

“What are the challenges and opportunities in Music Information Retrieval for academic music libraries in Ireland, from a librarian and user perspective?”

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Declaration

I, Laura Mangan, declare that I am the sole author of this dissertation, that during the period of registered study I have not been registered for any other academic award or qualification, nor has any of the material been submitted wholly or partly for any other award. I have personally carried out all the work of which this is a record. The Masters in Library and Information Management of which this is part has been delivered by Dublin Business School.

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Abstract

Much of the available literature relating to Music Information Retrieval discusses the challenges and issues associated with indexing, preserving and retrieving musical recordings. None of this research is based on the experience of academic music libraries in Ireland. This dissertation aims to explore the opportunities and challenges associated with Music Information Retrieval, specifically in academic music libraries in Ireland. The opportunities and challenges will be examined from the perspectives of both music librarians and users of academic music libraries.

Music Information Retrieval is split into two separate areas. “Symbolic representation” allows for musical recordings to be searched for using metadata, such as Artist, Composer or Title. The other area is “Content based” Music Information Retrieval, where the melodies in the music itself can be searched. Many papers have been written proposing tools for content based Music Information Retrieval, and some have indicated that these tools can be used in an academic music library environment. However, none of the research presents evidence of user perspectives on these tools. Additionally, there are no examples in the literature of an academic library using these types of tools. This dissertation will also examine user and librarian perspective on these types of tools, and, in conjunction with the discussion on issues in Music Information Retrieval in academic music libraries, explore the reasons why these tools are not as yet being used in academic music libraries.

CHAPTER ONE: INTRODUCTION

1.1. Background

There has been a rapid growth in the availability of recorded music on the internet in recent years (Futrelle, Downie and Fingerhut, 2002). The emergence of websites offering recordings for free or very cheaply, has prompted the music industry to make their recordings available to listen to or download on the internet (BusinessWeek, 2009). One of the differences between traditional formats such as Compact Disc (CD), and recordings on a website database is that, on a website database, the music itself can be analysed and searched using the latest technology (Melucci and Nicola, 2004, p.1059). This is because in a musical database, the music can be integrated with a software tool which allows for the contents of the music, for example the pitch or melody, to be analysed or queried. This type of technology has huge commercial potential, and tools like “Shazam”, which search for a recording based on a recorded section provided by the user, are extremely popular.

There is a large amount of research being conducted within the Library and Information Science and Computer Science communities to create tools like Shazam, which can search the contents of a recording, instead of the traditional metadata associated with a recording, such as title or composer name (Dannenberg, et al., 2007). These are known as “Query by Humming” or “Query by Playing” tools, and are the subject of much research within the field of Music Information Retrieval. In theory, these tools can not only be used for commercial purposes, but also within an academic music library (Sinanan, 2010, Dunn and Mayer, 2006, p.54). However, no studies can be found where a Query by Humming tool is in use within an academic music library. This raises the question: what problem or issue is Query by Humming purported to solve? To answer this question, one must first look at the issues surrounding Music Information Retrieval in academic music libraries. These topics will be examined in Chapter Two of this dissertation, the Literature Review.

1.2. Objectives of this research

The research questions will be discussed and repeated multiple times in this dissertation, and so will not be stated explicitly in this chapter. However, the overall objectives of the research can be

presented here. This research aims to discover the issues surrounding Music Information Retrieval in academic music libraries, from the perspectives of librarians and users (students). Moreover, it will examine user perspectives on the topic of Query by Humming tools, which does not appear to have been done previously.

This research will be limited to the experience of academic music libraries in Ireland. The reasons for this are not just because of easier access to Irish academic libraries, but also because of a major lack of previous research in this area. The data findings should be considered in the context of the current poor economic situation in Ireland. Many of the themes explored in the dissertation, such as subscribing to musical databases and librarian resources to carry out specialized projects, are influenced by fiscal matters.

The overall findings of the research will be presented in Chapter Four. In that chapter, the main themes emerging from the data will be discussed, without any conclusions being drawn.

1.3. Approach to the research

The primary research was conducted via interviews with academic music librarians, and surveys with users of academic music libraries. The justification for using this sample will be presented in Chapter Three, Research Method and Methodology. Additionally, that chapter will analyse various research strategies and philosophies which can be used, and determine the most appropriate methods to answer the research questions.

1.4. Contribution of the research

The main conclusions from the research will be discussed in Chapter Five. The conclusions will be drawn as a result of critical analysis of the findings, in the context of the literature review. The main conclusions are as follows:

- Academic music libraries in Ireland do hold rare and specialised audio materials.
- These rare and specialised audio materials are only available to listen to within the physical library space.
- Academic music library users are strongly in favour of using the Internet and subscription music recording databases, due to the ease of access and convenience of use.

- The usefulness or otherwise of content-based Music Information Retrieval systems like Query by Humming in an academic library context is not determined.

From these conclusions, it can be argued that the next logical step in research is to commence a pilot programme within an academic music library in Ireland. This will build upon the research conducted for this dissertation, in addition to other Music Information Retrieval research which has gone before.

1.5. Chapter Summary

This chapter has served as an introduction to the concepts of this dissertation, and to provide a context for the themes and topics which will be explored. The following chapter, the literature review, will critically analyse previous research and justify the inclusion of these topics in the dissertation.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

The aim of this chapter is to discuss the theories and concepts derived from a review of the literature, and to justify the use of these theories and concepts in relation to the overall dissertation. The concepts discussed in this chapter are: the split of Music Information Retrieval theory into two distinct areas of “symbolic representation” and “content based representation”, and the benefits and limitations of each, the issues associated with Music Information Retrieval, the importance of academic music libraries as cultural repositories, and the possibility of using content based Music Information Retrieval systems in academic music libraries. These concepts will lead to a discussion on the formation of the research questions at the end of this chapter.

2.2. Music Information Retrieval – An Overview

Smiraglia (2002) defines Music Information Retrieval as “the activity of automating the retrieval of musical works, or parts of musical works”. In simple terms, Music Information Retrieval is the area of research concerned with the location and retrieval of music documents. The term ‘music document’ covers a wide variety of material, both printed and audio. Printed material includes sheet music and books about music, whereas audio material consists of audio files of various formats (for example MIDI and MP3). Music Information Retrieval is not the solely of interest to the Library and Information Science (LIS) research community. It is also a topic of research for engineers, computer scientists, musicologists among others, as it encompasses mathematical and computer skills along with LIS skills (Wiering, 2007, p. 82).

The last decade has generated much research in this area, mainly due to the increased availability of music libraries on the internet (Futrelle, Downie and Fingerhut, 2002). These music libraries allow the user to listen to a recording. A simple search of the term “Music Information Retrieval” in the EBSCO host academic database yields hundreds of journal articles on the subject. Research topics include music recognition (Wieczorkowska, Kubera and Kubik-Komar, 2011), music segmentation (Rafael and Oertl, 2010) and music tagging (Lamere, 2008), in addition to research on specific music genres such as folk music (Van Kranenberg, et al., 2010) and non-western music (Gedik and Bozkurt, 2009).

Before the emergence of music libraries, where the user can listen to the recording, music information was recorded and retrieved exclusively using ‘metadata’ (Kelly, 2010, p.164). Metadata is employed to describe a document to aid retrieval. In the context of music information, examples of metadata are: composer name, title, genre, and year of recording. At present, Music Information Retrieval can be split into two distinct approaches: a “content based” system which allows the user to submit an audio query, and a “symbolic representation” system which uses metadata (Downie, 2004, p.1033). In a content based system, the actual music in the recording can be queried, whereas, in a symbolic representation system, the metadata associated with the recording can be queried. Strangely, some authors do not place symbolic representation systems in the area of Music Information Retrieval at all. For example King (2005, p.17) indicates that content based systems are the sole component of Music Information Retrieval. However, this does not appear to be the general consensus, so for the purposes of this dissertation symbolic representation systems are treated as part of Music Information Retrieval. In much of the literature it was found that each author focused exclusively on one approach or the other. Lippincott (2002, p.137), for example, briefly discusses the use of metadata based systems “in the past”, before focusing solely on content based systems. In contrast, Dickey (2008) describes how the implementation of the Functional Requirements for Bibliographic Records (FRBR) hierarchical model can improve Music Information Retrieval, without making reference to content based systems. Some authors have touched on the possibility of using both approaches, allowing one to complement the other (Dannenberg, et al., 2007), but in the majority of cases there does appear to be a ‘disconnect’ between the two schools of thought. The historical development of Music Information Retrieval as a field of research, and how these two schools of thought developed, will be explored in the following section.

2.3. The development of Music Information Retrieval

The first known use of the term ‘Music Information Retrieval’ was in a journal paper published in 1966. In this paper Kassler (1966, p.59) described the development of a program on an IBM computer, in which musical notations could be represented. However, very little follow up research was conducted in this area until the 1990’s (Lippincott, 2002, p.138). During this time the availability of musical recordings on the internet led to an upsurge of interest in Music Information Retrieval. As the amount of music available on the internet grew, so too did the challenge of indexing and retrieving it (Kelly, 2010, p.163). Although the first ‘computer music’

conference was held in the United States in 1974, it was in 2000 that the first large-scale conference on Music Information Retrieval, *The International Symposium on Music Information Retrieval (ISMIR)*, took place (Downie, Byrd and Crawford, 2009, p.14). Following that initial conference, the ISMIR has grown exponentially in the last decade in terms of contributing authors and attendees (Downie, Byrd and Crawford, 2009, p.14).

During the 1990's, the field of Music Information Retrieval experienced a large expansion which resulted in the split into the content based approach and the symbolic representation approach. Melucci and Nicola (2004, p.1059) cite a number of important developments during this time, including the creation of the metadata based online databases MUSICA and HARMONICA in 1999. Around the same time, content based systems were first being proposed. Ghias proposed one of the first instances of a content based Music Information Retrieval system in 1995, followed by Tseng in 1999 (Melucci and Nicola, 2004, p.1059). Currently, the content based approach appears to be outnumbering the symbolic representation approach. This is apparent from searching the electronic journal databases for recent research on the subject of Music Information Retrieval – more research is currently being conducted on the content based approach. As will be discussed in the section below, there is great potential to develop content based systems for commercial usage, so this may explain this imbalance in research. Alternatively, content based research uses the latest technology (Sinanan, 2010), which would traditionally hold more interest for researchers.

One area of content based systems which has generated much research recently is the “Query by Humming” system (Dannenberg, et al., 2007). This system allows the user to hum, sing or whistle part of a musical work and then searches for the musical work based on this input from the user. There is a variety of Query by Humming systems available on the internet, for example: Musipedia, VocalSearch and Tunebot, which was developed by researchers at NorthWestern University (Huq, Cartwright and Pardo, 2010). Tunebot is available both on the internet and as an iPhone application, and it allows users to search for recordings on the Amazon website and iTunes (Huq, Cartwright and Pardo, 2010). According to Birmingham, Dannenberg and Pardo (2006, p.687) Query by Humming offers strong commercial potential for music libraries on the internet. Indeed, a popular commercial product called ‘Shazam’ (Shazam, 2012) provides this

service and is available on the internet. Apart from commercial use, some authors have indicated that Query by Humming has potential use in a non-commercial setting, such as an academic music library (Sinanan, 2010 and Dunn and Mayer, 2006, p.54). This is an intriguing possibility, and one which will be explored throughout this dissertation. However, in the first instance, the strengths and challenges posed by both approaches will be examined.

2.4. Benefits and Limitations of Symbolic Representation

As stated previously, the challenge of indexing music has become much more complex with the increased availability of music recordings in the last decade. According to Dickey (2008, p.24), the FRBR theoretical framework can be effectively applied to catalogues containing music recordings, as it defines entities from a user perspective, rather than a cataloguer perspective. But is this approach sufficient when the user does not know any information about what they are searching for? Lee (2010, p.1025) suggests that the way in which users encounter music is vastly different to the way they may encounter text – for example, a person may hear a musical work on the radio without knowing who performs the work or what the title of the work is. This type of occurrence is rare in the context of text. Generally when searching for a specific book or journal article some of the metadata is known. If the user is not searching for a specific book or journal they also have the option to search for items by subject.

