Metadata for Phonograph Records: Facilitating New Forms of Use and Access

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Abstract

This dissertation presents a new metadata design, as part of a large digitization management system being developed, to assist in the consistent creation of digital libraries of phonograph records. The Metadata provides digital libraries with an effective tool for the description, discovery, management, control, delivery, and sharing of digital objects of phonograph record. The metadata design is the outcome of two pilot projects for the digitization of phonograph records that took place at the Marvin Duchow Music Library at McGill University. The new design offers an approach to maintaining and using digital sound and ensures the long-term viability of digital libraries of phonograph records.

The dissertation discusses key areas of preservation and addresses the most common retrieval problems of music in digital libraries. These problems include challenges in the digital context of bibliographic control, cataloging, distribution, and copyright protection. The dissertation revisits traditional cataloging approaches, summarizes historical music cataloging and metadata development, sets up preservation principles and rationales for digitizing phonograph records, and presents state-of-the-art techniques for preserving phonograph records in the digital domain.

The dissertation contains three main parts. The first is an introduction to the new metadata design for phonograph records. The second is a metadata dictionary, which assigns precise syntactic and semantic meanings to metadata elements, to guide digitizers working in libraries, archives, museums, and heritage sectors. These will be followed by two case studies of phonograph record digitization projects using the Metadata and the Data Dictionary. The dissertation concludes by examining three challenges that are critical to future development in both the preserving of and access to phonograph records: the issue of interoperability between different metadata standards, the need for usability and quality evaluation of digitization management systems, and the importance of further development in digital library retrieval services and tools.

Résumé

Cette thèse présente un nouveau modèle de métadonnées faisant partie du développement d'une large infrastructure pour la gestion de numérisation ayant pour but d'assister la création cohérente de librairies digitales de disques phonographiques. Les métadonnées fournissent aux librairies digitales une base efficace pour la description, la recherche, la gestion, le contrôle, la distribution et le partage d'objets numériques tirés de disques phonographiques. Le modèle de métadonnées est le résultat concret de deux projets pilotes de numérisation de disques phonographiques réalisés à la bibliothèque de musique Marvin Duchow de l'Université McGill. Le nouveau modèle offre une approche originale pour maintenir et exploiter le son numérisé et assurer aux bibliothèques digitales de disques phonographiques une viabilité à long terme.

La thèse présente les éléments clé de la préservation et aborde les problèmes de recherche les plus communs pour les bibliothèques de musique digitales. Ceux-ci incluent les enjeux dans un environnement numérique, du contrôle bibliographique, du catalogage, de la distribution et de la protection des droits d'auteur. Cette these revisite les approches traditionnelles de catalogage, résume l'histoire du catalogage musical et du développement des métadonnées, expose les principes et les raisons de la préservation de disques phonographiques, et présente les dernières technologies pour préserver les disques phonographiques dans le domaine numérique.

Cette thèse est constituée de trois parties principales: l'introduction du nouveau modèle de métadonnées pour les disques phonographiques; le dictionnaire de données des métadonnées associé, qui fournit une signification syntaxique et sémantique précise aux éléments de métadonnées pour guider les personnes en charge de la numérisation dans les bibiothèques, les archives, les musées et dans le secteur de l'héritage culturel; deux études de cas de projets de numérisation de disques phonographiques utilisant les Métadonnées et le Dictionnaire de Données. La thèse se termine par trois defies encore à relever et qui sont critiques pour le développement future aussi bien pour la préservation que pour l'accès aux disques phonographiques: les problèmes liés à l'interopérabilité entre les différents standards de métadonnées, le besoin d'application pratique et d'évaluation de la qualité des systèmes de gestion de numérisation, incluant les Métadonnées et le

Dictionnaire de Données, et l'importance de développer encore les services et les outils et recherche pour les bibliothèques numériques.

To my parents and brother.

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Table of Contents

Chapter 1 Introduction

This chapter provides an overview of the development of digital libraries and presents the rationale and research efforts involved in current digital preservation programs. The chapter also discusses emerging preservation issues in audio collections, particularly as they relate to the conversion of phonograph records, and identifies the pressing need for the development of tools. Especially needed is a new metadata design, to assist in the consistent creation and management of digital libraries of phonograph records. The chapter concludes with a roadmap for the remaining sections of the dissertation.

1.1 Evolution of Libraries and Digital Collections

Libraries, archives, and museums have historically been the cornerstones of research and scholarship. Their mission has always been forward-looking—to build collections, to preserve the vast historical and intellectual records of human experience, and to provide access to this recorded knowledge to current and future generations. The interaction of users with these institutions is presently evolving, with the expansion of the World Wide Web, the advent of modern, inexpensive computer technology, and advances in information management. This evolution includes the development of integrated library management systems, remote network access to information, and multimedia. Information and communications technologies have introduced new methods of scholarly communication, and significantly changed user expectations. Users now demand instant access to materials, especially via the Internet (Arms 2000; Dillon 2002; Institute of Museum and Library Services 2002; Tenopir et al. 2003; Xia 2003). As users embrace digital technology and become accustomed to searching for local and remote information resources online, cultural heritage institutions are finding themselves at a crossroads (Council on Library and Information Resources 2001; Creth 1996; Greenstein and Thorin 2002; Hawkins and Battin 1998; Kuny and Cleveland 1998; Lesk 1997).

In response to growing demand for direct information access, libraries, archives, and museums are rethinking and reinventing their roles in today's increasingly networked digital world. Many institutions are changing and updating their information services, extending and transforming the way they preserve and present human experience. A

current trend in library modernization, for example, is the creation of digital collections based on the library's own resources of rare books and special collections. Institutions that have been at the forefront of providing digital collections and services include: the Art Museum Image Consortium (comprised of more than 35 museums in the U.S., Canada, and U.K.), the British Library, the University of California at Berkeley, Cornell University, Harvard University, Indiana University, Library and Archives Canada, Library of Congress (LC), University of Maryland, and Stanford University. The digitization of cultural materials offers new ways to access rare and physically fragile primary sources, which are a major part of a society's collective memory. This ongoing effort to build digital collections from primary sources meets users' increasing demand for access to digital content. The growing availability of digital material also creates new challenges for the institutional mission of preservation, research, education, and cultural enrichment.

1.2 Emergence, Definition, and Issues of Digital Libraries

Despite the wide variety of digital collections in libraries, archives, and museums, the fundamental question of what constitutes a digital library (This idea has been identified by several names, including the electronic library, the virtual library, and the library without walls, and recently, the digital library) still inspires lively debate (Borgman 1999; Chowdhury 2002; Cleveland 1998; Fox et al. 1995; Harter 1996; Keller 1998; Lagoze et al. 2005; Levy 2000; Levy and Marshall 1995; Lyman 1998; Waters 1998). The origins of the digital library are attributed to three key early authors: Vannevar Bush, J.C.R. Licklider, and F.W. Lancaster. Bush's *memex,* an imaginative mechanical device that was capable of storing books, records, and communications, and could facilitate cross-references from one record to another with speed and flexibility (Bush 1945), is said to have inspired the subsequent development of hypertext. Twenty years after Bush proposed his theoretical proto-hypertext computer system, Licklider unveiled *Libraries of the Future,* his version of a fully computer-based library called the *Symbiont*—an advanced system that enabled users to perform data manipulation tasks such as searching, browsing documents, extracting, highlighting or annotating passages of text, and composing graphs from numerical data (Licklider 1965). Expanding

Licklider's thinking on fully electronic systems, Lancaster proposed the idea of a paperless society in *Toward Paperless Information Systems* (1978). These early information communication systems show the evolution of thought that led to the design of today's digital libraries.

Genuine interest in new forms of information management and retrieval in library information systems revived during the early 1990s, in response to advances in digital technology (Fox and Lunin 1993). Several organizations began to investigate and speculate about the future of libraries. This group included the National Science Foundation (NSF), American Association of University Presidents (AAUP), Research Libraries Group (RLG), Xerox Corporation, Coalition for Networked Information (CNI), Commission on Preservation and Access, as well as print publishers. These organizations gathered to form the next generation of libraries. They were keenly aware that enabling digital technologies had become available, making possible many components of the digital libraries, previously only imagined (Drabenstott 1994).

Depending on context, however, the concept of a digital library evokes different impressions and references. In 1993, Drabenstott conducted an analysis in the application of information technology to libraries, and compiled, from the literature, more than a dozen definitions that refer to "the library of the future." Various phrases were identified, including "digital library," "electronic library," "library without walls," and "bionic library" (Drabenstott 1994). Despite the differences in terminology, Drabenstott summarized the following commonalities in the definitions (Drabenstott 1994, 9):

- The digital library is not a single entity.
- The digital library requires technology to link the resources of many digital libraries and information services.
- The links between digital libraries and information services is transparent to end-users.
- The goal is universal access to digital libraries and information services.
- Digital library collections are not limited to document surrogates; they extend to digital artifacts that cannot be represented or distributed in printed formats.

The phrase "digital library" is a relatively recent term in the lexicon of the research community. It largely resulted from the Digital Libraries Initiatives (DLI)

funded by the NSF, the Defense Advanced Research Projects Agency (DARPA), and the National Aeronautics and Space Administration (NASA) in the United States, in 1994. These collaborating agencies granted 24.4 million dollars to promote the development of digital library research in six U.S. universities. Researchers in computer science, library science, and other disciplines, have adopted the term "digital library" and have used it widely (Fox and Lunin 1993; Harter 1996). As Fox and Sornil noted in their chapter in *Modern Information Retrieval*, the topic of digital libraries has been a major focus in many different areas of research: database management, human-computer interaction, information science, library science, multimedia information and systems, natural language processing, and networking and communications. Fox and Sornil also pointed out the many competing versions of the phrase used by the research community (Fox and Sornil 1999). From an information scientist's point of view, a digital library is a large database; however, from a librarian's point of view, a digital library is another step in the continuing automation of libraries that began in the early 1950s (Cleveland 1998). Borgman (1999) also discussed the diversity of digital libraries and clustered the definitions around two themes: digital libraries as content collected on behalf of user communities, and digital libraries as service institutions. The many dimensions of digital libraries have unquestionably generated definitions and connotations specific to different fields of research.

