been omitted during the selection process. This has been avoided as much as possible by conducting repeated controls of the full text of included papers. Further limitations were that data extracted could have been placed in multiple categories and sometimes the meaning of the identified categories overlapped. Finally, a significant shortcoming of the current work is that the plurality of the included studies present preliminary evidence on the interaction between individuals' music information-seeking behavior and musical creative activities, while assuming a connection between their findings related to information retrieval issues. Nevertheless, the current review offers a consistent synthesis of the relevant music information retrieval issues (needs and sources), as they have been highlighted in the literature, especially in relation to the creativity aspects we outlined in the Introduction.

Conclusion

This systematic review focused on the music information-seeking needs of individuals and the sources employed for creative activities such as listening and analysis, performance and improvisation, and composition. The findings of the study identified important needs and sources in the context of music information seeking that have a direct impact on the individuals' creative activities. From the perspective of music information needs, the study identified patterns for categorizing them into the following three

themes: (a) those that are knowledge- and learning related (b) those that are motivated by musical grounds, and (c) those that are related to social communication. In addition, music information sources were classified into three general categories: (a) those that are related to Internet and media technologies, (b) those that are related to music libraries, organizations and music stores, and (c) those that are related to the social environment.

Despite the aforementioned limitations, the current review also provides foundations for further discourse and research on topics related to music information-seeking needs and sources employed for creative activities such as the interaction between music information-seeking behavior and creative activities as a situation that leads to the final creative product. Certainly more empirical evidence on the interaction between music information and musical creative activities should be gathered in order to confirm the findings of this review, as well as to establish the precise extent of the specific interaction. A future extension of this review could extend the scope of the literature in a more thematic way by involving more proceedings (e.g. HCI Conferences) as well as taking bibliometric relations into account rather than following the PRISMA approach. In conclusion, the significance and originality of the current research area should be noted, since the continuous digitization of music production and consumption will require more attention from both researchers and practitioners in the future.

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Appendix

The following proceedings were included in the literature selection process.

- International Society for Music Information Retrieval Conference (ISMIR).
- Research & Development in Information Retrieval Conference (SIGIR).
- Theory and Practice of Digital Libraries Conference (TPDL).
- European Conference on Digital Libraries (ECDL).
- Joint Conference on Digital libraries (JCDL).
- SIGCHI Conference on Human Factors in Computing Systems.
- Asia Information Retrieval Symposium on Information Retrieval Technology (AIRS).
- European Conference on Advances in Information Retrieval (ECIR).
- Conference on Open Research Areas in Information Retrieval (OAIR).
- International Workshop on Social Media Retrieval and Analysis (SOMERA).
- Text Retrieval Conference (TREC).
- NII Testbeds and Community for Information Access Research (NTCIR).
- Information Interaction in Context Conference (IIIX).
- Australasian Document Computing Symposium (ADCS).
- ACM Symposium on Information, Computer and Communications Security (ASIA CCS).
- ACM Conference on Creativity & Cognition (C&C).
- Conference on Information and Knowledge Management (CIKM).
- International Workshop on Cloud Data Management (CloudDB).
- International Workshop on Data Warehousing and OLAP (DOLAP).
- International Workshop on Web Information and Data Management (WIDM).
- International Conference on Ubiquitous Information Management and Communication (ICUIMC).

- ACM International Conference on Interactive Tabletops and Surfaces (HC-ITS).
- ACM SIGACCESS Conference on Computers and Accessibility (ASSETS).
- ACM Conference on Recommender Systems (RecSys).
- Conference on Innovation & Technology in Computer Science Education (ITiCSE).
- ACM Conference on Computers and People Research (SIGSIM-CPR).
- International Multimedia Conference (MM).
- ACM Workshop on Audio and Music Computing Multimedia (AMCMM).
- Workshop on Music Information Retrieval with User-Centered and Multimodal Strategies (MIRUM).
- International Workshop on Machine Learning and Music (MML).
- Computer Science Education Conference (SIGCSE).
- ACM Conference on Information Technology Education (SIGITE).
- ACM International Conference on Web Search and Web Data Mining (WSDM).
- International Conference on the Theory of Information Retrieval (ICTIR).
- International Conference on Web Delivering of Music (WEDELMUSIC).
- International Conference on Advanced Computer Science and Information System (ICACSIS).
- International Conference on Computer and Information Sciences (ICCOINS).
- International Conference on Computer and Information Science (ACIS).
- International Conference on Computer Science and Information Technology (ICCSIT).
- International Association of Music Information Centres Annual Conference (IAMIC).
- International Computer Music Conference (ICMC).
- Sound and Music Computing Conference (SMC).
- International Conference on Acoustics, Speech, and Signal Processing (ICASSP).
- Conference on Neural Information Processing Systems (NIPS).
- Digital Audio Effects Conference (DAFX).