Metadata for text items may also contain information relating to the subject of the item. For example, a book entitled ‘Ireland in the twentieth century’ may be classified in the library catalogue under a subject term like ‘Irish History’ or ‘European History 1900-1999’. It is a relatively straightforward task to identify what a book or journal article is about, in order to make it available to a user searching for items related to that topic. In contrast, a musical work may be quite difficult to classify – the meaning or ‘aboutness’ of a musical work is quite often difficult to establish and is open to interpretation by the listener. As a result, standard search terms such as those contained in the Library of Congress of Subject Headings cannot be accurately applied to music documents (King, 2005, p.8).

These issues led researchers to focus on the contents of a musical document, rather than the features which may describe it. According to much of the available literature (Wan and Liu, 2008; Dannenberg, et al., 2007; Birmingham, Dannenberg and Pardo, 2006; Yang, Chen and

Wang, 2010) the most important aspect of an audio musical document is its contents, which can be broken down mathematically and accurately searched and retrieved. It has been argued that this can be achieved with a Query by Humming system.

2.5. Benefits and Limitations of Query by Humming

Query by Humming is a form of content based information retrieval specifically for musical recordings. In general, content based information retrieval works as follows: the multimedia file is indexed in the database according to specific features. Examples of such features are colour for an image file, or pitch for a music file. When the user submits a query, the system calculates the similarity between the features of the query and the features of the files in the database and returns appropriate results (Wan and Liu, 2008, p.41). Query by Humming allows the user to sing, hum or whistle a part of a melody into a microphone and then transforms it into a query. Depending on the specific system used, certain features of the query are then compared with features of files in the database, and results are returned (Yang, Chen and Wang, 2010, p.1).

The main advantage of Query by Humming and other content based information retrieval systems is that, unlike traditional symbolic representation systems, it can search the contents of the music file – that is, it can search the actual music. This is particularly useful when the user does not have any of the metadata associated with the musical item they are searching for. Rather than inputting the title, composer or other metadata, the user simply hums or sings a portion of the music to retrieve results (Yang, Chen and Wang, 2010, p.1). King (2005, p.8) raises the point that most music recordings are not ‘about’ anything, so it would be extremely difficult to search for a music recording using only symbolic representation. The benefit of using a Query by Humming system is that the user does not need to know what the recording is about, in order to search for it. Additionally, according to Dannenberg, et al. (2007, p. 687) and Birmingham, Dannenberg and Pardo (2006, p.50), these systems do not require any special musical knowledge or skills to be used effectively. This would imply that these systems can be used by casual music fans as well as music professionals and students. Finally, Query by Humming negates any potential language problems for users – if the metadata of the musical file is in a language unfamiliar to the user, this is not an obstacle when using Query by Humming. When the user hums, sings or whistle part of a musical piece the pitch and melody are used as the query, rather than the lyrics, so language is not an issue.

In theory, Query by Humming appears to represent a big step forward in the field of Music Information Retrieval. However, it has many shortcomings that have yet to be fully addressed. According to Yang, Chen and Wang (2010, p.1), and Birmingham, Dannenberg and Pardo (2006, p.50), the accuracy of search results depends on the quality of the query entered by the user. Not everyone is capable of humming or singing in the correct pitch or using the right melody. If the query is not accurate, then the system will not yield appropriate results. This contradicts the assertions made above that users require no special skills for using Query by Humming – it is more likely that trained singers or others studying music would create better quality queries than others, and would therefore be more successful in using the system. Another issue with these systems is that even if a pitch perfect query is submitted, the system may not always convert the features accurately to compare against the database (Yang, Chen and Wang, 2010, p.5). The ‘VocalSearch’ tool attempts to reduce these problems by using an error likelihood elimination system (Birmingham, Dannenberg and Pardo, 2006, p.51) – however, this approach is only effective for errors that have previously occurred and cannot anticipate new types of errors.

2.6. The use of content based systems in academic libraries

As stated in an earlier section, some authors have suggested that content based systems like Query by Humming may have a use in an academic music library setting. This is an interesting possibility; after all, the users of academic music libraries are students of music and may have some insight into the effectiveness of these tools. Additionally, as discussed in the previous section, people studying music may have more success in using these tools. However, a review of the available literature has not produced a single example of an academic library which uses a content based Music Information Retrieval system like Query by Humming. This is puzzling, and moreover, it appears that little to no research has been conducted on the perspectives of music students and librarians with regard to these tools. In order to delve deeper into this topic it is necessary to establish the challenges associated with Music Information Retrieval in general. The issue of capturing the ‘aboutness’ of music recordings has already been discussed. This raises the question of what other challenges are unique to the field of Music Information Retrieval. The challenges associated with this field in general, according to the available literature, will be discussed in turn in the following section.

2.7. The challenges posed by Music Information Retrieval

2.7.1. Multiple Manifestations

The issues associated with Music Information Retrieval are problematic and wide-ranging. One only need consider the difference between a book and a piece of music on a superficial level to begin to understand the challenges involved in accurately indexing and retrieving music. According to Kelly (2010, p.164) and Smiraglia (2002), there is a vast difference between music collections and collections of other forms, like books. While a book may be published multiple times, in different formats and even published in an updated version with additions and abridgments, there is a limit to the different ways one book can appear. A musical piece on the other hand can be performed multiple times, in multiple different ways – each performance may only contain minor differences, but is different nonetheless. Smiraglia (2002) illustrates the complexity of the problem using the example of Elton John’s song ‘Candle in the Wind’. The singer himself stated that he considers the original version an entirely different work from the version recorded upon the death of Princess Diana in 1997. Musically, however, the versions are almost identical. It would be particularly challenging for a Music Information Retrieval system (both symbolic representation and content based) to differentiate between the two.

2.7.2. Standards and Copyright Issues

In order to properly evaluate and compare systems, a set of standards is required. In the case of Music Information Retrieval, no such standards exist. Individual research projects are developed separately from each other and there is no means for comparison. Dannenberg, et al. (2007, p.687) cite the lack of a standard database as the main obstacle to comparing these systems. If Music Information Retrieval systems cannot be evaluated to a satisfactory level then the entire field of research is at a disadvantage. Unfortunately, there is no easy solution to this problem. Strict copyright laws and restrictions on sharing music prevent the creation of such a database (Dannenberg, et al., 2007, p.687; Downie, 2004, p.1034).

2.7.3. Preservation and Access

The conflicting ideals of preservation and access are a major challenge for academic libraries in relation to music materials. “Materials are preserved by restricting access to them, and, in turn, providing access to materials endangers their preservation” (Griscom, 2003). Music is available

in many formats: wax cylinders, LP records, cassette tapes, compact discs and others. All of these formats can be easily damaged or lost.

2.7.4. User Needs

It is a natural expectation that if a tool is being built for users, then the needs of those users would be accounted for in the planning stages of that tool. However, in many instances, this appears not to be the case. King (2005, p.2), states that any research on Music Information Retrieval that does not take user needs and search strategies into account is out of context and therefore holds less weight. Although King's findings are now seven years old, very little has changed since then. This is backed up in more recent research by Lee (2010), one of the few authors who attempts to examine user needs and behaviours in relation to Music Information Retrieval. Lee (2010, p.1025) states that the reason why current Music Information Retrieval research has so little actual practical use is because of the constant failure to examine user needs. As stated previously, there has been a suggestion by some authors that content based tools like Query by Humming could be useful in an academic music library setting. However, the literature does not supply any examples of academic music libraries using such a system. Instead, much of the research is based on experimental or pilot studies. There is a clear need to examine academic music library user and librarian perspectives on content based systems like Query by Humming. Moreover, the perspectives of these same groups on the current challenges in relation to Music Information Retrieval in academic libraries must be examined. In order to justify why the perspectives of academic music library users and librarians are significant, it is necessary to discuss the unique and important role of academic music libraries.

2.8. Academic Music Libraries

2.8.1. History and Development

Keyes (1940, cited in Campana, 2001, p.354) identified one of the first examples of an academic music library; the Oberlin Conservatory Library in the United States, which was formed around the mid nineteenth century. Others soon followed, including the Widener Library at Harvard University in 1870 (Harvard University, 2007) and the William and Gayle Cook Music Library at Indiana State University, which was established in 1921 (Indiana University, 2010). However, it was mainly during the post-World War Two period that there was large growth and expansion

of music libraries in general, and academic music libraries in particular (International Association of Music Libraries, n.d.). This growth was fuelled by the influx of European music scholars to the United States during the 1930's and 1940's, and established musicology as a new field of research (Hassen, 2001, p. 342).

As music developed, so too did academic music libraries. Specialized libraries began to appear in the 1980's, for example the Centre for Black Music Research at Columbia College in Chicago in 1983 and the University of Mississippi Blues Archive in 1984 (Bucknum, 2001, p.382). In Ireland, there is very little information available regarding the history or contents of music collections at third level institutions. There not only appears to be a gap in research regarding librarian and library user perspectives on content based systems in academic music libraries, but also research into Irish academic music libraries in general.

The purpose of academic music libraries is to preserve musical documents (printed and audio) and make these documents available for current and future generations to study. Many academic music libraries have built up collections of rare materials throughout the years, for example, the music library at Indiana State University (Indiana State University, 2010). It is reasonable then to argue that academic music libraries serve a function unmatched by internet music repositories such as Amazon and iTunes, because they hold rare and specialized materials. Because so little research has been done on academic music libraries in Ireland, it is difficult to state with confidence that they also serve this special function. Therein lies a gap in research in this area.

2.8.2. Access to music recordings from outside the physical library

Some academic music libraries now provide access to their music recordings from outside the physical library space, through the library website (Phinney, 2005). This means the library users can actually listen to the music without having to be inside the library. According to Phinney (2005, p.2), this has led to a marked decrease in the number of users visiting the physical library space. One of the first academic music libraries to provide access to their music recordings in this way was the Cook Music Library at Indiana University (Dunn and Mayer, 2006, p.54). Statistics relating to usage were gathered for this project, and it was found that usage of specialized material increased significantly when those materials were available to be listened to

from outside the physical library. Similarly, Phinney (2005, p.22) found that overall usage of music recordings in academic libraries increased significantly when the music recordings were made available to listen to from outside the physical library space. This indicates that providing this type of access to music recordings can be very beneficial to academic music libraries, both in terms of their overall usage, and usage of specialized or rare materials.

Additionally, making the libraries musical recordings available to listen to from outside the physical library space also provides a solution to the issues of access and preservation. According to Brooks (2005, cited in Imre and Cox, 2009, p.475) a significant number of LP records published before 1964 have not be re-issued in a more modern format, such as MP3. As a result, the only source for much historical music is a delicate vinyl record, which can easily become damaged. If these LP records were converted to MP3 format and made available to listen to through the library website, it would eliminate the need to use the original vinyl record, thus preserving it. Similarly, having a musical recording available to listen to through the library website would resolve the problem of only having one copy of the recording. Different users would be able to listen to the same recording at the same time, because the original LP, CD or cassette tape would not be required (Phinney, 2005, p.23).

However, the process of creating such a system for an academic music library would be quite time consuming. Additionally, copyright issues again appear to be hampering efforts to create these types of systems for academic music libraries (Griscom, 2003). It would be of interest to gauge the music librarian perspectives on this topic, to determine whether they have any further thoughts to add to this subject. Once again, there appears to be a gap in research on this particular topic.

2.8.3. External Subscription Audio Databases

Another important resource for academic music libraries which has emerged in the past decade is the subscription music database, such as Naxos Music Library or Classical Music Library. The musical contents of these databases can be listened to by users of an academic music library which is subscribed to the database. The advantage once again of having access to these types of resources is that they do not have to be accessed from the physical library space and are not

subject to the opening times of the physical library. Another advantage is that, because the academic library pays a subscription to the publisher of the database, they can be assured that there are no copyright or legal issues in using the contents of the database (Durman, 2009, p.109).

2.8.4. Academic Music Libraries and the Internet

Apart from the contents of music recordings in academic music libraries and the music databases they subscribe to, there is a further resource available to music students – the internet. Websites such as YouTube and Amazon allow users to listen to music for free, at any time, in any location. These types of resources are considered to be in a separate category of resource for the purpose of this dissertation because they are open source. There is very little literature available on the use of these resources by academic library users, as distinct from their use of subscribed databases such as Naxos Music Library, or their use of the library music recording collection. It would be interesting to determine how prevalent their use is, and what the opinions of academic music library users and librarians are in Ireland.