Outside the digital library community, the complexity of digital libraries has also led to confusion for users. Cleveland (1998) and Lagoze et al. (2005), for example, observed that many search engines such as Google and Yahoo have added to user's conceptions of a digital library. People consider the World Wide Web a digital library today because it contains a huge collection of documents and is capable of delivering information resources with convenience and efficiency. However, some leading scholars in the area of digital library research disagree (Griffith 1998; Levy and Marshall 1995; Lynch 1997). As Lynch asserted:

> The Internet—and particularly its collection of multimedia resources known as the World Wide Web—was not designed to support the organized publication and retrieval of information as libraries are. It has evolved into what might be thought of

> as a chaotic repository for the collective output of the world's digital "printing presses" (Lynch 1997, 52).

As Lynch emphasized, organization and the permanence of information resources are the distinctions that mark the difference between the World Wide Web and digital libraries. Since much confusion has surrounded the concept of a digital library, the need to share a common understanding of what constitutes a digital library is imperative, particularly among the associated libraries and allied organizations of the Digital Library Federation (DLF). In 1998, the partner institutions in the DLF crafted the following working definition:

> Digital libraries are organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities (Digital Library Federation 1998, http://www.diglib.org/about/dldefinition.htm).

This working definition, as proclaimed on the official DLF web site, suggests a set of attributes that gives coherence to the concept of digital libraries. However. the definition may be further redefined, as necessary, to address digital library issues in a larger context of service.

As researchers and other information professionals strive to comprehend and address the challenges in creating digital libraries, the issues relating to digital libraries only grow in complexity (Fox and Marchionini 1998). As a matter of fact, researchers, practicing librarians, and other information professionals continue to work toward a common understanding of what digital libraries are, in many workshops and conferences today.

For the purpose of this dissertation, the term "digital libraries" refers to more than digital collections of primary resources. It also refers to the systems that make digital collections accessible to library users. In other words, digital libraries are the electronic extension of the resources accessible in traditional libraries, archives, or museums and the functions they typically perform. This extension is beyond the reach of many of the Internet search engines. Rather, digital libraries support the collaborative creation of

digital resources and assist in the orderly maintenance and management of digital information stored in repositories. Digital libraries, moreover, ensure the preservation, dissemination, and copyright protection of cultural artifacts, and facilitate accessibility to digital information through Web-based services, which benefit the teaching, research, and cultural enrichment of the general public.

1.3 Digital Preservation Benefits

Growing numbers of cultural heritage institutions have initiated digital library programs that reflect their mission, leadership, funding, collections, and specific service strengths (Greenstein and Thorin 2002). Although various reasons have motivated their efforts at building digital collections, many have seen the potential of digital libraries as a means of preserving in digital form those scholarly materials that are unique and physically fragile. The ability of digitization to provide access to these rich but endangered intellectual resources helps ease the traditional conflict between preservation and access. Although traditional preservation and conservation methods have ensured the longevity of primary resources, safeguarding these unique research materials with restricted access in special and rare collections rooms has often been at the cost of reduced access (Conway 2000).

With digital technology, electronic files can provide extraordinary access to information. Digital content can be delivered directly to users without human intervention. Users do not have to travel to a library or present proof of their serious research interests in order to gain access to complex, fragile, or un-interpreted materials. Moreover, digital technology makes powerful teaching materials available to students who would not otherwise have access to them. Among the most valuable types of materials to digitize, from a classroom perspective, are those from the special collections of research institutions. These materials include rare books, manuscripts, photographs, musical scores, sound recordings, and moving images. Digitizing these primary source materials offers teachers at all levels new opportunities which will allow them to expose to their students the precious raw materials of history. Furthermore, the power of full-text searching and sophisticated cross-collection indexing gives users the opportunity to make new uses of traditional research sources. For example, digital surrogates can bring

together research materials stored at different host repositories, enabling users to compare and examine items from different locations side by side. In addition, easy access to reference surrogates, even though at a lower resolution, is a convenient feature for researchers who are developing efficient and effective research strategies. Through the use of thumbnail images, for instance, researchers can acquaint themselves with the source, and then decide whether or not consultation of the original material is necessary (Smith 1999).

As digital imaging and other technologies continue to improve, cultural heritage institutions have become increasingly committed to seek innovative approaches to the power of technology. National organizations such as the Institute of Museum and Library Services (IMLS) and the Association of Research Libraries (ARL) have recently endorsed digitization as an accepted preservation reformatting option for a range of materials. Moreover, they have helped create and share standards and best practices for the use of technology and digitization in libraries and museums. In its featured report published in January 2006, the IMLS appropriately expressed the needs of technology and digitization developments in libraries, museums and archives (Institute of Museum and Library Services 2006, 1):

> Digital technology enables the full range of holdings in our museums, libraries, and archives—audio, video, print, photographs, artworks, artifacts, and other resources—to be cataloged, organized, combined, and made accessible to audiences in new ways. It provides the public with new pathways to access museum and library collections and bring them "face-to-face" electronically with librarians, curators, scientists, artists, and scholars. By using technology, rich scientific, historical, aesthetic, and cultural resources can be presented with contextual information that enhances educational value.

The use of technology, particularly digital technology, has had a profound impact on the effective and creative use of collecting, preserving, and making information accessible. Although many challenges remain, "many of the building blocks for a coordinated effort to develop and present useful cultural and scientific heritage collections in digital form are in place" (Spinazzé et al. 2004, 5). Collaboratively, these technologies can be readily

integrated to establish new policies, standards, and methods for digital preservation (Jantz and Giarlo 2005).

1.4 Building Digital Libraries of Phonograph Records

While digital imaging has dominated the preservation discourse in worldwide digital library programs, custodians of audio collections still face challenges in conserving and preserving sound recordings in older formats (Institute of Museum and Library Services 2006; Reed-Scott 1999; Smith 1999; Smith et al. 2004; Spinazzé et al. 2004). The two major formats that in which sound recordings were commercially available throughout most of the twentieth century were the 78-rpm and the Long Playing (LP) record. To ensure that these recordings of historical, cultural, and aesthetic importance are available to researchers in the future, equipment such as turntables must be maintained for playback. Many of these phonograph records, however, are deteriorating and must be reformatted while they are still playable.

The preservation needs of historical and rare audio collections of phonograph records have recently been acknowledged at the highest levels of government in the U.S. and Canada. In the U.S., for example, Congress passed the National Recording Preservation Act of 2000 and created the National Recording Preservation Board (NRPB), which consisted of the nation's leading audio engineers, to advise the LC on audio preservation issues. The NRPB's responsibility is to conduct a comprehensive national recording preservation study and to report to the LC important issues that pertain to the preservation of and access to protected sound recordings. Pressing issues on the NRPB's agenda include the current state of archiving, preservation, and restoration activities; the establishment of clear standards for reformatting old sound recordings; and the current laws and restrictions regarding the preservation and use of sound recordings, including recommendations for changes which will allow digital access and preservation.

In addition to the emerging efforts at audio preservation at the LC (Cohen 2001), awareness of the cultural importance of sound recordings has also increased in academic libraries. At a conference co-sponsored by the University of Michigan University Library and the ARL entitled "Redefining Preservation, Shaping New Solutions, Forging New Partnerships" in 2002, the topic of audiovisual preservation was placed on the list of the

most pressing issues for the preservation community (Matz 2004). In response to the priorities set forth during the conference, the Council on Library and Information Resources (CLIR), subsequently conducted a survey of the state of recorded sound in academic libraries, with an emphasis on rare or unique audio collections. The survey showed that collections of recorded sound in campus libraries are rich and diverse, but several barriers have prevented some institutions from improving the condition and accessibility of these audio holdings. In the conclusion of its report, the authors highlighted important areas in need of immediate attention. These areas include the design of appropriate standards to describe and provide access to audio as well as the development of tools to automate key steps in the preservation process that are currently performed manually (Smith et al. 2004).

Other events have taken place to move the field of audio preservation forward. At a two-and-a-half day program entitled "Sound Savings: Preserving Audio Collections" in 2003, sponsored by the LC, the NRPB, the ARL, and the School of Information's Preservation and Conservation Studies at the University of Texas at Austin, an esteemed group of curators, educators, scholars, and practitioners in the area of audio preservation worked together to define agenda and strategies to meet the challenges of preserving recorded sound (Matz 2004). In November and December 2006, the LC and the NRPB held public hearings in Los Angeles and New York to hear testimony and comments that would help them in drafting a national plan for the preservation of and access to recorded sound. Among the major issues discussed were quality assurance standards, rights management and practice, development of metadata, and creative solutions that might overcome obstacles to preservation (Library of Congress 2006a).

Rigorous efforts at audio preservation have also been undertaken in Canada. The Music Division of Library and Archives Canada has initiated a large digitization program for preservation of sound recordings and developed a multimedia website, the *Virtual Gramophone*, devoted to the historical sound recordings of Canada (Library and Archives Canada 2005). The Audio-Visual Preservation Trust of Canada, in addition, has dedicated to promoting and facilitating access to and usage of regional and national collections through collaborations with members of the audio-visual community (Audio-Visual Preservation Trust of Canada).

The endangered state of the world's audio heritage and the growing acceptance that audio materials form an essential component of the collective memory confirm the need for active preservation in the digital domain (Pymm 2006). The old paradigm of preserving for stable audio carriers and formats is inadequate because the "successful future preservation of sound demands that the content be the target and not the carrier" (Schüller 2004, 125).

In light of this situation, many cultural heritage institutions have initiated digitization programs to build digital libraries of phonograph records. A number of factors have inspired this enormous undertaking. First and foremost, 78s and LPs are at risk because phonograph discs are fragile their physical composition always deteriorates during playback. Secondly, many rare and culturally significant recordings are being discarded because the appropriate playback equipment is becoming scarce and cumbersome to maintain. Thirdly, although traditional preservation methods in libraries and archive communities have ensured the longevity of these endangered materials, storing and protecting phonograph records against risks of damage or misuse in archival custody has reduced access. Also, in many countries including Canada, recordings of classical music released before 1956 are now in the public domain, in accordance with the terms of copyright (see Section 3.4.3). Digitizing these recordings and their album covers or any accompanying, and making them freely available on the Internet, is valuable for musicological research and music education and provides a source of enjoyment for the general public.