2.9. Development of the Research Questions

The initial research question for this dissertation was “What are academic music librarian and user perspectives on content based Music Information Retrieval systems such as Query by Humming?” The motivation behind this question was the huge amount of research currently being carried out in the field of Query by Humming, and the theory that these systems could be used in academic music libraries. However, it soon became apparent that, rather than being a system used regularly in academic libraries; Query by Humming has only been developed on an experimental or pilot basis. This raised a further question – what actual problem is this type of system purported to solve? To answer this question, a review of the available literature on current Music Information Retrieval issues was required. Additionally, a gap in research was identified in terms of academic music libraries in Ireland, the contents they hold in terms of specialized music, and the issues they are facing in relation to access and preservation of music recordings.

Following on from the above, the main research question evolved into: “What are the challenges and opportunities in Music Information Retrieval for academic music libraries in Ireland from a

librarian and user perspective?” A secondary research question is “What are academic music library user and librarian perspectives on content based Music Information Retrieval systems, such as Query by Humming?”

The objectives behind these research questions are to determine the following:

- Do academic music libraries in Ireland hold rare or specialized musical recordings?

The literature has indicated that academic music libraries in other countries, particularly the United States, hold large collections of specialized audio musical materials. Is this also the case in Ireland?

- How are musical recordings accessed by users of the library (students)?

In order to answer the question as to whether a content based Music Information Retrieval system would be useful in an academic music library in Ireland, the ways in which music library users currently search for musical recordings must be examined.

- What issues are facing academic libraries in Ireland in relation to Music Information Retrieval, from the perspective of librarians?

The literature has shown that there are specific challenges relating to Music Information Retrieval, particularly in preserving and providing access to music recordings – do academic music libraries in Ireland encounter the same challenges?

- What is the level of awareness among academic music library users and librarians in Ireland of content based systems like Query by Humming?

There are no examples in the literature of an academic music library using a content based system such as Query by Humming. Additionally, there is nothing in the literature to indicate whether academic music library users and librarians are aware of these systems.

- What are academic music library users and librarian perspectives on content based systems such as query by Humming?

Some of the literature has indicated that content based systems such as Query by Humming could be used in an academic setting. The answer to this question will establish user and librarians perspectives on the topic.

2.10. Chapter Summary

The aim of this chapter, as stated in the introduction, was to critically examine theories and concepts derived from the literature, and to justify the relevance of these theories and concepts for the dissertation. A number of concepts were discussed throughout this chapter. The concepts were as follows: the development of music information as a field of research, the issues and challenges surrounding this field, the two distinct research areas in MIR and how they developed, the advantages and disadvantages of each of these fields, the history, development and importance of academic music libraries, and the current challenges facing these libraries today. Gaps in the research were identified on a number of occasions, to justify why there is a need for further research in this area. Finally, the evolution of the research questions was explained in detail. The next chapter will discuss the research methods and methodology which were used to answer the research questions.

CHAPTER THREE: RESEARCH METHODS AND METHODOLOGY

3.1. Introduction

The aim of this chapter is to identify the methods which were used to answer the research questions, and justify their use within the context of an overall research philosophy. Research methods allows for a meaningful research strategy to be designed and carried out, while the methodology assists in the implementation of the strategy. Designing an effective research strategy allows for practical issues such as time constraints, sampling issues and limitations of the research to be identified and addressed, thereby mitigating their risk to the overall quality of the research. This chapter utilises the concept of the ‘Research Onion’, which was created by Saunders, Lewis and Thornhill (2009). They proposed the idea of research as comprising several layers, which must be peeled back one at a time, in order to fully carry out quality research. An image of the research onion (Saunders, Lewis and Thornhill, 2009, p.108) is shown in Figure One below. This chapter will identify and discuss the most appropriate philosophy, approach and strategy which was adopted for this research. Additionally, the most effective and practical methods by which the research was carried out will be identified in this chapter. Issues of time restrictions, potential bias and limitations to the research will be also be discussed in detail.

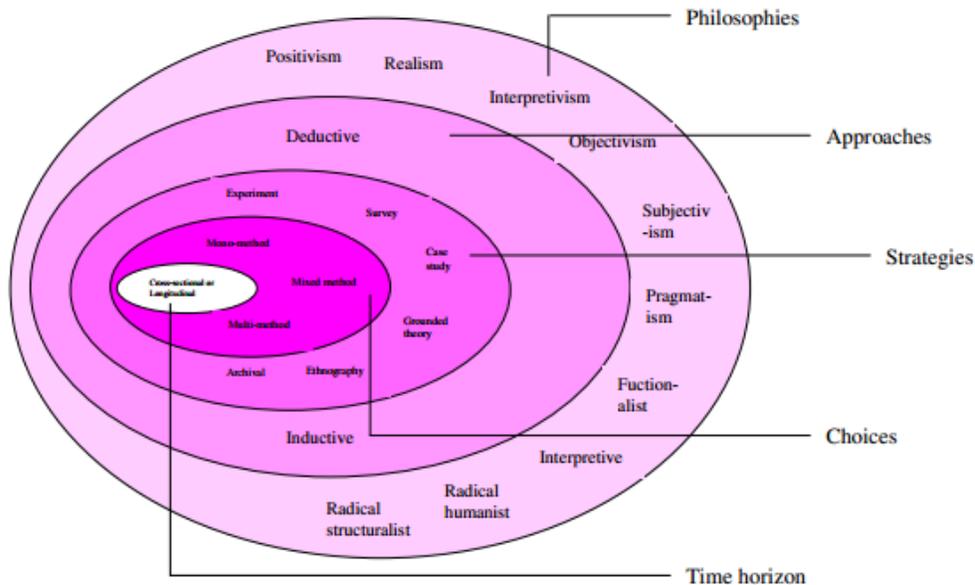


Figure 1: The Research Onion

3.2. Research Philosophy

According to Eriksson and Kovalainen (2008, cited in Flowers, 2009), epistemology is a research approach which is focused on ways of defining knowledge, and the boundaries and limits of that knowledge. From an epistemological viewpoint, the philosophy adopted for this dissertation was that of interpretivism, as it is chiefly concerned with the thoughts and opinions of the research subjects (Saunders, Lewis and Thornhill, 2009, p.120). As discussed in the literature review, the main research question is concerned with the issues and challenges facing academic libraries in Ireland in the field of Music Information Retrieval. This question is heavily entangled with the emotions and experiences of the research subjects. Therefore, a philosophy such as positivism (Saunders, Lewis and Thornhill, 2009, p.121), which is chiefly concerned with unbiased facts as knowledge, would not suffice. That is not to say that positivism is completely discounted – the current Music Information Retrieval systems used in Irish academic libraries are unchanging and undisputed facts. However, the opinions of both the users (students) and librarians using these systems must be taken into account and therefore a primarily interpretivistic approach is required. Furthermore, the type of research questions must be taken into account. The main research question relating to the issues and challenges of Music Information Retrieval and the sub-question of user and librarian perspectives on content based systems like Query by Humming do not form a hypothesis. They are open-ended questions which can only be answered through the study of both quantitative and qualitative data. This further re-enforces the argument for interpretivism which, according to Saunders, Lewis and Thornhill (2009, p.122) is more suited to open ended questions.

Ontology is concerned with how the researchers define reality; is it created from our experience, or does it exist outside our experience? (Hatch and Cunliffe, 2006, cited in Flowers, 2009). In terms of ontology, a mainly subjectivist viewpoint was adopted within the research philosophy. Subjectivism, as the word implies, contends that reality is created from and influenced by the actions of the stakeholders (Saunders, Lewis and Thornhill 2009, p.128). In the case of the research questions at hand, the motivations and actions of librarians and students must be considered in order to fully examine the issues and challenges in academic music libraries in Ireland. The purpose and motivations behind the use of content based systems, or lack thereof,

must be taken into account, as should the intentions behind using other systems in the library. However, as with the epistemology, there was also a slightly objectivist approach.

While epistemology and ontology seek to find answers relating to the definition of knowledge, and the means of retrieving it, axiology causes the researcher to question the value of that knowledge (Saunders, Lewis and Thornhill, 2009, p.129). In answering that question, the researcher must attempt to identify not only what they consider to be of value, but also their own pre-existing biases (McGregor, 2011, p.12). Again, the interpretivistic and subjective philosophies were employed for this dissertation because the researcher, a library science student, is inherently tied to the research, and is therefore subjective (Saunders, Lewis and Thornhill, 2009, p.128).

3.3. The Research Approach

In contrast to the research philosophy the next layer of the research onion, the research approach, was much less difficult to identify. According to Saunders, Lewis and Thornhill (2009, p.130) there are two approaches to research: inductive and deductive. This dissertation used an inductive approach for a number of reasons. In a deductive approach, a hypothesis is formulated in advance and then tested to determine whether or not the hypothesis endures (Crowther and Lancaster, 2009, p.24). In the case of this dissertation, no specific hypothesis was formulated. The research questions examined user perspectives on content based Music Information Retrieval systems like Query by Humming, and the issues relating to Music Information Retrieval in academic libraries in Ireland. The result could have been positive, negative or inconclusive, depending on the outcome of the research. In addition, according to Thomas (2003) one of the main reasons for using an inductive approach is to gather together a multitude of data and express it concisely in a summative manner. This is precisely the aim of this dissertation, which assimilated a variety of quantitative and qualitative data to form a conclusion.

3.4. Research Strategy and Choice

Saunders, Lewis and Thornhill (2009, p.138) cite a number of different options which can be employed as methods of gathering research data: case studies, surveys, experiments, action research and others. Experiments have been used in much of the literature reviewed, for example, by Dannenberg, et al. (2007) and Huq, Cartwright and Pardo (2010). In these

experiments, the effectiveness of Query by Humming systems was measured scientifically. However, the research objectives of this dissertation are not concerned with proving scientifically the effectiveness of content based systems. Instead, the issues surrounding academic music libraries in Ireland and the users and librarians opinions on content based systems are the primary research objectives. Phinney (2005) combined a student survey and usage statistics to gather data on electronic music usage in libraries. Similarly, Griscom (2003) used a survey to gather data on librarian attitudes to electronic music retrieval. These types of strategies are more in keeping with the research objectives of this dissertation. As a result, a survey was employed as a research strategy in this dissertation.

Although Saunders, Lewis and Thornhill (2009, p.144) cite the survey strategy as being more commonly associated with deductive research, it would be the most appropriate means of gathering a wide range of data relating to the user (students) experience in academic music libraries. This is particularly the case during the summer months, when students willing to do a face to face interview may be difficult to contact. Additionally, the survey allows for a large amount of quantitative data to be collected in a short time period (Saunders, Lewis and Thornhill, 2009, p.144), which was a major consideration for this dissertation. It does, however, raise the question as to whether a mono-method, that is, a single data collection method (Saunders, Lewis and Thornhill, 2009, p. 151), can fully explore all of the potentially interesting data to be collected from both academic music library users and librarians.

An interview, whether face to face, by telephone, or email adds a qualitative dimension to the collected data. In contrast to students, academic music librarians may have more information to give than can be obtained from a survey, due to their years of practical experience working in academic music libraries. An interview aimed at academic music librarians was used as another research strategy in this dissertation. Although the interview questions were standardised, the open-ended nature of the questions allowed music librarians expand on their experiences of Music Information Retrieval, and their opinions of content based systems in academic music libraries today. This choice of research method, using more than one method of collecting data, is defined by Saunders, Lewis and Thornhill (2009, p.151) as multi-methods. The multi-method

choice of two strategies, a quantitative survey and a qualitative interview were the most appropriate for meeting the objectives of this research.

3.5. Time Horizons

Saunders, Lewis and Thornhill (2009, p.176) define two types of time horizons: cross sectional and longitudinal. Cross sectional research is akin to taking a picture of the situation at one particular time and often uses a strategy involving a survey (Saunders, Lewis and Thornhill, 2009, p.176). In contrast, longitudinal research examines changes over a period of time (Saunders, Lewis and Thornhill, 2009, p.176). In order to determine the most appropriate time horizon approach, a number of factors must be considered. These factors are of equal importance but can lead to conflict. When this occurs, a compromise must be reached to resolve the conflicting factors.

One of the main factors to be considered is whether a cross sectional or longitudinal approach would best answer the research questions (Saunders, Lewis and Thornhill, 2009, p.176). In an ideal situation, a longitudinal case study could be carried out on a particular academic library in Ireland, and the changes to Music Information Retrieval issues over time could be examined in great detail. Similarly, a pilot project could be created within an academic library in Ireland where the use of content based systems could be implemented, and their usefulness to the library could be examined over time. However, another important factor to consider is time constraints (Saunders, Lewis and Thornhill, 2009, p.176). The window for collecting data was very short, therefore neither of the above options was realistic. Because of this, a cross sectional approach to time was employed in this dissertation. The data collection period occurred from July 01st to July 30th.

3.6. Primary Data Collection

According to O'Leary (2004, p.150) there is no right or wrong method to collect data. However, the data collection method depends on the research objectives. The following sections will identify the data required for the study and the methods by which it was gathered. There will also be a discussion on how this data answered the research questions posed.

3.6.1. Student Survey

As stated earlier, a survey was used to collect data from music students. This quantitative method was used to gather data from academic music library users, music students, in a short period of time. Additionally, it was assumed that students would be more likely to agree to answer a survey online rather than sit down to a face to face interview. A breakdown of the rationale for the questions is below.

Question One: Where do/did you study music?

- Trinity
- UCD
- DIT
- RIAM
- Maynooth
- Queens Belfast
- Other (please specify)

Questions Two: What is the primary focus of your studies?

- Performance
- Theory and Research
- Other (Please specify)

These questions were necessary to separate out the respondents institutions, in order to ensure that a wide range of responses were received. It would have been detrimental to the study if all respondents originated from the same institution. Additionally, Question Two determined if there was a difference in the issues experienced by students studying music performance, as opposed to students studying music research.

Question Three: Do you search for audio recordings in the course of your music studies?

- Regularly

- Sometimes
- Rarely
- Never

Question Four: Does the library in your college hold a collection of audio recordings?

- Yes
- No
- Don't Know

Question Five: What format(s) are those audio recordings in?

- CD
- Vinyl
- Cassette Tape
- Electronic (e.g. MP3)
- Other (please specify)

The above questions are essential because the main focus of the dissertation relates to the issues with musical recordings, as opposed to printed musical materials. The question determined how common it is for music students to search for audio music and what the most commonly available audio recording formats are in academic libraries.

Question Six: Do you use the audio recordings in your library?

- Frequently
- Sometimes
- Rarely
- Never

Question Seven: What do you mainly use these audio recordings for?

- Assignments
- Personal Use

- Other (please specify)

These questions determined how, and how often, music recordings are used by music students. For instance, some may use music recordings for study, others for recreation. The literature has stated that academic music libraries are extremely important in the study of music. The answers to these questions indicate whether audio musical recordings are considered important or useful to those studying music.

Question Eight: Do you agree with any of the following statements

- It is easy to search the music collection in the college library
- The selection of audio recordings in the library is wide ranging
- The selection of audio recordings in the library is limited
- I prefer to use the internet when searching for audio recordings
- The library has audio recordings not available from other sources
- I find it easy to search the music collection in the college library

Question Nine: Which of the following methods do you mainly use when searching for audio recordings?

- Search by artist/title/composer
- Search by genre/style

Question Ten: Does the library offer a facility for accessing its audio recordings off campus?

- Yes
- No
- Don't Know

Question Eleven: How would you rate this off campus facility?

- Very Good
- Good
- Average

- Poor
- Very Poor

Question Twelve: Would you use the library resources more frequently if its music collection were available off campus?

- Yes
- No
- Don't Know

The questions above are concerned with the student's satisfaction with the library regarding musical recording resources. They identified any issues associated with access to musical resources and whether this is was a factor in the student's library usage.

Question Thirteen: Do you use other online resources (e.g. iTunes, Amazon, YouTube) when searching for recordings?

- Frequently
- Sometimes
- Rarely
- Never

Question Fourteen: What is the main benefit of using online resources like iTunes?

- Easy to use
- Convenient
- Available 24/7
- Wide ranging
- Other (please specify)

These questions chiefly concern the usage of audio musical resources outside the library collection, in particular, on the internet. They aimed to identify how prevalent their use is, and what the students consider the main benefits to be.

Question Fifteen: Query by Humming (QBH) and Query by Playing (QBP) are software tools which allow you to sing, hum or play part of a melody and then search the musical database for similar sounding melodies. Have you ever used these tools?

- Yes
- No

Question Sixteen: Do you use these tools?

- Frequently
- Sometimes
- Rarely
- Never

Question Seventeen: What is your opinion of these tools?

- They are very useful
- They are not very accurate for searching
- They are only good for entertainment
- I have never heard of them until now

Question Eighteen: Which of the following QBH/QBP tools have you used?

- Vocalsearch
- Tunebot
- Tunepal
- Midomi
- Other (please specify)
- I have never used these tools

Question Nineteen: Would you use your college library resources more frequently if they offered QBH/QBP searching of their audio collection?

- Yes

- No
- Don't Know

By asking the questions above, the idea of content based searching, in particular Query by Humming tools, was introduced to the student. These questions determined how well known these tools are, how often they are used and what the student's opinion is of them.

Question Twenty: Do you have any further comments on the audio collection in your college library?

This is the only open ended question on the student survey. It allowed for some qualitative data to be gathered on student opinions regarding issues with retrieving musical recordings in their library.

3.6.2. Interviews with Music Librarians

The other data collection method was through the use of structured interviews with music librarians. According to Corbetta (2003, p.37), qualitative methods provide data with more depth and richness. The interview as a data collection method was utilised to provide this qualitative data. The interview has two main advantages. It allows the interviewee to express their thoughts and opinions, and also allows the interviewer to follow strands of previously unexpected topics. This cannot occur with a survey as a data collection method, which is far more restrictive for both the researcher and respondent. The interview, as noted by Cohen, Manion and Morrison (2007, p.355), is about much more than just cold hard facts – rather, it encompasses the human experience. The rationale behind the questions asked in the interview is in the section below.

Question One: Can you provide a brief outline of the music collection in the library in terms of both printed and audio files?

Question Two: Are there any rare or specialised musical materials in the collection?

These questions were asked to determine the relative size of the music collection in the library. They also established the types of musical works (both printed and audio) currently held in academic music libraries in Ireland and whether, as indicated by the literature, academic libraries are essential repositories for preserving musical works.

Question Three: What are the main issues facing you as the music librarian, in relation to preserving and retrieving audio works in the library?

This question established the main issues in Music Information Retrieval according to the librarian. It was hoped that because the question is open ended and general, that the librarian would offer many issues.

Question Four: Is the audio collection available electronically, meaning can users of the library listen to audio files through the library portal (as opposed to searching through the catalogue to locate audio that is physically located in the library building)?

As discussed earlier in the literature review chapter, the literature indicates that musical recording collections which are available from outside the physical library space are very popular with students as they allow easier access and are more convenient – this has led to increased use of the music collection in many libraries. This question was posed in order to establish whether Irish libraries provide this type of access to their musical recording collections.

Question Five: (If the audio collection is not available electronically) how do students search for audio materials?

Question Six: (If the audio collection is available electronically) how do students retrieve recordings from the audio collection?

These questions identified the methods used by libraries in helping students retrieve musical works like recordings, with or without having a musical collection available to listen to from outside the physical library space.

Question Seven: (If the collection is not available electronically) are there any specific reasons for not having the music collection available electronically?

This question sought to determine the main problems associated with making a musical collection available to listen to from outside the physical library space (for example, through the library website) from the perspective of an Irish academic library. It was asked because there may be reasons other than staff shortages or cost.

Question Eight: (If the collection is not available electronically) do you think that having an electronic music collection would be beneficial to the library? If so, in what way?

Much of the literature points to ease of access and convenience in having access to listen to music recording collections from outside the physical library space. This is mainly because the user does not need to be physically present in the library to listen to the music, and also the music itself can be searched (as opposed to the metadata associated with the music, like title or artist name). This question was asked in order to determine whether Irish music librarians hold the same opinion.

Question Nine: (If the collection is available electronically) has the electronic music collection changed MIR in the library? If so, how?

The purpose of this question was to provide an Irish perspective on whether having access to listen to the musical collection from outside the physical library space has changed the way students and staff retrieve musical works. If there has been a change, has it been positive or negative? Has there been an increase in usage of the music collection? If so, how has this been recorded?

Question Ten: There is a lot of research on content based Music Information Retrieval like Query by Humming (QBH). This is a software application which allows the user to hum, sing or play part of a melody and then searches the contents of audio files in the library for a matching melody. What is your opinion of these systems and do you think they would add anything to Music Information Retrieval in academic libraries, as opposed to a user with a casual interest in searching for music?

Much of the research in the literature review has highlighted the benefits of content based systems like Query by Humming. This question aimed to establish the viewpoint of Irish music librarians on this subject. It aims to determine whether a content based system like Query by Humming, which allows the user to search the music itself, actually be useful and practical in an academic setting, from the perspective of an academic music librarian.

Question Eleven: What are the most common types of requests from students searching for audio?

Here, the most common difficulties encountered by users of the music collection were identified. The needs of users were also identified. For example, do students ever ask about accessing the music collection from outside the physical library space? Is it common for students to look for a melody without knowing any of the details about the piece?

Question Twelve: What are your thoughts on the availability of music libraries online like iTunes? Are they a threat to the library?

In this question the librarians were able to offer their opinion as to whether other music libraries on the internet are taking students away from the traditional academic library, or are another useful resource. This ties back to one of the main research questions of the dissertation – could content based systems benefit academic libraries in Ireland?

Question Thirteen: What are the future plans for the library in terms of access and preservation of audio files?

This question was posed in order to establish the future plans of Irish academic libraries in terms of Music Information Retrieval. Are they planning to make their music recordings available in a database, where the music can be listened to from outside the physical library space, and the music itself can be searched? Do they have any ideas on how to increase usage? Or, are they satisfied that preservation and access to audio files in the library is sufficient?

Question Fourteen: Would you like to offer any final thoughts on the subject of content based Music Information Retrieval systems in academic libraries or Music Information Retrieval in academic libraries in general?

This question is completely open-ended. Its purpose was to allow the librarian to share any thoughts they might have in relation to Music Information Retrieval in academic libraries which had not already been covered in the interview.

3.7. Secondary Data Collection

The student survey was self-administered by music students on the Survey Monkey website. This website was chosen because it is well known and easy to use. The survey contained twenty questions, though not all were applicable to each respondent. Some questions were automatically skipped, depending on their answer to other questions. The aim was to achieve at least twenty responses, and this target was surpassed – in fact forty responses were received. Prior to distributing the link, the survey was piloted on a small number of people unrelated to the research. This step is vital to ensure that the survey questions are clear to respondents (Cohen, Manion and Morrison, 2007, p. 78). The link to the survey was distributed in a number of ways: through word of mouth using an existing music student contact, through emails sent to the music departments of each institution, through music librarians who agree to an interview and also through the Boards.ie website. This website contains a discussion area for each of the main third level institutions in Ireland.

The interviews with music librarians were face to face where possible, using a Dictaphone to record the conversation. However, issues concerning distance meant that some interviews were not possible to conduct face to face. In this case, a telephone interview was the second preference for conducting interviews. In the event that neither a face to face nor telephone interview was possible, the final option was to send the interview questions via email. It was hoped that at least five music librarians would participate in an interview, and this target was achieved. There were fourteen interview questions in total but, again, not all were relevant to each interviewee. A number of institutions in Ireland provide courses in music, and the libraries for each institution were contacted by telephone initially. Following initial contact, the interviews were arranged.

3.8. Data Analysis

Robson (2003, cited in Saunders, Lewis and Thornhill 2009, p.407) points to a major risk in qualitative data analysis today – with the wide availability of software tools such as SPSS, it is very easy to analyse data incorrectly. This was something to be aware of when qualitative data obtained from the student survey was approached for analysis. The questions for the student survey were created with data analysis in mind, which is an important factor to consider when creating these types of data collection tools (Saunders, Lewis and Thornhill 2009, p.407). The aim of this analysis was, as argued by Connaway and Powell (2010, p.262) to summarize the raw data in order to provide answers to the research questions.