1.5 Digital Libraries of Phonograph Records: Managing through Metadata

Cultural institutions have come to support digitization as a viable preservation strategy for phonograph records because digitization preserves their cultural value and provides wider access to them. Digital objects derived from phonograph records include not only collections of sound files, but also digital images of album covers, record labels, and any accompanying material such as liner notes. Due to the complexity of digitized representations of phonograph records, building digital libraries of phonograph records requires different and considerably more extensive metadata than that typically used for

managing collections of physical materials. Metadata for describing digital libraries of phonograph records encompasses not only traditional cataloging information (e.g., bibliographic information such as composer name, work title, publisher, publication year, and shelving location) but also additional information that is necessary to construct, preserve, and control access to the presentation of phonograph record online. New types of structural metadata that tie the parts of a compound resource together are vital to grouping the audio, image, and text files that comprise the digital version of a phonograph record. Structural metadata supports many functions such as browsing (e.g., viewing the different components that make up a record album) and navigation (e.g., turning the pages of a liner note). Other types of metadata are also useful. Technical metadata, for example, refers to the digitization process (e.g., hardware used for digital transfer). This technical metadata informs scholars and audiophiles how accurate a reflection of the original the digital version provides.

To enhance readers' understanding of the purpose and importance of a new metadata design to assist in the consistent creation of digital libraries of phonograph records, the next chapter (chapter 2) focuses on a brief historical account of events leading up to the current metadata systems, and explains the importance of metadata to digitization projects and digital library retrieval services. Chapters 3 and 4 discuss the challenges in developing digital collections of phonograph records, including issues of data acquisition and rights management. They also address the current limitations on search and retrieval of music information about phonograph record online. Chapter 5 introduces a new metadata design for phonograph records and explains in detail the development process, including the underlying data model and a metadata dictionary. This dictionary provides precise semantic meanings and content designation and formatting principles of metadata elements. Following the introduction of the Metadata, chapter 6 presents two case studies of digitization projects that used the Metadata to develop and optimize the search and retrieval of phonograph records, thus enabling search features currently unavailable in online catalogs. The last section, chapter 7, reinforces the importance of creating and maintaining a comprehensive metadata for phonograph records and concludes with some remaining challenges and future research possibilities in music information retrieval.

Chapter 2 Historical Background of Metadata Creation

This chapter introduces the concept of metadata before the term was coined and explains the development of metadata in the context of the history of cataloging. The chapter then provides a brief historical account of events leading up to current metadata efforts, including a discussion of the definitions and use of metadata. To further illustrate the concept, the chapter concludes with examples of metadata standards created for managing and documenting library collections, and explains the necessity of metadata to digitization projects and digital library retrieval services.

2.1 Library Catalogs

The concepts and techniques of metadata creation have been around since the first library catalog was created more than 2000 years ago. The first appearance of the term *metadata* dates back to the 1960s (Vellucci 1998) and became established in the context of database management systems in the 1970s. The first national cataloging code, arranged by author entry, was the French code of 1791, which used catalog cards and rules of accessioning and guiding (Hayes 2004). Various cataloging rules were developed and published in different countries. Sir Anthony Panizzi's cataloging rules, which are considered "modern" because they attempt to solve many of the same problems that librarians still face today (Taylor 2004), were developed for the British Museum Library in 1841 (Hayes 2004). Charles A. Cutter's *Rules of a Dictionary Catalog*, which introduced alphabetical filing rules using author, title, and subject entries (Taylor 2004), was published in the U.S. in 1876. Around the turn of the 20th century the library associations in Britain and the U.S. made separate efforts to develop cataloging rules. In 1904, the American Library Association and the Library Association in the U.K. decided to cooperate and produced an international cataloging code which was published in two separate editions in 1908 (Hayes 2004).

At the International Conference on Cataloging Principles in Paris in 1961, participants drafted twelve "Paris Principles" to make a common basis for the assignment

and form of access points (i.e., attributes under which a bibliographic record may be searched and identified, such as the subject heading). The American and the British library associations cooperated again to work on a new set of cataloging rules. Based on the "Paris Principles," two different versions (due to disagreements on a few points) of the first edition of the *Anglo-American Cataloguing Rules* (*AACR*) were published in 1967 (Spalding 1967). As a means for the international exchange and sharing of bibliographic information from different sources, the International Federation of Library Associations (IFLA) issued the *International Standard Bibliographic Description* (*ISBD*) in 1974 (International Federation of Library Associations). The primary objective of the *ISBD* was to overcome language barriers and to facilitate the interpretation and conversion of records from different countries (Taylor 2004). The second edition of the *AACR*, the *AACR2*, published in 1978, incorporated the *ISBD* and brought cataloging of non-book materials into the mainstream (Gorman and Winkler 1988). Libraries worldwide have gradually come to adopt and use the interpretation of *AACR2* for the cataloging of bibliographic records. The adoption of a common standard has since allowed an authoritative control of library catalogs and facilitated transparency in the exchange and sharing of catalog records (Taylor 2004).

2.2 Electronic Catalogs

By the late 1950s, computer technology had begun to come into use. The idea of applying computer-based solutions to the difficult problems that libraries were experiencing became possible (Rayward 2002). The computerization of library documentation began when computer-based systems first appeared in engineering libraries in the 1950s (Kilgour 1970). During the 1960s, special information units and libraries in both North America and the UK experimented with computerized systems to produce machine-readable catalog cards that could be machine sorted and printed (Tedd 1993). In 1961, using technology developed by L. R. Bunnow (Bunnow 1960), the Douglas Aircraft Company became the first to produce catalog cards by computer (Koriagin 1962). The cards were alphabetized in packs for individual catalogs. In addition to the production of catalog cards, accession lists from the same machine-readable data were also generated (Kilgour 1970). The next development in catalog cards

occurred at the Air Force Cambridge Research Laboratory Library, in 1963, where a special device called a Crossfiler printed catalog card images on paper tape (Fasana 1963). Other libraries such as Yale (Kilgour 1966) and the New England Library Information Network (Nugent 1968) also developed special-use applications to bring catalog card production into operation. Libraries began to recognize the possibility of improving efficiency by the automation of library functions and continued to develop various local solutions. For the processing of their bibliographic records, the LC, with the assistance of the CLIR, took the initiative in standardizing the format. Their efforts encouraged the development of networks for the exchange of cataloging information in machine-readable form. The fundamental tool that standardized cataloging data format and thus enabled the exchanges of catalogs in computer-based systems was the Machine-Readable Cataloging (MARC) format developed by the LC, in 1967–1968, under the leadership of Henriette Avram (McCallum 2002). The availability of MARC records has benefited library patron by allowing them wider access to searchable catalogs and it still forms the basis of the MARC 21 formats used today by thousands of libraries worldwide. The implementations of *AACR2* and MARC have made universal bibliographic control and interoperability between different systems possible. Interchange of bibliographic information online has since become available globally (Taylor 2004).

To support the sharing of bibliographic data through a central database, bibliographic record supply networks emerged in the 1970s. The major bibliographic networks, several of which continue to exist today, are the Online Computer Library Center (OCLC) and the Research Libraries Information Network (RLIN). Cooperatively built databases such as the OCLC and the RLIN provide favorable economies of scale.

The Ohio College Library Center (OCLC) was formerly set up to share the MARC database and reduce rising library costs in 54 academic libraries in the state of Ohio. During the 1970s, OCLC's service became available to libraries in other states. The OCLC thereafter became known as the Online Computer Library Center (in 1981) and was used by more than 3000 academic, public, and special libraries during the 1980s. This non-profit membership organization, with its headquarters in Dublin, Ohio, has expanded and opened offices in Europe and the Middle East (Tedd 1993). As of 2007, the OCLC has provided services to more than 41,000 libraries in 112 countries and

territories. The OCLC and its member libraries around the world have created and maintained WorldCat (the largest online public access catalog in the world which includes holding records from most public and private libraries worldwide). The OCLC's bibliographic database is accessible via subscription to OCLC's FirstSearch reference service, and it assists users in locating, acquiring, cataloging, lending, and preserving library materials. WorldCat currently contains more than 1.1 billions holdings in its catalogs. The database continues to grow as new records are continuously being added, on an average of one every 10 seconds (OCLC 2007).

RLIN, similarly, was initially set up by four large North American research libraries, namely Columbia University, Harvard University, New York Public Library, and Yale University, which formed the Research Libraries Group (RLG), to cooperatively develop and share access to collections, preserve research materials, create bibliographic tools, and reduce information costs. In 1978, the RLG decided to make its services available to other university and research institutions. The RLG then expanded and is now comprised of nearly 150 research libraries, archives, museums, and other cultural institutions. The online RLIN databases contain a wide range of information and resources covering books, journals, visual materials, maps, sound recordings, and more (Tedd 1993). On July 1, 2006, RLG merged with OCLC to combine products and services to further expand access to information online. Their strategy aims to give libraries, archives, and museums new leverage in collectively creating, sharing, and developing services, standards and software that will support research and the dissemination of knowledge (RLIN 2006).

Large-scale bibliographic databases such as OCLC and RLIN continue to grow, and the means of disseminating information proliferates via bibliographic networks. The requirement to respond more effectively to user expectations and needs in search and retrieval of bibliographic records has been acknowledged by the library community. A recent development in response to this changing bibliographic environment is the Functional Requirements for Bibliographic Records (FRBR), a data model developed by the IFLA. Unlike the single flat record concept underlying current cataloging standards, FRBR has introduced an entity-relationship model that reflects the conceptual structure of information resources that users follow when consulting bibliographic records. The

entities in the FRBR model are classed in three groups. The first group comprises four levels of representation: work, expression, manifestation, and item, where a work is realized through an expression, an expression is embodied in a manifestation, and a manifestation is exemplified by an item. The second group contains the entities responsible for the intellectual creation, physical production and dissemination, and the custodianship of the entities in the first group: person and corporate body. The third group includes the entities that are subjects of works: concepts, objects, events, and places (IFLA Study Group on the Functional Requirements for Bibliographic Records, and International Federation Library Associations and Institutions 1998).

2.3 Metadata Initiatives

With the advent of modern, inexpensive computer equipment and the improvements in network technology, the World Wide Web has gained popularity. It gives users access to a vast array of documents and information at speeds that were previously unavailable. As the volume of information on the World Wide Web increases, there is an increased concern about the ability to ensure that digital documents will continue to be retrievable and accessible.

In response to the tremendous growth of the Internet and concerns over the continuing accessibility of materials online, the idea of cataloging the resources on the World Wide Web bourgeoned in the mid-1990s. The quest to bring order and control to electronic documents and resources on the Internet became known as the Dublin Core Metadata Initiative (DCMI). The DCMI provides a minimum set of 15 metadata elements as a standardized set of conventions for describing the content, context, and structure of information objects. The Dublin Core Metadata Element Set (DCMES) consists of the following elements: title, creator, subject, description, publisher, contributor, date, type format, identifier, source, language, relation, coverage, and rights. Search engines such as Google provide full textual search of materials, but they use algorithms based on text-matching techniques, and frequently return search results of enormous size, in random order, lacking both precision and recall. Annotation of electronic documents using metadata allows users to locate, evaluate, retrieve and use online information resources in a controlled context, which ensures a higher degree of precision and recall for the search

results. Furthermore, the DCMES has many other use and functions, such as administration and management of resources, preservation management of digital resources, and record of intellectual property rights. It can also carry out the annotation and data analysis of materials that are otherwise difficult, if not impossible, to interpret using only content analysis of textual information. As the DCMI promotes the widespread use and application of its element set across different disciplines, other domain-specific metadata sets, or metadata schemas, have been developed to fulfill particular organizational needs in managing, describing, and preserving information resources. Divergent metadata standards, such as the Government Information Location Service (GILS) and the Publishing Requirements for Industry Standards (PRISM), therefore, have emerged to address the specific needs of the professional community (Caplan 2003; Duval et al. 2002; Hillmann and Westbrooks 2004).

2.3.1 Definitions of Metadata

Metadata standards abound, and the acceptance and use of metadata standards are diverse. Various definitions have been created under the umbrella term "metadata." To analyze and develop prospective resource description models for accessing metadata is the goal of the Task Force on Metadata. This Task Force is a special committee made up of university librarians and other information technology professionals and was formed by the American Library Association in the summer of 1998. It compiled more than 25 different definitions of the term "metadata" in the appendix section of its final report. The most widespread definition is the succinct phrase: "metadata is data about data" or "metadata is structured data about data." Other more sophisticated definitions of metadata include "a tool to accomplish various processes," and "a cloud of collateral information around a data object," which Lynch used to address the challenges of building digital libraries during his keynote speech to the Institute on Metadata (cosponsored by the Association for Library Collections and Technical Services and the Library and Information Technology Association, in Washington, D.C., in 1998). The formal working definition of the term "metadata" used by the Task Force is "metadata are structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment, and management of the described entities"

(ALCTS, Committee on Cataloging: Description and Access, Task Force on Metadata 2000).

Other important phrases often heard in a discussion of metadata are "metadata element," "metadata element instance," "metadata schema," and "metadata schema instance." The first phrase, *metadata element*, represents a specific concept that characterizes data, such as "Date," whereas the second term, *metadata element instance*, is a specific example of that concept, such as "2006-11-23." The third term, *metadata schema*, refers to a set of unique data elements used to describe information resources, and the fourth term, *metadata schema instance*, is a specific example of this concept, for example, the Dublin Core (Intner et al. 2006). The phrase metadata schema, like the term "metadata," also has many definitions. The definition by Murtha Baca in her *Introduction to Metadata*, edited for the Getty Research Institute, defines metadata schema as "a set of rules for encoding information that supports specific communities of users" (Baca 1998).

2.3.2 Categories of Metadata

Depending on the function and use of metadata and in accordance with the particular needs of organizations in the professional community, different ways of arranging metadata into categories are possible. In the literature, metadata has usually been divided into three to five categories. The taxonomy designed by Tennant (1998), for example, divides metadata into three categories, namely descriptive metadata, structural metadata, and administrative metadata (Tannant 1998, 30):

- Descriptive metadata includes the creator of the resource, its title, and appropriate subject headings—basically the kinds of elements that will be used to search for and locate the item.
- Structural metadata describes how an item is structured. In a book, pages follow one another. But in a digital book, if each page is scanned as an image, metadata must "bind" hundreds of separate computer files together into a logical whole and provide ways to navigate the digital "book."
- Administrative metadata may include such things as how the digital file was produced and its ownership.

Other classifications of metadata have also been developed, such as the categories proposed by de Carvalho Moura et al. (1998) and Gilliland-Swetland (1998). Based on a functional classification of metadata elements, de Carvalho Moura et al. suggested a taxonomy based of metadata component types: metadata for resource discovery, metadata for resource availability, metadata for resource usage, and metadata for administration and control. The four categories are further divided into subcategories. For example, the metadata for resource administration and control include (de Carvalho Moura et al. 1998, 12):

- Metadata for resource modification control (e.g., modification date, review date)
- Metadata for resource administration (e.g., creation date, resource administrators)
- Metadata for resource use history (e.g., copy, edition, removal)
- Metadata for metadata administration (e.g., language, standard version)

Gilliland-Swetland's taxonomy, similar to that of de Carvalho Moura et al., also considers the aspect of functional use in her classification of metadata. She categorizes metadata into five distinct categories: administrative, descriptive, preservation, use, and technical metadata (Gilliland-Swetland 1998, 8):

- Administrative metadata are metadata used in managing and administering information resources
- Descriptive metadata are metadata used to describe or identify information resources
- Preservation metadata are metadata related to the preservation management of information resources
- Technical metadata are metadata related to how a system functions or metadata behaves
- Use metadata are metadata related to the level and types of use of information resources

For a more in-depth study of the various forms of metadata categories, an extensive overview is available in Intner et al. (2006).

2.4 Library-based Metadata Standards

Although metadata issues concerning the description of and access to information are not difficult to understand, the practical implementation of guidelines to coordinate the creation of metadata in a production environment can be complex. The library community has led the way in standardizing the data formats and standards for description and access that make the electronic bibliographic records of library catalogs interoperable. These standards can be divided into two types: content standards and encoding standards.

2.4.1 Content Standards

Content standards are guidelines that prescribe the semantics associated with the description of an information object, for example, how the date of publication should be formatted. The ultimate goal of content rules is to standardize the data that describes information objects, in order to facilitate retrieval (Intner et al. 2006). The library and archives communities have produced many content rules. Some of the most widely used library-based content rules include *AACR2*, *Dewey Decimal Classification (DDC)*, *Library of Congress Classification (LCC)*, and *Library of Congress Subject headings (LCSH)*.

2.4.1.1 Descriptive Content: AACR2

When creating metadata values, or metadata element instances, consistency is important to ensure the retrieval of information in a predictable manner. As explained above (Section 2.1), *AACR2* is an internationally recognized metadata standard for descriptive cataloging that provides rules for describing the content of library materials such as books, serials, electronic resources, maps, films, sound recordings, and more.

Radical changes in the cataloging environment have led up to a number of revisions of *AACR2*, including revisions in 2002, 2003, and 2004, and an update in 2005. The expansion of the World Wide Web and the proliferation of information media have given rise to new formats that are no longer clearly defined in *AACR2*. The Joint Steering Committee for Revision of *AACR* is currently working on the next edition of *AACR*:

AACR3. The new edition, which is also known as *RDA: Resource Description and Access*, will be published in 2007 (Paskin 2006).

2.4.1.2 Subject Content: LCSH, LCC, and DCC

Subject cataloging involves the assignment of a number from a classification system, or a subject heading from a controlled vocabulary, to information resources. Classification systems and control vocabularies provide consistency and accuracy with the goal of improving retrieval results. A large number of controlled vocabularies and classification systems exist, both general and specific to individual subjects. A few that dominate globally are the *LCSH* for the assignment of subject headings from a controlled vocabulary (Chan 1995), and the *LCC* and *DCC* for the assignment of a number from a classification system (Chan 1999; Scott 2005).

2.4.2 Encoding Standards

New metadata encoding standards have emerged in the early 1990s because the growing role of network access to library holdings led to a need to include information beyond that which was provided by traditional MARC records. A few encoding standards have been developed to provide better descriptive tools, retrieval possibilities, and management capabilities for specific types of cultural materials. Some of the most well-known metadata encoding standards include the Encoded Archival Description (EAD): developed as a search aid for inventories, registers, indexes, and other documents created by libraries; the Metadata Object Description Standard (MODS): a descriptive metadata standard that is a derivative of MARC 21, i.e., the current version of the MARC family of formats used today, and is expressed using the XML schema language; and the Text Encoding Initiative (TEI): a set of rules for marking up electronic texts such as novels and poems, primarily to support research in the humanities (TEI Consortium 2004).

2.5 Other Metadata Standards

Metadata is important to the creation and management of various types of objects in digital libraries. Although the attachment of metadata to digital objects may seem easy at first (e.g., taking the existing catalog information, reformatting it to the appropriate encoding standard, and linking it to the digital objects), the process of describing digital

library collections, however, is quite complex. For example, a finer granularity (i.e., the level at which an information object is described) of metadata is necessary to provide access to digital collections. Various organizations in the digital library community, therefore, have initiated efforts to develop domain-specific metadata standards for the description of digital objects. The most prominent developments in digital library metadata standards have been in the area of digital imaging, for example, the Categories for the Description of Art and the Visual Resources Association's Core Categories. Other types of metadata standards, such as preservation metadata and multimedia metadata, both general and domain-specific, have also been developed. These include the preservation metadata of the OCLC and the RLG, the Metadata Encoding and Transmission Standard, Z39.87, MPEG-7, and MPEG-21.

2.5.1 Description Standards for Imaging Collection

2.5.1.1 Categories for the Description of Works of Art

Categories for the Description of Works of Art (CDWA), a product of the Art Information Task Force funded by the J. Paul Getty Trust, is part of the Getty Standards and Digital Resource Management Program. The categories provide guidelines for the description of art objects and images, such as paintings or sculptures, to improve access to information on the visual arts in electronic form. The standard includes 26 main categories, and most have an additional set of subcategories. The goal of the guidelines is to ensure integrity and longevity of data, giving end-users, particularly academic researchers and scholars, consistent and reliable access to information (Intner et al. 2006).

2.5.1.2 Visual Resources Association's Core Categories

The Visual Resources Association's Core Categories (VRA 2006), which build on and expand the work of the CDWA, define a metadata element set to describe works of visual art as well as reproductions of the works. The VRA Core, currently version 4, consists of a single set of 19 categories. The Data Standards Committee of VRA Core 4.0 adopted principles developed by the DCMI. Similar to DC, VRA Core 4.0 does not require any particular syntax or rules for representing content; however, it emphasizes the use of controlled vocabularies for specified elements. A number of existing vocabularies

are suggested and communities are encouraged to develop additional vocabularies as needed (Intner et al. 2006).

2.5.2 Metadata Standards for Digital Preservation

2.5.2.1 (PREMIS) PREservation Metadata: Implementation Strategies

The PREMIS working group, initially sponsored by the OCLC and the RLG, is made up of expert participants from various institutional and geographic backgrounds. The objectives of the working group were to "identify key attributes and responsibilities of trusted digital repositories serving cultural heritage institutions" as well as to "identify and describe metadata necessary to support the digital preservation process" (Lavoie 2004, http://www.dlib.org/dlib/april04/lavoie/04lavoie.html). The working group developed a prototype of metadata elements recommended for the preservation of digital objects in 2004. The elements fall into a data model that includes five types of entities involved in digital preservation activities: Intellectual Entities (a coherence set of content, e.g., a database), Objects, Events, Rights, and Agents (e.g., persons, organizations). To facilitate proper implementation of the prototype elements, the PREMIS Data Dictionary was also developed to "support digital preservation, including implementation details such as repeatability, obligation, and examples" (PREMIS Working Group 2005, 8).