There are three important processes in qualitative data analysis: data reduction, data display and drawing and verification of conclusions (Miles and Huberman, 1994, p.11). Data reduction is concerned with transcribing the interview contents and cleaning it to facilitate analysis, otherwise patterns hidden in the data will remain hidden (Miles and Huberman, 1994, p.246). Data display involves converting the cleaned data into a graphical form, showing the links between different units (Miles and Huberman, 1994, p.246). This step requires much iteration, as units gradually become broader or narrower in scope. Finally, conclusions are drawn from the completed data display. That final step is considered to be relatively straightforward as the difficult task of displaying the data has already been completed. The processes described above were used in analyzing the qualitative data drawn from the interviews.

3.9. Population and Sample

Sampling is necessary because it is not possible or practical to survey the entire population (Marshall, 1996, p.552). The thoughts and opinions of the larger population can be inferred from those of a sample of the population (Freedman, 2004, p.1), and as a result selecting the appropriate sampling design requires much consideration. Simple random probability sampling was utilised for this dissertation, that is, all music subject librarians in Irish academic institutions, and all students of music (both performance and research). Many techniques have been developed for this type of sampling, including Rand Corporation's *A Million Random Digits*, which is essentially a collection of random numbers (Connaway and Powell, 2010, p.121). However, a formal sampling technique was not necessary in this case because the sample size was already quite limited.

Selecting the appropriate sampling design from the population is extremely important, as bias can very easily skew the results of the research (Freedman, 2004, p.1). Sampling error, according to Mugo (2003), occurs most commonly in research. This is caused by choosing units in the sample that are not actually representative of the population (Mugo, 2003). A possible sampling error which could have occurred in the particular research would have been to choose music students from only one institution in Ireland. Another risk is that of non-sampling error, when the results are inaccurate due to poorly chosen tools or methods of collecting data. A possible non-sampling error which could have occurred in this research would have been to use survey and interview questions that were ambiguous or unclear in any way. It is hoped that the samples chosen for this research have provided an accurate representation of the issues in academic libraries in Ireland in relation to Music Information Retrieval. It was also considered that sampling is not the only area within which bias could occur.

3.10. Ethical Issues

In addition to the above, the risk of bias can also be mitigated through the application of ethics. Ethics are defined by Resnik (2007) as "...norms for conduct that distinguish between acceptable and unacceptable behaviour". A failure to apply ethics in research can lead to a skewing of the results. Objectivity is particularly important. As a researcher, this author has a personal stake in achieving an outcome to this research. However, it must be ensured that the data collection tools, the interview and survey questions, are not inherently biased towards a particular viewpoint or

result. Indeed, there may be no definitive answers to the research questions at all, so steering the sample towards one result or another is merely “self-deception” (Resnik, 2007).

Another potential issue was related to confidentiality or permission from the research subjects. Davison (2002) highlights the common problem whereby interview subjects are not explicitly informed of the full facts in relation to the research project. The music librarians and students were fully briefed on the goals of this research prior to answering any survey or interview questions, and their anonymity was guaranteed. Failure to do so could have potentially led to the research subjects withdrawing their input from the project.

3.11. Limitations to the Research

A number of possible limitations to this research were identified. The primary limitation related to the strict time frame within which this research could be conducted. As the data collection window was quite small, the data collected within the time could have been limited. A longer time frame would have produced more in depth findings. This will be discussed in greater detail in the chapter on future research.

Another limitation related to the population sample. As far as the author is aware, there is no educational institution in Ireland currently using content based Music Information Retrieval tools, nor is any literature available on Irish institutions using content based Music Information Retrieval. As the sample chosen comprised music librarians and students from Irish institutions, their knowledge and awareness of content based systems was quite limited. As a result, the findings may be less useful than if a sample was chosen from, say, an institution in the United States where content based systems appear to be well known. However, one of the main research questions seeks to find what the current issues are in relation to Music Information Retrieval in Irish academic libraries; therefore it was worth pursuing this research, even with this lack of awareness.

3.12. Chapter Summary

The aim of this chapter, as stated in the introduction was to discuss how the most appropriate methods of collecting data were chosen, and to justify their use in the context of answering the research questions. The methods were selected to form an overall research philosophy, which

aimed to answer the research questions of this dissertation. Although, as stated within this chapter, there is no right or wrong method to collect data, it is important that the methods chosen provide a framework within which the research questions can be explored and answered effectively. This has been achieved within this chapter. The following chapter will present the findings of the data collection.

CHAPTER FOUR: DATA ANALYSIS AND FINDINGS

4.1. Introduction

The purpose of this chapter is to identify and clearly present the findings which emerged from the data collected for this dissertation. The objective of this chapter is not to draw conclusions from the findings, but to simply discuss the main themes. The next chapter will discuss these themes in the context of the overall research questions. It is important to keep the research questions in mind when discussing the findings of the data. As stated in the previous chapter, the main research question is:

- What are the challenges and opportunities in Music Information Retrieval for academic music libraries in Ireland, from a librarian and user perspective?

And the sub question is:

- What are academic music library user and librarian perspectives on content based Music Information Retrieval systems, like Query by Humming?

The objectives behind these research questions are to determine the following:

- Do academic music libraries in Ireland hold rare or specialized musical recordings?

The literature has indicated that academic music libraries in other countries, particularly the United States, hold large collections of specialized audio musical materials. Is this also the case in Ireland?

- How are musical recordings accessed by users of the library (students)?

In order to answer the question as to whether a content based Music Information Retrieval system would be useful in an academic music library in Ireland, the ways in which these library users search for musical recordings must be examined.

- What issues are facing Irish academic libraries in relation to Music Information Retrieval, from the perspective of librarians?

The literature has shown that there are specific challenges relating to Music Information Retrieval, particularly in preserving and providing access to music recordings – do academic music libraries in Ireland encounter the same challenges?

- What is the level of awareness among academic music library users and librarians in Ireland of content based systems like Query by Humming?

There are no examples in the literature of an academic music library using a content based system such as Query by Humming. Additionally, there is nothing in the literature to indicate whether academic music library users and librarians are aware of these systems.

- What are academic music library users and librarian perspectives on content based systems such as query by Humming?

Some of the literature has indicated that content based systems such as Query by Humming could be used in an academic setting. This question will establish user and librarians perspectives on the topic.

In the first instance, this chapter will give an overview of the collected data, to provide a context within which the themes can be presented. This will be followed by a discussion of the main findings of the data in turn.

4.2. Overview of the collected data

Five music librarians from third level institutions in Ireland were interviewed. In addition, forty student survey responses were received, though 35 of those were fully completed. The majority of student survey responses were from Trinity College Dublin (77%), followed by Dublin Institute of Technology (10%), University College Dublin (7%), NUI Maynooth (2.5%) and University College Cork (2.5%). A graphical representation of the institutional breakdown is

shown in Figure 2 below. The data from the student survey was analysed using the analytical functions available from the Survey Monkey website. This was chosen because this website was used to collect the data, so it was already in a format which could be analysed. The data from librarian interviews was analysed without the use of software. Instead, the qualitative data analysis process described by Miles and Huberman (1994) was utilised. This process involves three stages: data reduction, data display and drawing and verification of conclusions. This process was chosen because the researcher felt that it would ensure no significant themes were missed from the qualitative data. As the interviews were conducted with five different people, it seemed risky to use an automatic software tool to pick up common words or phrases – considering that each respondent might use a different phrase to describe the same thing.

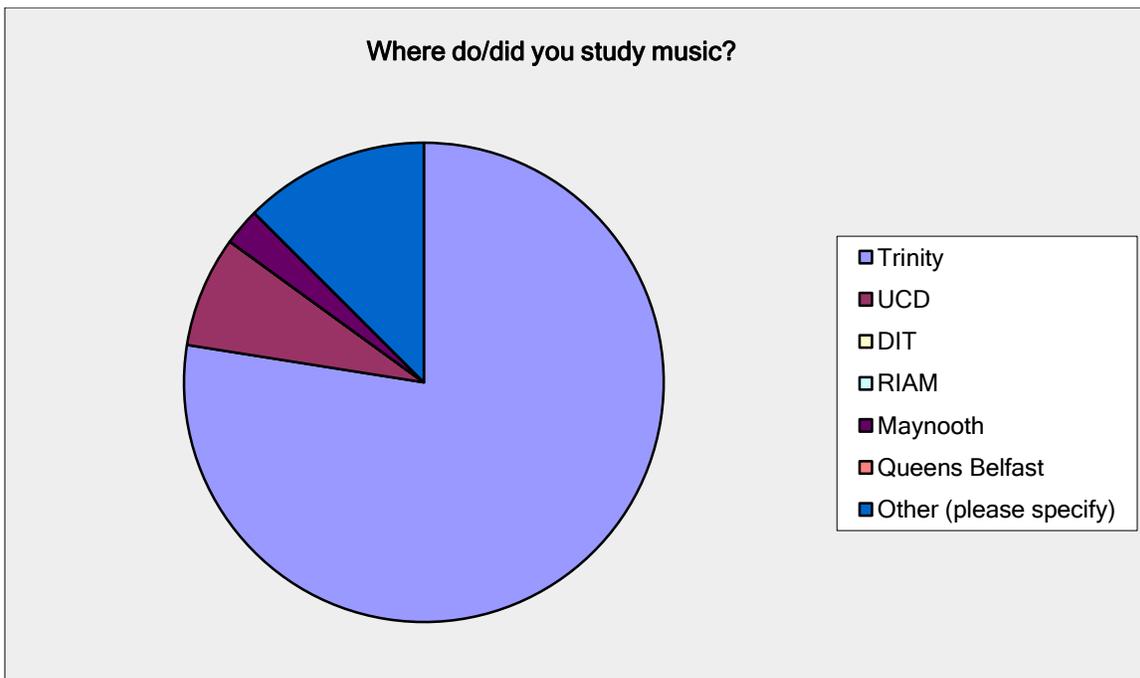


Figure 2: Breakdown of Institutions

4.3. Music collections in Irish academic libraries

It is appropriate at this stage to state that none of the academic music libraries involved in the interviews currently provide access to the contents of their music collection through a database, where the music can be listened to. As a result, none use content based systems like Query by Humming. Instead, all of the libraries provide music recordings in the form of CDs, cassette tapes, DVDs and records. However, four of the five libraries do subscribe to music libraries such

a Naxos Music Library. The size of the audio collection in each of the libraries involved in the interviews range in size from “quite small, mainly CDs” to “a large vinyl collection of about five thousand records”. The following sections will discuss the main themes to emerge from the data.

4.4. Themes arising from the interview and survey data

4.4.1. Specialised Music Recordings

Three out of the five librarians interviewed for this dissertation identified specialised or rare audio materials held in the library. These ranged from rare LP records, to church music recordings and “tapes with rare traveller songs”. Additionally, two of the libraries hold recordings of student works, on campus performances and master class performances.

4.4.2. Copyright Issues

The issues of copyright and licensing appeared multiple times throughout the interviews with librarians, particularly in relation to specialised or rare audio music materials. Two of the five music librarians interviewed discussed the problem of converting rare LP records held by the library into MP3 format in order to make their contents available in a database. Because of the uncertainty surrounding copyright law, they have not proceeded with this. Similarly, another music librarian referred to the practice of student’s musical works being made available on a database. Due to the strict copyright rules, these musical works cannot be accessed from outside the institution from which they were created. This same librarian discussed the possibility of students being allowed to listen to music within the classroom, which would add to their learning experience. Again, copyright issues prevent the institution from allowing students to do this. Another librarian spoke of the problems associated with having different arrangements of the same musical work. Although the composer of the work may be out of copyright, the individual responsible for the arrangement may not be.

4.4.3. Preservation and Access to Audio Materials

The librarians and students both raised the issue of preservation and access to musical recordings, though from very different perspectives. From the librarian perspective, a source of constant frustration is CDs, records or cassette tapes being damaged, stolen or lost. As a result, all of the librarians interviewed confirmed that borrowing of such materials is highly restricted.

From a student perspective, these restrictions are inconvenient and a barrier to learning. Seven of the forty respondents to the student survey answered the open ended question which asked for general comments on Music Information Retrieval in their academic library. Five of those seven respondents cited the problem of not being able to borrow music materials and the inconvenience of having to visit the library to listen to music materials as an issue affecting them. One of the music librarians stated that the library currently provides access to a number of subscribed music databases, and their hope is that with greater use, the issue of preserving CDs, DVDs, records and tapes will be resolved. Another librarian confirmed that, although the library currently does not provide access to subscribed music databases, they plan to do so in the future, thereby removing both the need to preserve physical audio materials (such as CDs) and the space required to listen to them. Additionally, another librarian commented on the fact that cataloguing music recordings will become less common with the increased usage of online streaming music databases. The interviews with librarians have identified issues relating to cataloguing of musical works, which will be discussed in the following section.

4.4.4. Cataloguing Musical Works

Three of the music librarians interviewed discussed the time consuming aspect of cataloguing musical works. One of those librarians referred to the fact that music recordings can be multi-lingual, and so a separate entry is required for each language. Similarly, the same librarian spoke about the challenge of having a CD with more than one artist; again a separate entry is required for each artist. Another librarian spoke of having a musical work with different arrangements – each arrangement must be catalogued separately. Finally, a third librarian spoke of the importance of ensuring that as much detail as possible for the musical work is contained in the catalogue entry, while at the same time, avoiding including too much information. However, all of these librarians stated that, while all of this can be time consuming, they do not consider them to be issues of major importance. Instead, they consider them to be part of the job. Unfortunately, the student survey did not contain a question relating to specific problems students may have in searching for music recordings within the library, so there is no student data to either contradict or strengthen the librarian perspective on this theme.

4.4.5. Searching for audio materials within the library catalogue

A theme to emerge in both the interviews with music librarians and the student surveys is the methods and motivation for students searching for musical recordings, and their level of satisfaction with the materials provided by the library. 72.5% of respondents use audio materials frequently in the course of their studies, followed by 17.5% who use audio materials sometimes. Of those, 100% search by specific artist, composer or title – as opposed to searching by genre or style. This is in line with the results from the librarian interviews, which revealed that the most common type of request from students according to all music librarians interviewed, concerns locating a specific piece of music, either in the physical library or from an online musical database. 72% of student respondents who frequently use audio materials in the course of their studies agreed with the statement that it is easy to search for audio recordings within the library, while 28% agreed with the statement that it is difficult to search for audio recordings within the library. This is illustrated in the Figure 3 below.

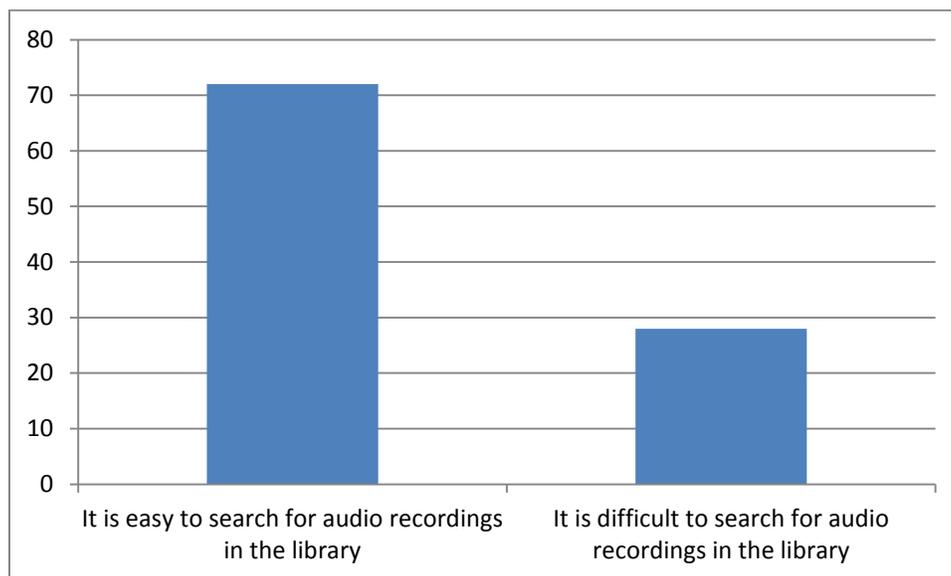


Figure 3: Breakdown of students who use audio

55% of student respondents who frequently use audio materials in the course of their studies use the audio materials for personal use, as opposed to 19%, who use them for assignments. One of the librarians noted that one of the most common difficulties students encounter when searching for music is in misspelling the composer name. Another librarian cited difficulties for students in

interpreting the search results provided by the library catalogue or database. This librarian specified that this difficulty comes from the large amount of detail required in cataloguing a musical work, which was discussed in an earlier section.

As stated earlier, none of the libraries involved in the interviews provide access to their own music recordings on a database, which can be listened to from outside the library. Instead, users search the library catalogue for materials such as CDs or DVDs which can then be retrieved in the physical library. 71.4% of total student respondents agreed that they would use the music materials from the library more frequently if it were available from outside the physical library. Although the libraries own music materials are not available outside the library, many do subscribe to musical databases. This will be discussed in greater detail in the following section.

4.4.6. Searching for audio materials within subscribed online databases

Four of the five music librarians interviewed confirmed that the library subscribes to a musical database such as Naxos Music Library. The benefit of using such resources, according to the librarians, is the fact that they can be accessed from outside the physical library space. Two of the librarians discussed the fact that many of their students are studying part time and live outside the immediate area, so being able to access music databases is essential to their studies. However, another librarian raised the concern that the type of searching allowed in such resources is very basic, for example, simple keyword searching. One of the librarians represented a library that does not subscribe to any online musical databases. The reasons for this were purely financial, and the library plans to subscribe to a musical database in the future.

4.4.7. Searching for audio materials using the internet

Another theme to emerge from the data is student use of websites, such as YouTube, for music recordings. 68% of all student respondents who use music recordings frequently in the course of their studies agreed with that statement that they prefer to use the internet when searching for recordings. In addition, the overall majority of students (73.5%) who responded to the survey agreed with this statement. Similarly, 94.3% of all student respondents use the internet when searching for music recordings. All of the music librarians interviewed for this dissertation were aware of this use and all stated that, rather than being a competitor to the library, the internet is

useful for the students. One librarian did mention that the use of the internet has had an impact on borrowings of the library, though no actual statistics were available to confirm this.

The main benefits of using websites such as YouTube was, according to the students, the availability of these resources at any time (32.4%), and the convenience of using them (29.4%). A lesser percentage of student respondents (17.6%) cited the wide range of choice as the main benefits of these resources. Similarly, the music librarians interviewed all agreed that the main benefit of internet websites is their availability at any time, they are not subject to opening hours, and that they can be used anywhere, for example on a laptop or mobile phone. The overall quality of the recordings on these websites was called into question by some of the librarians, and their concerns about students using these resources were discussed.

4.4.8. User Education

The use of websites such as YouTube raised concerns among three of the five librarians interviewed for this dissertation. This concerned the ability of students to distinguish quality resources from substandard ones, and also their ability to search effectively. According to one librarian "...we think in terms of students wasting time with inefficient searches, when they could do more effective advanced searches." Another librarian commented that websites like YouTube do not offer advanced searching and so students often have to wade through irrelevant results to find what they require. The standards of these resources were also called into question; according to one librarian "...the quality is not always great...".

Most of the librarians spoke about efforts the library has made in assisting students to develop information literacy skills for music research. One of the librarians discussed how the library provides research skills training embedded within the course. This librarian commented "...we have had some real success with this in the music department." Another librarian confirmed that the library provides sessions on how to search the internet effectively, though the participation of students is not very high. The theme of educating users on effective searching also led to a discussion on the role of the library and how it has changed with the emergence of websites where music recordings can be listened to. This will be discussed in the following section.

4.4.9. The changing role of the academic music library

The role of the library as an educator was discussed by all of the librarians throughout the interviews. “Users need guidance, it shouldn’t just be left up to them”, according to one of the librarians interviewed for this dissertation. Another stated “There is definitely a role for the library in guiding students on how to use web resources. I think any library worth its salt would do that.” Still another librarian commented on how libraries are no longer the keepers of resources; instead they show students how to use them.

This discussion also raised the issue of the reliance of libraries on subscribed musical databases, such as Naxos Music Library. One librarian raised concerns about the fact that the library is subject to the whims of the publishers of online music databases. “If they decided to pull subscriptions say throughout Western Europe, we would be left high and dry.” Similarly, the cost associated with subscriptions to these musical databases was a concern. As stated earlier, one of the libraries is not in a financial position to subscribe to any musical database. Another librarian commented that the library would have to drop an existing subscription if they wished to subscribe to a new music database. Still another librarian stated that some subscriptions to musical databases may have to be dropped due to financial pressure.

4.4.10. Lack of awareness of Query by Humming systems

Another strong theme to emerge from the data was the distinct lack of awareness amongst users of academic libraries in Ireland of content based Music Information Retrieval systems like Query by Humming. This was evident from both the interviews with librarians and the student surveys. Only two of the librarians interviewed were aware of the existence of such systems, and even then, this awareness was limited. The remaining librarians had not heard of them previously. Similarly, 71.4% of respondents to the student survey were not aware of these systems, and 88.6% had never used them. This is illustrated in the following charts.

Query by Humming (QBH) and Query by Playing (QBP) are software tools which allow you to sing, hum or play part of a melody and then search the musical database for similar sounding melodies. Have you ever used these tools?

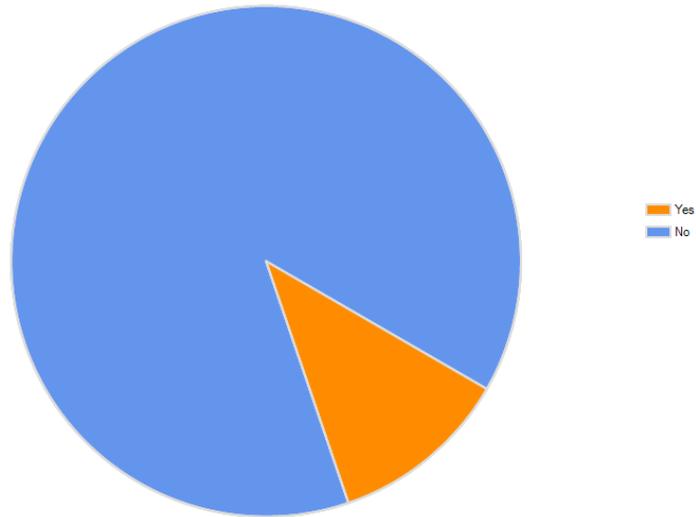


Figure 4: Awareness of QBH tools

Do you use these tools

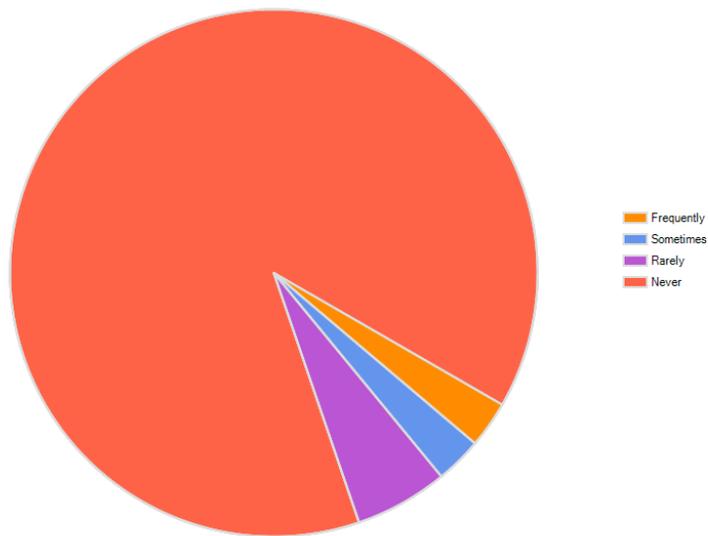


Figure 5: Usage of QBH tools

4.4.11. User perspectives on Query by Humming systems

The perspectives of students in relation to Query by Humming tools were quite negative. 66% percent of respondents who stated that they had *never* used the tools agreed with the statement that they are not very accurate for searching. This was an unexpected result, how could so many respondents have an opinion on the accuracy of a tool they had never used? Exactly half of those

same respondents stated that they would not use the library more frequently if they offered Query by Humming searching of the audio collection. None of respondents who use these tools frequently agreed with the statement that they are not very accurate for searching, though only 11.4% of the total respondents had used Query by Humming tools. In other words, all respondents who had used Query by Humming tools thought highly of them.