2.5.2.2 Metadata Encoding and Transmission Standard

The Metadata Encoding and Transmission Standard (METS) was developed by the DLF as an implementation strategy for preservation metadata. As an encoding format, it was designed to describe the complex structure of digital library objects. Specifically, METS provides a method for expressing and binding descriptive metadata, administrative metadata, and structural metadata for digital objects within the context of a digital library. Furthermore, METS facilitates the exchange of digital library objects between different repositories (Intner et al. 2006).

2.5.3 Metadata Standards for Multimedia

2.5.3.1 NISO Z39.87 /AIIM 20-2002 Technical Metadata for Digital Still Images

The *Data Dictionary—Technical Metadata for Digital Still Images*, published by the National Information Standards Organization (NISO) and the Association for Information and Image Management (AIIM) International, is the result of an image metadata workshop held by RLG, CLIR, and NISO in 1999. In addition to descriptive metadata for the purpose of discovery and identification, workshop participants observed the need for technical metadata that describe the production and technical attributes of digital images. In 2002, the NISO and AIIM International developed a standardized set of more than 100 metadata elements for raster digital images. Their reason for providing a comprehensive set of technical metadata for digital still images is to document production metadata such as image provenance and history and to ensure that the image will be rendered faithfully upon display, on screen, print, or film. Standardizing technical metadata in effect facilitates interoperability between systems, services, software, and long-term management of digital image collections, so that users may develop, exchange, and interpret digital image files reliably (NISO and AIIM 2005).

2.5.3.2 MPEG-7

MPEG-7, a standard developed by the Moving Picture Experts Group (MPEG), defines the metadata elements, structures, and relationships used to describe features of audio and video content such as still pictures, music, speech, or 3D model. The standard is composed of three parts:

- *Description Tools*, including Descriptors, which define the syntax and the semantics of each metadata element, and Description Schemes, which encode the structure and semantics of the relationships between the elements.
- *Description Definition Language*, the language that allows Description Tools to modify the syntax of existing Description Scheme, and
- *System tools*, that support storage, transmission, synchronization, management, and protection of intellectual property rights.

The multimedia standard combines content metadata (e.g., title, creator, rights) as well as technical metadata about the file so that users can search, browse, and retrieve the content more efficiently and effectively. Much of the research effort in MPEG-7 has focused on developing efficient low-level digital signal processing methods to extract values from image, video, and audio. For example, algorithms have been developed to automatically transcribe speech and video content (Koenen and Pereira 2000).

2.5.3.3 MPEG-21

MPEG-21 was developed to ensure interoperability of digital multimedia objects. It defines a multimedia framework to enable the use of multimedia resources across a wide range of networks and devices in an efficient and transparent manner. Within a multimedia framework, the standard includes many parts and is continuously updated and developed. The first nine parts include the following components (Bormans and Hill 2002):

- Part 1: Vision, Technologies, and Strategy, which give the complete vision and plan for the framework.
- Part 2: Digital Item Declaration, which creates a model for defining digital items, including syntactic and semantic rules.
- Part 3: Digital Item Identification, which allows identification and linking of digital items with related information.
- Part 4: Intellectual Property Management and Protection, which provides tools for intellectual property management and authentication.
- Part 5: Right Expression Language, is a computer language for processing the declaration of rights and permissions.
- Part 6: Rights Data Dictionary, which contains a standard set of terms to be used with the Rights Expression Language in Part 5.
- Part 7: Digital Item Adaptation, which provides tools with which one user can interact with another, and a method by which multimedia content can be created and shared with reliably.
- Part 8: Reference Software, which forms the systems-related specifications in MPEG-21.

- Part 9: File Format, which is a complex collection of information, including both still and dynamic media.

The preceding sections gave an overview of the metadata standards currently being used in libraries, museums, and archives. These metadata models are designed for the use and management of heterogeneous information resources across networks, but each metadata standard has different functions and is applied to different purposes. Library-based metadata standards, such as content and encoding standards, ensure accuracy and eliminate ambiguity in bibliographic metadata. MODS and METS facilitate the exchange of bibliographic and structural metadata between libraries. TEI enables the encoding of literary text online. CDWA and VRA Core describe visual documents depicting works of art, architecture, and artifacts. NISO Z39.87/AIIM 20-2002 describes the capture process and technical characteristics of the digital images. MPEG-7 provides a system for describing audiovisual content. And MPEG-21 covers the metadata related to the generation, use, manipulation, management, and delivery of multimedia content across different networks and devices.

Digital objects derived from phonograph records encompass more than collections of sound files. They include digital images of album covers, record labels, and accompanying materials. Accordingly, selective features from these metadata standards may be incorporated to describe digital objects derived from phonograph records.

In preparation for a discussion of the current practices for cataloging sound recordings and on using metadata to describe digital libraries of phonograph records, the next chapter provides an historical background of the development of sound recording and describes current efforts and challenges in audio preservation.

Chapter 3 Audio Preservation and Challenges

This chapter presents a summary of the development of sound recordings and discusses their impact on our culture, science, economy, and history. It also presents a rationale for preserving historic audio recordings, via digitization. The chapter then gives a survey of current efforts at audio preservation, and lastly, it discusses the challenges involved in developing digital libraries of phonograph records for the purposes of preservation and access.

3.1 Changing Technologies for Sound Recordings

Music plays an important role in our culture and history. It not only provides people with pleasant diversion, it also records human creativity and enables the dissemination of artistic expression (Brylawski 2002; Harvith and Harvith 1987; Kenney 2003; Millard 2005; National Recording Preservation Board of the Library of Congress 2006a). The availability of a new documentary technique, however, is relatively recent. The history of sound recording began only 130 years ago, with Thomas Edison's invention of the phonograph in 1877. The methods of sound recording, despite their relatively short history in comparison to print material, have passed through a number of technological stages. These developments have included the use of several different recording formats such as cylinders, discs, tapes, and digital carriers, as well as the use of different materials including tinfoil, wax, plastic, rubber, and metal. In addition, within each format and composition, different techniques have been discovered to record sound (Eargle 1980; Gelatt 1977; Gronow and Saunio 1998; McWilliams 1979; Millard 2005; Morton 2004; Voloshin 2002; Weblch and Burt 1994).

Since the invention of Edison's phonograph, history has witnessed "the emergence of one innovative recording technology after another," where "each new technology has quickly supplanted its predecessor" (National Recording Preservation Board of the Library of Congress 2006a, 1). Defining moments in the early history of sound recording occurred mainly as a result of the stiff competition between the two

earliest recording formats, the cylinder and the disc (Gelatt 1977; Gronow and Saunio 1998; Welch and Burt 1994). These experimental recordings and their players launched the recording and entertainment industry (Gelatt 1977), and these recordings have since become collectible items (McWilliams 1979).

Edison's phonograph used a metal cylinder covered with a soft material, first of tinfoil, then of lead or wax, on which a recording stylus engraved the patterns of vibrating sound in grooves. This was the first device that allowed the sounds to be recorded (Gelatt 1977). As Gelatt explained (Gelatt 1977, 20):

> The instrument that Edison designed consisted basically of a metal cylinder (with a fine spiral groove impressed in its surface) and two diaphram-and-needle units—one to be used for recording, the other for reproduction. The cylinder was mounted on a screw, so that turning a handle would make it both revolve and move from left to right. A piece of tin foil was to be wrapped around the cylinder, and thereon the recording needle, following the spiral groove, would indent a pattern of the sound vibrations directed into the mouth-piece. The stylus would move vertically, creating a so-called "hill and dale" pattern in the trough of the groove. On replaying, the reproducing needle was to convert these indentations on the tin foil back into sound.

With the development of the new graphophone (rotating at a constant speed with power provided by an electric motor in place of the impractical hand crank of Edison's original design) and with later versions perfected by Edison (using a compound of paraffin wax and a natural resin), marketing of the phonograph was underway in the late 1880s (Morton 2004). This pioneering sound recording technology gained in popularity during the decade from 1900 to 1910 (Gelatt 1977). When sound recording devices first made their debut in the commercial market, however, the phonograph industry was burdened with three challenges (Gelatt 1977, 46):

> First, the quality of reproduction was extremely poor. Only a fraction of the tonal spectrum could be caught in the wax, and even that fraction issued from the ear tubes in so blurred and indistinct a manner as to make any resemblance to real music almost coincidental. Second, the wax cylinders played for a maximum of two minutes, which was too short a playing time to be productive of any really satisfying musical results. Third, and most important, there was no method of duplicating

cylinders; as a consequence, every recording sold was necessarily a custom-made product.

To overcome these challenges, a new development, the disc gramophone record (which has become synonymous to the term "phonograph record" in the American vocabulary), began to dominate commercial recording in the early 1900s. Instead of a cylinder using Edison's "hill and dale" (i.e., vertically cut) method, Emile Berliner used a disc and a groove cut from side to side (i.e., laterally cut). Berliner perfected and patented the disc format in 1887. The first gramophone records appeared on the market toward the end of 1894, and as Berliner had predicted, the greater convenience of flat audio discs gained public favor and allowed records to reach a mass audience. They also led to the creation of "home entertainment," which was an entirely new concept at the time (Gelatt 1977).

Early models of Berliner's gramophone players were hand-powered instruments, but the design was improved with a spring motor in 1896. Incremental improvements were also made in the composition of gramophone records. The early Berliner records were pressed into 7-inch diameter discs of hard rubber, but a new plastic compound called Durinoid was substituted when rubber was found to cause problems with warping and breakage. From the 1890s until the 1950s, most of the Berliner records were made primarily from lacquer (an excretion from insects) and lampblack (powdered carbon), mixed with cotton fibers or ground rock powder, a substance known as *shellac*. The 7-inch discs were finally retired in 1907 when 10-inch discs became the standard. Within a few decades, Berliner's gramophone had largely replaced Edison's phonograph cylinders (Gelatt 1977; Morton 2004; Welch and Burt 1994).