Similarly, the opinions of librarians on Query by Humming tools were quite negative. Three of the five librarians stated that Query by Humming would not be useful in an academic setting; rather they might be of use in a public library setting. According to one librarian "...students don't really look for something that's in their head...they mainly look for titles." Another librarian questioned "...why would they need this, wouldn't they already know the name of what they were studying?" Query by Humming tools are "... a solution looking for a problem..." according to one of the librarians. Another librarian discussed the fact that, although Query by Humming tools might be useful, it is already difficult to get students using existing resources, so it would be a luxury rather than a practicality. There were also some positive comments from comments in relation to these tools. It was suggested that they might be useful from a musicologist perspective, to analyse classical music. Another suggestion was that it may be used more specialist areas like traditional Irish music.

4.5. Chapter Summary

The quantitative and qualitative data collected for this dissertation was analysed, and the findings identified. Each of the themes identified in the analysis have been discussed in detail in this chapter. The themes were: the prevalence of specialised music recordings in Irish academic libraries, copyright issues, problems in cataloguing musical recordings, searching for recordings in the library catalogue, subscribed musical databases and the internet, the importance of user education in the library, the changing role of the library and a lack of awareness of Query By Humming systems. The discussion of the themes have created a setting in which the research questions can be answered. The significance of the findings in the context of the research questions and objectives will now be discussed in the following chapter.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND FUTURE RECOMMENDATIONS

5.1. Introduction

The major topics of the findings have been presented in the previous chapter. In this chapter, the findings will be discussed and analysed in the context of the literature review and the research questions posed. In the first instance, the research questions and objectives will again be presented. This will be followed by a discussion which will integrate the main findings of the research with the theories described in the literature review. It is intended to examine the concepts discussed in the literature review from the perspectives of academic music library librarians and users. This will enable conclusions to be drawn, and answers to the research questions to be offered. Finally, the overall contribution of this research to the field of Music Information Retrieval will be discussed, along with a recommendation for future research. It is hoped that the research findings contained in this dissertation will form a foundation upon which a future project can be carried out.

5.2. The Research Questions

It is appropriate once again to re-iterate the research questions for this dissertation. The main research question is:

- What are the challenges and opportunities in Music Information Retrieval for academic music libraries in Ireland, from a librarian and user perspective?

And the sub question is:

- What are academic music library user and librarian perspectives on content based Music Information Retrieval systems, like Query by Humming?

The objectives behind these research questions are to determine the following:

- Do academic music libraries in Ireland hold rare or specialized musical recordings?

The literature has indicated that academic music libraries in other countries, particularly the United States, hold large collections of specialized audio musical materials. Is this also the case in Ireland?

- How are musical recordings accessed by users of the library (students)?

In order to answer the question as to whether a content based Music Information Retrieval system would be useful in an academic music library in Ireland, the ways in which these library users search for musical recordings must be examined.

- What issues are facing Irish academic libraries in relation to Music Information Retrieval, from the perspective of librarians?

The literature has shown that there are specific challenges relating to Music Information Retrieval, particularly in preserving and providing access to music recordings – do academic music libraries in Ireland encounter the same challenges?

- What is the level of awareness among academic music library users and librarians in Ireland of content based systems like Query by Humming?

There are no examples in the literature of an academic music library using a content based system such as Query by Humming. Additionally, there is nothing in the literature to indicate whether academic music library users and librarians are aware of these systems.

- What are academic music library users and librarian perspectives on content based systems such as query by Humming?

Some of the literature has indicated that content based systems such as Query by Humming could be used in an academic setting. This question will establish user and librarians perspectives on the topic.

5.3. Do academic music libraries in Ireland hold rare or specialized musical recordings?

In the first instance, it is necessary to re-iterate the reasoning for posing this question. In much of the literature reviewed, academic music libraries are described as having a unique and important role in the field of musical study. This is because many academic music libraries, such as in the United States, have built up rare and specialised collections of music. However, because of a lack of available literature on Irish academic music libraries, it is difficult to determine whether these libraries also hold rare or specialised materials. Do Irish academic libraries offer audio musical materials that cannot be found elsewhere?

The findings from the interviews and surveys showed that Irish academic libraries do hold special or rare musical materials to some extent. As discussed in the previous chapter, these specialised materials range from large collections of LP records, some of which are rare, to cassette tapes containing rare songs. However, there appears to be very little focus on making these rare materials more accessible to the users of the library. In one library there is an on-going project to digitalise the LP record collection, but this is progressing very slowly. In the other libraries where rare or specialised materials are held, there are no plans make these recordings accessible from outside the library space, to be listened to on the library website for example. As discussed previously, making these specialised audio materials available in this way would go some way to ensuring the preservation of the source material. It would also make these materials more accessible to users and as a result, ensure that these materials are not consigned to a dusty corner of the physical library space. However, the practical reality is quite simply that there are not enough resources, monetary or personnel, to carry out such projects.

5.4. How are musical recordings accessed by users of the library?

Once again, it is important to re-iterate the motivation for asking this question. The literature has indicated that content based Music Information Retrieval systems like Query by Humming can be useful to academic music libraries. However, a content based system can only be used where the contents of the music is available i.e. the music itself can be listened to and queried, as opposed to where the library catalogue record of the material can be queried in the catalogue and the actual material such as a CD can be accessed in the physical library space. The interviews and surveys conducted for this dissertation have shown that academic music libraries in Ireland do not provide access to their content in a manner in which the music itself can be searched.

Academic libraries in Ireland provide access to audio music materials in two ways: the physical material (such as cassette or CD) can be searched for in the library catalogue and then either borrowed or listened to in the physical library space, or the audio material (recording) can be searched for and listened to on a subscribed music database. A content based system would not be appropriate in the first instance because of the format of the recording, nor in the second instance due to the limited searching functionality within the subscribed musical recording databases used by academic music libraries in Ireland.

Moreover, the data has shown that the way users of Irish academic music libraries search for audio materials is in contrast to much of the literature reviewed. As stated in the literature review, content based systems such as Query by Humming are useful when the individual does not know any of the metadata (for example, title or artist) associated with the music they are searching for. The data from the research carried out for this dissertation has indicated that in reality, this occurs very rarely in an academic music library setting. Instead, as confirmed in the data findings, academic music library users generally know something about the item they are seeking, such as title or composer name.

5.5. What issues are facing Irish academic music libraries in terms of music recordings, from the perspective of librarians?

A number of issues relating to musical recordings were identified in the literature review. These included the issues of cataloguing multiple manifestations of the same work, copyright issues and the challenge of meeting the needs of users. Additionally, the advantages and disadvantages of the two different approaches to Music Information Retrieval, content based and metadata based were examined. The purpose of this section is to discuss the findings of this dissertation in the context of the above points.

Overall, the findings show that, in contrast to the findings of the literature review, academic music librarians in Ireland are not overly concerned with issues such as multiple manifestations of the same musical work, or the best method of searching for music. As stated earlier, none of the libraries involved in the interviews provide content based searching of the music recordings in their collection, rather, the library catalogue is used for finding a record of the recording, and the actual recording is accessed within the physical library space. The findings show that the

librarians do not consider this to be a problem, and they were able to confirm with some certainty that students generally find what they are looking for in the library catalogue.

Instead, the findings show that librarians in academic music libraries are more concerned with the “bigger picture” of the role of academic music libraries, rather than the predictable day to day irritations. As stated in the previous chapter, the role of the academic music library is changing from a provider of materials to an enabler. This has led to some disquiet amongst academic music librarians in Ireland, where they recognise that resources are no longer under their control. Instead, access to music is being provided by large musical licensing companies. The opposite side of the argument is that academic music libraries no longer need to concern themselves with issues of copyright if they subscribe to licensed musical databases. Additionally, having subscribed audio databases instead of physical items such as CDs greatly reduces the risk of damage to materials. However, these subscriptions can be expensive and, as can be seen from the findings, at least one academic music library is at a major disadvantage because they do not have the funding to subscribe to such resources. Additionally, the enthusiasm for subscribed audio databases on the part of academic music librarians raises the risk that the library will focus their energies on the recordings available in these databases, and rare or specialised music belonging to the library itself will be forgotten, lost or ignored. Academic music libraries in Ireland today are performing a delicate balancing act in terms of funding and resources, and should proceed with greater caution when considering the subject of subscribed music databases.

The findings from the interviews also show that academic music librarians are chiefly concerned with providing for the needs of their users – regardless of whether the users are using the resources of the library. As discussed in the previous chapter, the emergence of music recordings on the Internet means that more and more materials are available to users. Rather than taking a “head in the sand” approach, academic music libraries in Ireland are putting time and effort into ensuring that their users are using these Internet resources more effectively. They are doing this by providing embedded and ad-hoc research skills classes. This is extremely positive and ensures that academic music libraries remain relevant, even if their own materials are not being utilised by students.

5.6. What issues are facing Irish academic libraries in terms of access to musical recordings, from the perspective of users?

Academic library users (students) are mainly concerned with access to audio materials. They want access twenty four hours a day, and seven days a week. This would explain the high usage of the internet when searching for musical recordings amongst academic music library users.

The main issues students encounter when using the library audio materials relate to restrictions on access and borrowings. This is in agreement with the literature which stated that academic music library users today expect to be able to access resources at any time and from any place. The findings indicate the users of academic music libraries in Ireland would use the library audio resource more frequently if they were available from outside the physical library space, for example, where music could actually be listened to on the library website.

Unfortunately, the student survey did not contain a question relating to the difficulties they encounter when searching for audio materials, so issues of multiple manifestations of the same work cannot be examined in the context of user perspectives. However, there was a space in the student survey to comment on Music Information Retrieval in general, and this was not raised by any of the respondents. This would lead to the conclusion that users are not concerned with the results or quality of audio searching, but instead with the convenience of searching. In this respect, the literature and data findings for this dissertation are in complete agreement.

5.7. What are the perspectives of librarians and users of academic libraries in Ireland, on content based Music Information Retrieval systems, such as Query by Humming?

As stated in the previous chapter, awareness of content based Music Information Retrieval systems amongst academic library users (students) and librarians was very low. Librarians who were aware of such systems were generally dismissive of their potential benefits in an academic library setting. However, of those users who were aware of these systems and had used them, the feedback was quite positive. Additionally, as stated in the previous chapter, academic library users who professed not to have heard of such system also stated that they were not very accurate for searching. This implies that, although the feedback was generally negative, it is not based on actual experience; rather it might be based on assumption. On the other hand, the librarians and users may be basing their opinions on their overall experience of using Music Information

Retrieval systems, and do not need to actually use a system to determine whether it would be of use. As stated previously, there is no evidence from either academic music librarians or users that users search for music recordings based on anything other than the name of the work or composer. The analysis of this topic is inconclusive. In order to reach a definitive conclusion, further research is required, in which a Query by Humming system is piloted in an academic library in Ireland. However, this can only be done where a content-based Music Information Retrieval system is already in place. The possibility of developing such a system in an academic music library in Ireland is discussed in the final section of this chapter.

5.8. The contribution of this research to Music Information Retrieval

The purpose of this dissertation is not simply to meet the requirements of the Masters programme, but to provide useful new research which builds upon previous work. It is hoped that this dissertation has achieved that goal, providing insights into academic music libraries in Ireland in the same way that other research has studied academic music libraries in the United States. Additionally, it is hoped that this research can itself be used for future studies in the field of Music Information Retrieval, particularly in relation to academic music libraries in Ireland, where the available literature is quite limited.

The findings of the research strongly indicate the following:

- Academic music libraries in Ireland do hold rare and specialised audio materials.
- These rare and specialised audio materials are only available to listen to within the physical library space.
- Academic music library users are strongly in favour of using the Internet and subscription audio databases, due to the ease of access and convenience of use.
- The usefulness or otherwise of content-based Music Information Retrieval systems like Query by Humming in an academic library context is not determined.

These findings are significant from the point of view of the researcher. Having read a lot of literature relating to Music Information Retrieval, one could be forgiven for assuming content-

based Music Information Retrieval systems are commonplace in all academic music libraries. However, the research has shown that this is not the case, and in some instance, academic music libraries hold only CDs and LP records in their audio collection. Additionally, some aspects of Music Information Retrieval that are defined as issues or problems in the literature review are not considered issues for the music librarians who deal with them every day. Other important topics such as the changing role of the library and the importance of educating users are given greater priority by academic music librarians.

The first three points set out above indicate that now may be an appropriate time to pilot a project in an academic music library in Ireland relating to content-based Music Information Retrieval systems. The purpose of the project would not be to conclude on the fourth point above, but at the same time it should go some way to answering the question as to whether content-based Music Information Retrieval systems like Query by Humming has a place in an academic setting.

5.9. Future Recommendations: A pilot content-based system

This project would involve making the rare or specialised music recordings belonging to the library available to search and listen to on the library website. As stated previously, none of the academic music libraries involved in the research for this dissertation provides access to their own music recordings from outside the library space. This proposed project would ensure that rare or specialised recordings belonging to the library would not only be available easily to the library users, but also that delicate materials would be preserved.

Phinney (2005) describes how a similar project was piloted at the University of North Carolina. Some of the findings from that project have already been discussed in the literature review section of this dissertation, so they will not be examined in great detail at this point. However, it is important to note that the music department of the university encoded the audio collection of the library in MP3 format, and made those files available to users via the library website (Phinney, 2005). A similar project is envisioned for an academic music library in Ireland, especially for audio materials considered rare or specialised. This project could, for example, be a continuation of the on-going project at one of the academic music libraries involved in the research for this dissertation. This library is attempting to digitize its collection of four to five

thousand LP records. An appropriate continuation of this could be to further encode the digital files into MP3 format and make them available to users via the library website.

Usage statistics would be required both at commencement of the project and following the implementation of the new system. These statistics should provide an insight into whether actual usage of the library audio collection increases when the collection is made available from outside the physical library space. Additionally, user feedback could be gathered, relating to the search habits of users and their preferences when interacting with content-based Music Information Retrieval systems. The findings from this project could contribute to the area of Music Information Retrieval in general. Additionally, plans could be made to build a content-based Music Information Retrieval system like Query by Humming on top of this system, which would contribute to the debate on whether these systems are appropriate for an academic setting.

The implementation of a project like the one described above would admittedly be quite difficult in the current economic climate. As discussed in previous sections, academic music libraries in Ireland are struggling to fund subscriptions to musical databases such as Naxos Music Library. As a result, it is not likely that funding would be available at present for this project. However, if it were possible, this project would provide some much needed research on Music Information Retrieval in academic music libraries in Ireland. Furthermore, it would allow academic music librarians and users an opportunity to experience content-based Music Information Retrieval systems such as Query by Humming, which is something they have been lacking up to now.

5.10. Chapter Summary

The aim of this chapter was to discuss the findings of the data in the context of the literature review, and to draw conclusions on their significance. The main themes of the findings were discussed and analysed, and conclusions were formed based on both the findings and the literature. Because some of the conclusions have led to further questions, a possible basis for further study has been described. The contribution of this research to the overall Music Information Retrieval field has been identified and discussed. The final chapter of this dissertation will analyse the effect this dissertation has had on the learning skills of the researcher.

CHAPTER SIX: SELF REFLECTION ON LEARNING AND PERFORMANCE

6.1. Introduction

The purpose of this chapter is to analyse and discuss the ways in which my own personal learning style has changed as a result of my experience in writing this dissertation. As I will be writing about my own personal learning experience, I will be using a first person narrative. I will initially identify my learning style prior to the dissertation experience. This will be identified through analysis of how I carried out assignments throughout this two year course. I will then discuss changes to my learning style using examples from my experience of writing this dissertation. I will illustrate how each of the changes occurred because of the differences between writing assignments and writing a dissertation. Finally, I will discuss and illustrate ways in which I can apply what I have learned to a work situation.

6.2. My existing learning style

In order to identify my existing learning style prior to the dissertation experience, I have examined some aspects of how I approached assignments throughout the two year course. Each of these aspects is discussed below.

6.2.1. Critically analysing secondary data

All assignments required a review of existing literature in order to become familiar with the topic. This is an aspect of learning that I particularly enjoy as I work best on my own. I also enjoy getting to know new topics and, in general, all of the topics covered throughout the course were very interesting.

Critically analysing secondary data for an assignment and drawing conclusions are my strong points. I feel that I have the ability to form an argument and back up that argument with examples and previous research. I try to use peer reviewed literature to argue a point wherever possible. Additionally, I try to avoid using dubious sources, and I question the motivation of the source before using it. I have a very cautious approach to this part of assignment writing.

In writing assignments, the topic was set by the lecturer, so keeping focused on the task at hand was not particularly difficult. There have been instances where my focus has lapsed, and I tended

to wander off topic. However, because the topic of the assignment was set by another person and not subject to change, it was usually a relatively straightforward task to get back on point.

6.2.2. Time Management

I usually write a number of drafts before submitting assignments. I am very cautious about putting forward a conclusion, and occasionally could spend a significant period of time refining one point. This did not get in the way of reaching assignment deadlines, but I would often find myself spending too much time on one paragraph, or indeed, one sentence. This is a weakness in my learning style, and I admit that I have often wasted hours on material that was not included in the final assignment.

6.2.3. Presenting the results

On a number of occasions, part of the assignment would be to present findings to the class. This is one area where my skills were definitely lacking. I am a naturally shy person and find it difficult to talk to a crowd. Additionally, my ability to improvise or answer unexpected questions was very limited. I attempted to get around this problem by including a lot of text in my presentations, but this had the disadvantage of making the presentation too cluttered in appearance.

6.2.4. My existing learning style prior to the dissertation

Based on the above discussion, I can identify my learning style prior to the dissertation experience as reflective. This is, according to Honey and Mumford (1992, cited in Mullins, 2007, p.192), a style in which the individual requires time to think about a topic before taking action. As can be seen in the previous section on time management, this is a style which can be attributed to me. An individual with a reflective style tends to postpone decision making, and is drawn to the section of the 'learning cycle' which relates to drawing conclusions (Honey and Mumford, 1992, cited in Rollinson, 2008, p.186). Additionally, I have an introverted personality where, according to Mullins (2007, p.192), I work best when I have time to think and formulate a plan before taking action or answering a question. This can be seen in the way I approach presentations.

6.3. Changes to my learning style during the dissertation

6.3.1. Analysing secondary data

The way in which I approached the literature for the dissertation was very different from the way in which I approached it for assignments. The difference was due to the fact that, for the dissertation, the literature was a means to an end. I had to ensure that the literature could be tied in with my findings in a coherent fashion. For an assignment, however, the literature was the end. I could base all of my arguments on the literature alone and not be concerned with the practical implications of analysing primary data in the context of the literature. This can be illustrated with the fact that my original literature review for this dissertation was written as part of a 'Research Methods' module over a year ago. That piece of work was vastly different to the completed literature review in the dissertation, despite the fact that it centered on the same topic of Music Information Retrieval. I was forced to amend large parts of the original literature review because it would not be practical to explore some of the topics in an actual dissertation where primary data would be required. In this way I became more practical or pragmatic in my style.

Another difficulty I experienced in analysing secondary data for this dissertation was the fact that, although I had developed the research questions early on, I tended to lose focus quite easily. I attribute this to the fact that, unlike an assignment where the topic is set by the lecturer, the research questions were set by me. I feel that on a subconscious level, I believed the research questions could change at any point, if I found an interesting secondary source. On a number of occasions, I spent time following up secondary data which had no real bearing on the research questions without realising it. This was a source of real frustration to me throughout the dissertation experience, but I was able to identify it as a problem and work on it. Once again, my learning changed to a more pragmatic style.

6.3.2. Gathering primary data

6.3.2.1. Contacting potential interviewees

Gathering and using primary data was a new experience, and one which made a definitive change to my existing style of learning. The main change was in my approach to people. As I

stated earlier, I am naturally a shy person and work best on my own. However, gathering primary research for a dissertation requires contacting potential interviewees and conducting interviews. The former was particularly difficult as I did not have existing contacts for music librarians in Ireland. In the first instance, I phoned academic libraries in institutions in Ireland where music is studied. I initially explained my research to the person answering the phone, which I quickly learned was not the most effective method. I was surprised by the less than enthusiastic response I received. In one memorable instance the individual I spoke to on the phone was extremely suspicious as to my real motives in calling, and, despite leaving my contact details, I did not hear from this intuition again. I deduced that a more effective means of gaining access was to ask to speak directly to the music librarian, and to refrain from going into too much detail about my research to the person answering the phone.

This stage of the dissertation also required a lot of persistence. It was necessary to contact the same institutions or librarians a number of times before finally reaching agreement on an interview. My natural instinct was not to bother people, but I was forced to overcome this in order to gather the primary data.

6.3.2.2. Conducting Interviews

Interviewees generally like to fill any silence, however short. As a result, interviewees often did not wait for a question from me – instead they spoke about things that interested them. Additionally, many of the interviewees wandered off topic when speaking, which resulted in irrelevant information being recorded in the interviews. To counter-act this, I learned to start each interview by explaining the purpose of my research and that I had a number of specific questions to ask. Similarly, I learned to interrupt when the interviewee wandered off on a tangent, and steered them back on topic with a question. As a result of my experiences with gathering primary data, my style became more extroverted.

6.3.2.4. Drawing conclusions from primary data

Analysing the primary data I had gathered for the dissertation was particularly difficult. Once again, this is due to the difference between writing an assignment and writing a dissertation. I had not analysed primary data for any assignment previously. Primary data must be analysed in a completely different way to secondary data, because interviewees and survey respondents tend

not to supply their ideas and opinions in a peer reviewed and coherent format. I had to learn to rely on not only what respondents said, but also how they said it, and pay attention to intonation and tone.

6.3.3. Time Management

As I stated earlier, I tended to concentrate all of my efforts fully on completing assignments over a number of weeks. This was not possible for the dissertation because of the much longer time period involved. It would not have been possible to sustain the same effort over a number of months, rather than weeks. As a result, I developed deadlines for each section of the dissertation and kept to them as much as possible. In this regard, I would say that my learning style changed more towards an activist who, according to Honey and Mumford (1992, cited in Rollinson, 2008, p.186) who focusses more on the experience itself, rather than a reflector, who prefers reviewing the experience.

One unexpected aspect of my personality which emerged from working with deadlines was impatience. I would not normally consider myself to be an impatient person, but found that on many occasions I would have to refrain from moving to the next section of the dissertation, even if I were still working on the previous section, simply to re-assure myself that progress was being made. I would again attribute this to my unfamiliarity with working on an academic piece over such a long period.

6.3.4. Summary of changes to my learning style

In summary, I can say with confidence that a number of changes to my learning style occurred while writing this dissertation. That is not to say that no changes to my learning style occurred over the two years of the course. I have focused on the dissertation period because it is fresh in my memory. My learning style evolved from being introverted and reflective style towards a more extroverted, activist style. I discovered unexpected things about myself and others, and had to adapt my style to meet situations as they arose. In conclusion, I feel that I have certainly improved as a student and can apply what I have learned in this process in a real world work situation.

6.4. Applying learning to a work situation

The main benefit of what I have learned throughout the dissertation experience is that I can be more extroverted when the appropriate situation arises. It is not always a negative thing to be outspoken, nor is it always a negative thing to be quiet. It depends on the situation and, having gone through this experience I feel better equipped to be outspoken when required.

Additionally, I feel better able to manage my time, which is an important skill to have in any workplace. I can set realistic targets for myself, and generally meet those targets. I can also adapt to deal with unexpected situations, without causing major delay to meeting the goals I have set for myself.

6.5. Chapter Summary

As stated in the introduction to this chapter, I have examined the ways in which my learning style changed over the course of writing this dissertation. Using actual examples of situations I experienced in both writing assignments and the dissertation, I analysed how those changes occurred and what they mean for me in both a personal and employment capacity.

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