The next great technological breakthrough in sound recording came with the introduction of electrical recordings. Before 1925, recordings were rendered acoustically, that is, by the conversion of the physical energy of sound into mechanical vibrations that drove the stylus to cut the discs. This method had a number of limitations, including a lack of sensitivity and restricted frequency response, which made it virtually impossible to make a good acoustic recording of, for example, a symphony (McWilliams 1979). With electrical recording, in contrast, sound was transformed into amplified electrical signals to drive the cutting stylus. The advent of electrical recording resulted in an

appreciable increase in the frequency and dynamic range of sound, which caused a great improvement in the quality of the recording:

> In these new "electrical recording" systems, microphones and amplifiers replaced the recording horn used previously. If necessary, the output of several microphones could be "mixed" together electronically to form a single signal. By electronically controlling the sensitivity level of each microphone, amplifiers made it possible for musicians to spread themselves out in the studio, freeing up their playing style. Amplifiers could boost weak sounds or cut loud ones, and amplification made the recording system more sensitive, so that larger groups of performers could be recorded without losing the details of the sound (Morton 2004, 66).

The overwhelming advantages of the electrical recording systems led to a wide acceptance by manufacturers. The first commercial electrical recordings were issued by Victor and Columbia in 1925 (McWilliams 1979).

The flexibility of the electrical recording process, and the widespread availability of equipment, popularized the use of disc recordings in noncommercial settings (e.g., in the fields of ethnomusicology, conference documentation, and home recording) by the 1930s. Two new materials, cellulose acetate and cellulose nitrate, which allowed greater convenience and speed in the recording process, were introduced for disc recordings. Although the recording process of these discs, referred to as "instantaneous" recordings, could produce recordings of high quality, the acetate or nitrate surfaces were soft. Acetate discs, due to their chemical composition, could only be played a few times before significant deterioration occurred (McWilliams 1979).

No major breakthrough was made in the technology of disc recording during the 1930s and 1940s. Berliner's gramophones, recorded at approximately 78 revolutions per minute (78-rpm), remained unchallenged from 1929 (when Edison's phonograph cylinders finally ceased production) until the introduction of the next new recording technology—the long-playing record (LP)—which appeared after World War II. Experimentation with LPs took place in the 1930s, but the slower speeds required finer grooving and the playback technology (i.e., a rotating turntable) was not sufficiently developed at the time (Voloshin 2002). After the invention of vinyl during the war years, the American recording industry introduced LPs made of a low-noise Vinylite plastic

(McWilliams 1979). The new records came in 10- and 12-inch diameters and played music with superior sonic quality. With the slower speeds, smaller grooves, and closer grove spacing, it was possible to play a single side of a record for up to 30 minutes. The LP was commercially introduced by Columbia Records in 1948, and led to the demise of the 78-rpm record. Significant production of the 78s finally ceased in 1957 (Voloshin 2002).

The 78-rpm record not only gave way to flexible vinyl 33⅓-rpm LP records in 1948 and 1949, it also gave up its market dominance to the magnetic recording tape developed in Germany during the late 1930s. Magnetic tape, which was introduced into the U.S. after World War II, came into widespread use in commercial recording sessions by the late 1940s. Almost all the tape recording prior to 1963 had used the reel-to-reel format. By the mid-1960s, when record companies started selling prerecorded, continuous-loop, multi-track recordings such as eight-track tapes to the public, audio tapes began to reach the consumer market. Then, when Philips compact cassettes were introduced in the U.S. in 1964, cassette tapes, both blank and prerecorded, reached the consumer market in large quantities by the end of the 1960s (Gronow and Saunio 1998; Millard 2005; Morton 2004).

The next major breakthrough in sound recording after tape was the introduction of digital recording in the 1980s. The arrival of the first widely available digital carrier, the compact disc (CD), premiered in 1982. Since then, a new wave of recording and playback methods in digital formats has continued (Gronow and Saunio 1998; Millard 2005; Morton 2004). As digital audio has gained precedence, other new digital carriers and formats such as DVD and MP3 have already begun to jeopardize the dominence of CDs.

3.2 Rationale for Audio Preservation and Digitization

The swift evolution of audio recording technologies has made it clear that innovation and obsolescence in sound recording are continuous. Sound recordings, among all the media employed to capture human creativity, have undergone particularly radical transformations in the last two decades due to revolutionary developments in digital recording. From Edison's invention of the phonograph in 1877 to the invention of

digital sound recording in 1983, incremental advances in audio recording have helped society to document the world's cultural heritage, making the sharing of artistic expression and entertainment possible. Although the history of sound recording has only spanned a relatively short period of time, the body of recorded sound that has been captured since 1877 constitutes one of the greatest creative and historical treasures of the world.

Given the pervasive role that sound recordings now play in our culture, science, economy, and history, the fact that nearly all recorded sound in analogue form are in peril of becoming inaccessible is alarming. As the digital revolution has introduced new audio formats to consumers and collections in cultural institutions, libraries and sound archives must make a transition from their traditional duties of preserving analogue recordings collections (e.g., cylinders, phonograph records, tape reels, cassette tapes) to creating digital files (Smith et al. 2004).

The National Recording Registry at the LC supports the preservation of historic recordings. In 2000, it directed the librarian of Congress to not only add sound recordings of aesthetic, historical, or cultural value to the registry, but also to: one, establish an advisory national recording preservation board; two, create standards for audio preservation in digital form; three, devise and implement a national plan to ensure the long-term preservation of and access to our national audio heritage; and four, establish a national foundation to fund that work (National Recording Preservation Board of the Library of Congress 2006a).

Debates in the recording industry about the merits of preserving sound recordings in digital format have raged, for many years, since digital recording and playback came into widespread use in the 1980s. In a two-part series on the state of the industry's recorded-music archives in *Billboard Magazine*, Bill Holland reported that the preservation format agreed upon by leading audio engineers and organizations such as the Audio Engineering Society (AES), the National Academy of Recording Arts and Sciences (NARAS), and the Association for Recorded Sound Collections (ARSC) was the analogue tape format, rather than the digital tape format, "because analogue tape has been proven to last, generally" (Holland 1997, 99) while the shelf life of digital tape was unknown at the time. As of 2005, however, evidence has shown that analogue magnetic

tape is no longer a feasible format for audio preservation. Only one major manufacturer, namely Quantegy, formerly Ampex, still manufactures analogue magnetic recording tape stock for the U.S. market, and only a small number of companies still produce the machines that play open-reel tapes. Moreover, some tape manufactured for preservation and reformatting is susceptible to chemical degradation. For example, polyester tape has been reported to decompose from interaction with moisture in the air over periods of time, a chemical reaction known as binder hydrolysis. Upon playback, these tapes can break down and become unplayable (National Recording Preservation Board of the Library of Congress 2006a). Only recently, in fact, have leading audio engineers and audio preservationists begun to initiate and support the preservation of audio materials in the digital format (Brylawski 2002; IASA and Bradley 2004).

Librarians and archivists have also begun to accept digitization as a means of preserving audio holdings that are at risk of deterioration within the next few years (Arthur et al. 2004). Although cultural heritage institutions still struggle to fully grasp the implications of new technologies to their traditional library functions, many compelling reasons have influenced institutions' decisions to launch digital archival preservation efforts.

First, the audio heritage in analogue formats is endangered because it depends on the appropriate playback equipment for access. To ensure that the recorded sounds of the past century are available for study and pleasure of future generations, media that are no longer commercially viable demand preservation intervention, in digital form, in order to preserve and enable long-term access to the recorded sound now stranded on obsolete hardware and formats (Gladney 2001; Silver and Stickells 1986; Smith et al. 2004; St-Laurent 1991).

Second, sound recordings in analogue formats are subject to deterioration from number of factors: the intrinsic fragile nature of the medium, the potential for chemical breakdown in the constituent materials, mechanical damage due to rough handling, inappropriate equipment for playback, adverse environmental/storage conditions, and the inevitable physical damage occurring during playback (Gladney 2001; Silver and Stickells 1986). To eliminate the possibility of excessive damage to the original sound

recordings due to frequent use, sound recordings in analogue format must be reformatted while they are still playable and in good condition.

Third, reformatting analogue sound recordings into digital form allows transmission of files in many ways, such as the World Wide Web, making public access easy and cost-effective. The interaction of users with libraries, archives, and museums has changed drastically with the advent of the Internet and advances in computer and communication technologies. Many users expect fast delivery of digital audio files with scanned images of accompanying material from free and well-maintained websites. Waiting in line to borrow sound recordings, then sitting in a listening room is no longer an acceptable option (Brylawski 2002; Danielson 2001; Gladney 2001).

Fourth, as has been the case with many rare and special collections that received little attention while in analogue formats, demand for audio increased dramatically once it become available digitally. The LC's American Memory site (Library of Congress 2007), which offers millions of digitized special collections items free over the Internet, has amply demonstrated the increased use of rare and special collections. It has become a successful digital library model, and has made a major breakthrough in access (Smith et al. 2004).

Fifth, digital media have the advantage of no loss of quality when reproduced. Duplicates can be sent to other archives or transferred to new formats. Unlike the generational losses inherent in the duplication of analogue media such as discs and cassette tapes, digitization provides substantial improvements in features with no loss of content information (Gladney 2001; Smith 1999).

Sixth, advanced restoration techniques have become available for removing clicks, pops, scratches, hiss, or other imperfections from sound recordings. By applying emerging post-processing techniques to files created from archival copies, libraries can offer unprecedented services, presenting audio content in optimized digital quality that would be impossible to achieve with the original sources (Gladney 2001; Library and Archives Canada 2005).

And lastly, digitization of analogue sound recordings, when combined with searchable metadata that describe information pertaining to the recording itself, will provide digital archives with unprecedented tools, such as full text searching of content in

historic audio collections. The completion of such digital archives will create an audio file depository that is unique and valuable (Brylawski 2002; Gladney 2001; Lai et al. 2005; Lai and Fujinaga 2006a).

3.3 Recent Research in Distributed Music Libraries and Archives

With the ever-growing public concern about the need to reformat and assure continual access to unique audio collections, a number of digitization projects focusing on sound recordings are in development.

3.3.1 Harvard University

The Loeb Music Library Audio Preservation Studio (APS) at Harvard University has initiated a pilot project to develop the technologies and methodologies necessary to access sound recordings. The goal of this project is to preserve, reformat, and reproduce the sound recordings of the Archive of World Music (AWM), a special collection of the Loeb Music Library established in 1976.

The project adapted EAD finding aid protocols to create multimedia finding aids for three of the Archive's premiere collections: the Laura Boulton Collection of Byzantine and Eastern Orthodox Chant, the Joseph Jeffers Dodge Duke Ellington Collection, and the James Rubin Collection of South Indian Classical Music. The project has also developed an administrative metadata, comprised of 15 metadata elements, to support digital audio files, quality assessment (i.e., both to machine operations and curatorial evaluations), and audio data processing. The project, furthermore, has created software for the collection of metadata and for the deposit of audio files to Harvard's digital repository. The ultimate goal of the project is to create a new model of information retrieval, and to provide students and scholars with online access to the finding aids, images, and audio files of rare and unique sound recordings for the purpose of preservation (Harvard University 2005).

3.3.2 Indiana University

The VARIATIONS Project of Indiana University (IU), originated in 1995, was a joint effort of the University's Cook Music Library and digital library program. The name of the research project is not an acronym; it refers to musicians' need to study musical materials in varying formats such as text, sound, score, and video, a concept introduced by Rurroughs and Fenske in 1990. Unlike many digital library projects whose primary goal is to provide users with increased access to unique and/or archival collections, VARIATIONS began building its digital collection from the standard musical repertoire of the IU School of Music. The digital library system, which has served the Cook Music Library since 1996, began primarily as an electronic reserve system for sound recordings, containing over 6,000 titles, drawn from source materials such as CDs, LPs, and tapes, housed at the Cook Music Library (Dunn and Mayer 1999).

In 2002, the project redeveloped and was replaced by a new version, Variations2. The project continues the visions of the developers of VARIATIONS: to create a truly integrated multimedia digital library that provides users with access to musical materials in a variety of formats, in an integrated setting. The Variations2 project has completed usability studies of its prototype designs for a music digital library. It has also created and documented a metadata model to describe how music may be stored in multiple representations and in different media. Other areas of research that the Variations2 project has analyzed and documented include topics in network services, system architecture, human-computer interaction, and intellectual property rights (Dunn and Isaacson 2002). As of September 2005, the Institute for Museum and Library Services has announced funding of the Variations3 project, which will extend Variations2 into an open-source tool that may be used by the music libraries of other institutions (Indiana University 2005).

3.3.3 Indiana University and Harvard University

The *Sound Directions* project, started in 2003, is a joint technical archiving project and a collaborative research and development initiative between the AWM at Harvard University and the Archives of Traditional Music (ATM) at Indiana University. The project aims to develop best practices and examine emerging standards and current

practices for the digitization of audio material. The project focuses on the preservation of sound recordings that are unique, irreplaceable, and historically significant, since the challenge of preserving audio resources accurately, reliably, and long term, remains unsolved. The *Sound Directions* project makes significant contributions for audio preservation in the areas of technical metadata for audio, construction and exchange of preservation packages, construction of digital files for archival preservation, creation of derivative files for access, quality control, workflow management, and storage in a digital repository (Sound Directions 2006).

3.3.4 Library of Congress

The Digital Audio-Visual Preservation Prototyping Project of the LC has moved through two phases of the prototyping of the digital preservation of recorded sound. The first phase (1999–2004) of the project conducted preliminary assessment of transfer technology, digital-object packaging (i.e., the files that contain the audio and images, and metadata) and metadata. It explored preservation issues such as selecting the target format for reformatting, determining the quality of the reformatted copy, the importance of the metadata, and analyzing the longevity of digital copies. The second phase of the project is now focusing on the development of transfer technology (Library of Congress 2005).

The Librarian of Congress, mandated by the National Recording Preservation Act of 2000, has also launched a number of cooperative efforts aimed at the preservation of recorded sound. The LC asked the CLIR to commission a background investigation on the accessibility of U.S. recordings and copyright of recorded sound. The first study was entitled "Survey of Reissue of U.S. Recordings" (Brooks 2005). Another report was on "Copyright Issues Relevant to Digital Preservation and Dissemination of Pre-1992 Commercial Sound Recordings by Libraries and Archives" (Besek 2005). The LC has also appointed an advisory board, the National Recording Preservation Board (NRPB), to study the present state of standards and best practices for capturing sound from analogue discs and tapes. The LC hosted a roundtable discussion in January 2004 among leading audio engineers to investigate procedures to reformat sound from analogue media into digital files, with a particular focus on issues such as mitigating deterioration of the

original sound recording, obtaining the most accurate transfer possible, best practices for digital conversion, sampling standards, manual versus automated transfer, and creating metadata for digital recordings. In March 2006, the NRPB sponsored a subsequent roundtable discussion with the emphasis on digital file formats and standards, metadata schemas, storage media, repositories, software tools, and collaboration between the archival and scientific community (National Recording Preservation Board of the Library of Congress 2006a).

Recently, the LC and the NRPB are conducting another nationwide study of the current state of recorded sound preservation and restoration in the U.S., based on two public hearings held in Los Angeles and New York in November and December 2006. The result of the study will assist the LC and the NRPB in formulating a national plan for the preservation of and access to recorded sound (National Recording Preservation Board of the Library of Congress 2006b).

3.3.5 Library and Archives Canada

The Music Division of the National Library of Canada has undertaken a variety of projects to promote greater awareness of its collections and of Canada's musical heritage. One of the projects at the National Library's Recorded Sound Studio is the *Virtual Gramophone: Canadian Historical Sound Recordings*. The object of the project is to assist in the preservation and promotion of Canadian sound recordings by revitalizing sound recordings in older formats with newer techniques and technologies.

The project has undergone nine phases since the summer of 1998. Phases one through six each focused on a different theme, or musical topic, for their selection of 78-rpm and cylinder recordings from the early history of recorded music in Canada. Phase seven (January 2004) incorporated the addition of educational resources, for example, the history of recorded sound in Canada and music in Canada, as well as a complete site redesign to improve the usability of the *Virtual Gramophone*. Phase eight (April 2005) continued to focus on a former theme with the addition of a number of articles to enhance the coverage of a popular topic. Phase nine (June 2006), also known as Turning Points, included additional biographies of Canadian musicians and added podcasting as a new

option for accessing the vast number of digital collections (Library and Archives Canada 2006).

The *Virtual Gramophone* database currently contains over 300 complete sound recordings. There are more than 4,700 audio files available in MP3 and RealAudio format. Technical notes about the digitization process, including topics on proper stylus size, proper playback speed, analogue to digital conversion, digital noise reduction, digital recording and editing, and compression methods, are available on the *Virtual Gramophone* website. A description of the *Virtual Gramophone* database fields is also available. Cataloging rules from *AACR2* have been applied to data entry. The database contains a total of 34 metadata fields: title; composer/lyricist; larger work; generic label; transcribed label; sub label; issue number; matrix number; take number; side number; album number; coupling number; control number; miscellaneous numbers; distributor; city; manufacturer; province/country; date of recording; recording location; recording company; release date; release year; issue type; alternative issues; comments; authority; sound material designation; dimensions; genre; sub-genre; language; siglum; and shelf number (Library and Archives Canada 2005).

3.3.6 Stanford University

The Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University has started a digitization project of Edison's cylinder recordings. It received an anonymous donation which included not only an extensive audio collection of more than 1500 pre-1920 cylinder recordings, but also cylinder players, and supporting peripheral equipment and materials. The audio collection covers many genres of recorded sound, for example, classical, popular, folk, spiritual, and march music, as well as vaudeville routines and speeches. The collection thus provides an audio history of the U.S. from almost a hundred years ago.

CCRMA recognizes the value of this collection as teaching and research material for classes and research and is continuously digitizing, cataloging, and documenting each recording, work done primarily by students as projects. One of the projects in 2002 investigated the issues of digital encoding and preservation and audio restoration. Various experiments in the signal chain (i.e., the steps involved in capturing, processing, and

distributing an audio signal) led to recommendations for the best combination of equipment and tools (e.g., the type, configuration, and placement of a microphone) to use in order to capture the highest sound quality possible. Additional signal analysis of the original, distorted waveform also suggested new algorithms for removing distinctive artifacts inherent in the old recordings. The results for the algorithms developed for removing distortion in the waveform, however, varied. The proposed method for removing signal distortion, nevertheless, has provided a foundation for building more robust algorithms to improve the quality of old analogue recordings (Stanford University 2002).

3.3.7 University of California Los Angeles

The Chicano Studies Research Center (CSRC) at the University of California at Los Angeles (UCLA) has initiated the digital preservation of the Arhoolie Foundation's Strachwitz Frontera Collection, which is the largest repository of Mexican and Mexican-American popular and vernacular recordings in existence. The Frontera collection comprises recordings made in Mexico and the U.S. from 1905 to 1990. It includes approximately 15,000 78-rpm records, 17,000 45-rpm discs, and 2,500 33-rpm LPs. Digitization of the 78-rpm phonograph recordings of 30,000 performances started in October 2001. The project is a collaborative effort between CSRC and the UCLA Digital Library Program, which provides technical support and programming facilities. The UCLA Music Library, in partnership with the UCLA Digital Library Program, currently hosts the Strachwitz Fontera Digital Archive. The collection is available for browsing and search online. Reproductions of audio disc labels, audio and the associated metadata from 7 metadata fields, are available online. Unfortunately, because of copyright issues, access to the complete audio archive is restricted to UCLA users only (University of California Los Angeles).

3.3.8 University of California Santa Barbara

The University of California Santa Barbara (UCSB) Libraries, in collaboration with the Department of Special Collections, have initiated a cylinder preservation and digitization pilot project (CPSP) in 2002. The CPSP project has digitized and saved preservation copies of cylinders recordings in the Wave file format at 44.1kHz/24bits. It

also created MARC records for inaccessible and uncataloged recordings, and investigated various compression codecs for web delivery of audio. A digital collection of 60 cylinder recordings, which are now in the public domain, is currently available for download or streaming over the Internet in MP3 or Quicktime. Although preliminary results show that the technology is mature enough to continue the digitization of the remaining 7,000 cylinders, numerous technical issues had to be overcome during the course of the pilot study. The project team is currently studying the challenges it encountered in developing digital collections of cylinder recordings, and it will document them in a forthcoming technical report (University of California Santa Barbara 2006).

3.4 Challenges in Developing Digital Libraries of Phonograph Records

The importance of preserving and ensuring continual access to our audio heritage has been widely recognized by libraries, archives, and museums. Although cultural heritage institutions have largely agreed that preservation programs are important to endangered audio collections, with a few exceptions, the lack of authoritative manuals on how to digitize phonograph records for preservation is keeping institutions from improving the accessibility of their rare phonograph materials (Smith et al. 2004). While lack of funding has often been cited as the greatest barrier to a digitization program, other, more complex challenges have also been identified.

3.4.1 Hardware/Software Acquisition and Transferring Standards for Audio

The subject of transferring phonograph records has been controversial in the audiophile community. Heated discussion has covered topics such as cleaning methods, cartridge size, stylus size and shape, playback equalization, filtering, playback speed, and choice of equipment for turntables, tonearms, and analogue-to-digital converters (Willens 1991). The rapid changes in hardware and software versions, further complicate the transferring task. There are problems with file formats, storage devices, operating systems, and software versions (Sitt 2000). A list of resources for audio preservation and transfer experts that can provide authoritative and up-to-date guidelines for developing an

audio preservation workstation (e.g., technical manuals and key specifications and configurations) will help institutions to establish a quality digitization program.

3.4.2 Selecting Phonograph Records for Digitization

Since the cost associated with digitization is often a factor in digital library programs, a good selection of material for digitization is vital to a wise investment of resources and adds value to the preservation efforts. Selection for digitization is a complicated process, however, and has much in common with purchase of digitization equipment. Selecting materials for digitization, while largely based on an institution's mission and digital collection-building strategies, should also avoid duplicated efforts and complement digital conversion programs that have already been undertaken by other institutions. Although general guidelines for selecting materials have been developed by a number of institutions, particularly for digital imaging programs (Hazen et al. 1998; Sitts 2000), criteria for evaluation and prioritization of phonograph records requires an in-depth musical knowledge. The person making the selections must know the history, genres, and formats of recorded sound collections in order to make good selection decisions based on evidential value, sensitivity of musical topic, authenticity, and record condition.

3.4.3 Rights Management

The lack of understanding of intellectual property rights with regard to sound recordings has often influenced institutions' decisions about digitization. In fact, copyright law related to sound recordings and musical composition is extremely complex, both in Canada and the U.S. This complexity is a result of historical and political factors as well as the challenges presented by new ways of disseminating music with digital and communication technologies. Copyrights of sound recordings involve two types: rights pertaining to the sound recording itself and rights pertaining to the underlying musical compositions.

In Canada, sound recordings are currently protected by the copyright law under the Berne Convention for the Protection of Literary and Artistic Works of 1886. Canadian recordings are thus protected for at least 50 years after the author's death (Ricketson 1987).

In the U.S., sound recordings published prior to 1972 are protected by a combination of state, civil, and criminal laws, until 2067, while sound recording produced after 1972 is protected by federal copyright law. Regardless, U.S. federal copyright laws still apply to sound recordings prior to 1972 with only a few exceptions, such as foreign recordings. U.S. copyright law provides each copyright holder with a bundle of rights that can be licensed separately or together. This includes the right to make copies; the right to make derivative work based on a copyright work; the right to distribute copies of the work publicly such as via the Internet; the right to display a copy of the work publicly; and a performance right to sound recordings by means of digital transmission (Besek 2005).

Phonograph records are often the aggregate creation of several parties. Photographers, translators of lyrics, designers of artwork on album covers, and others also have varied rights to the use of the sound recordings, which further increases the complexity of copyright issues. And since the date of a phonograph record's release was not widely indicated on record labels or album covers before the inclusion of phonogram dates beginning in 1976 (Sistrunk 2004) and renewed or extended copyrights can be initiated by the re-release of albums (Brooks 2005), legal clearance of phonograph records for digitization requires tedious work and rights management checks to avoid placing institutions at legal risk.

3.4.4 Metadata Creation

The absence of appropriate metadata standards for cost-effective description, discovery, management, control, delivery, and sharing of phonograph records has often been a decisive factor in excluding a sound recording collection from digitization (Smith et al. 2004). Although traditional standards for cataloging sound recordings exist, they provide rules for annotating the basic physical and bibliographic attributes of music only, and are inadequate for digitized representations of phonograph records (see Chapter 4).

In a digital library where web-based search and retrieval processes demand the engagement of complete content, more accurate descriptive metadata, such as name and role of recording engineers, musical work and artist information, keyword description, and the credits for photos and artwork on the album cover, is necessary to improve access

to digital libraries of phonograph records. Additional types of metadata, for example, technical metadata regarding the digitization process (e.g., digital bit depth, sample rate, and playback speed used for digital transfer and file format and display equipment), legal rights metadata regarding the dissemination of digitized recordings (e.g., copyright begin date, copyright end date, copyright registration number), administration metadata regarding the management of resources (e.g., provenance of data, comment about the provenance of data), and structure metadata regarding font and layout characteristics of visual components (e.g., layout of artwork, typography of text), are equally, if not more, important to providing digital libraries with effective tools for the control, delivery, and sharing of digital phonograph record objects. Technical metadata informs scholars and audiophiles how accurate a reflection of the original the digital version provides, and documents the need for post-transfer quality control. It also provides the ability to reproduce digital objects in a different program environment than the one originally intended. Legal rights metadata, as another example, provide a means to protect intellectual property rights, control access and transaction in digital collections, and monitor events in the life cycle of a digital collection. Developing a comprehensive metadata for phonograph records is challenging (Lai et al. 2005b). However, metadata is crucial to the long-term management and organization of digital collections and will facilitate new forms of use and access to digital libraries of phonograph records (Lai et al. 2005a).

3.4.5 Content Rules

Another challenge related to the lack of metadata standards for phonograph records is the problem of standardizing the encoding of metadata element instances. The present rules available for the description of the basic physical and bibliographic attributes of music, which generally comprise relatively few elements of metadata (Hemmasi 2002), rely on "informal rules, implicit logic, and variant name forms for the same concept, object, work, or person" (Hemmasi 2004, 194). Content rules that explain assumptions shared by the music cataloging community are becoming increasingly problematic because staff members in charged of data and metadata entries often lack the formal music cataloging training required for music catalogers, and consistent

interpretation of the content is vital to providing access and information of phonograph records in a structured, comprehensible, and comprehensive fashion.

3.4.6 Software Development

The other technical barrier to reformatting phonograph records in digital form is the absence of effective and cost-efficient software tools to assist the process of digitization. Due to the enormous quantity of existing recordings, much time is required to properly and carefully digitize them. Because of financial constraints, automation of the digitization process is desirable to reduce human intervention and to bring more affordable solutions to digitization.

3.4.7 Quality Assurance

Another challenge in developing digital libraries of phonograph records is the evaluation of the quality of digital audio and image files in the online system. The need to be able to display images and play audio in a broad variety of user environments makes the creation of derivative, or surrogate, files from the originals difficult. Quality evaluation of digital images and audio is difficult to prescribe because technical specifications for surrogates vary depending on the characteristics of the source material as well as on the needs requirement of the intended user.

In summary, some building blocks needed to develop audio collections in digital form are in place as institutions have begun digital preservation programs. However, these resources are scattered and published reports do not cover all parts of the audio digitization process. Table 1 below summarizes the recent efforts at building digital audio collections, focusing on the metadata design each institution has adopted or developed. If further reconstructed and extended, these metadata designs can be readily integrated to establish new standards and methods and to facilitate new forms of use and access to digital collections of phonograph records.

Institution	Medium	Digital format	Collection	Metadata
Harvard University	Reel-to-reel	96kHz/24bit	• Laura Boulton Collection of Byzantine and Eastern Orthodox Chant • Joseph Jeffers Dodge Duke Ellington Collection • Rubin Collection of Indian Classical Music	• 15 administrative metadata
Indiana University	• Cassette • CD • LP	44.1kHz/16bit	Standard musical repertoire	• 47 descriptive metadata • 2 structural metadata • 25 technical metadata
Harvard and Indiana *Sound Direction Project*	• Cassette • Disc • Reel-to-reel			Technical metadata (work in progress)
Library of Congress	• Discs • Tapes	• 48kHz/24bit • 96kHz /24bit		• 18 audio metadata • 53 audio source metadata • 14 rights metadata
Library and Archives Canada	• 78-rpms • Cylinders		Early Canadian recorded sound	34 descriptive metadata
Stanford	Cylinders	• 44.1kHz/16bit • 48kHz/24bit	• Classical music • Popular music • Folk music • Spiritual music • March music • Vaudeville routines • Speeches	
UCSB	Cylinders	44.1kHz/24bit	• Todd Collection • Blanche Browning-Rich Collection • Moran Collection	MARC bibliographic metadata

Table 1: Summaries of current audio digitization efforts, focusing on the metadata design.

To show the need for and the importance of a new metadata design for digital objects of phonograph records, the next chapter focuses on common retrieval challenges for music in digital libraries, such as the digital context of bibliographic control, cataloging, and distribution and copyright protection, by revisiting the traditional approaches to music cataloging.

Chapter 4 Information Retrieval for Music Recordings

This chapter provides a context for the nature, structural basis, and historical development of music cataloging and considers current practices in libraries and other cultural heritage sectors. The chapter also presents a review of new methods of retrieval for music information about phonograph records.

4.1 History of Cataloging Music

Since libraries first began collecting music materials, such as manuscripts and printed music and then sound recordings, librarians have encountered thorny issues integrating musical works into library catalogs using the bibliographic control originally designed for books (Brown 1897). Music materials have characteristics different from books that must be considered for the description of sheet music manuscripts and sound recordings. First and foremost, unlike book cataloging, transcribing the titles of musical works of an international repertoire independent of alphabetic language so as to make the author-title catalog entries effective for access and retrieval in libraries is highly problematic. The title of a musical work, because of language variants (e.g., *Symphonie no. 4*, *Symphony no. 4, Fourth Symphony*) and the source of the information (e.g., choices among title pages, captions, and covers of printed music; choices among record labels, jacket, and record sleeves of sound recordings), can differ or give conflicting information, thus making the cataloging process for music difficult (Smiraglia 1989). Second, the cataloging of music is more complicated than the cataloging of books because each piece of musical work and every part of each work can be manifested in various scores (e.g., for different arrangements of instruments or voices) or editions as well as in multiple recordings of different performances. Third, the nature of sound recordings, which are often anthologies containing performances of works by different artists, further complicates the difficulty of describing music materials. For example, one must decide whether the recording should be cataloged as a whole or filed under different entries for each of the performances recorded on it. Although music has been collected in

libraries for nearly 600 years and each generation has endeavored to develop and organize library music collections (Smiraglia 2006), music has only received serious bibliographic treatment since the late nineteenth century (Bradley 1981; Smiraglia 1989).

4.1.1 Development of Rules for Cataloging Music Materials

The first recognized effort to establish a unified bibliographic control for cataloging music was an appendix published by Sonneck in the fourth edition of Charles Ammi Cutter's *Rules for a Dictionary Catalog* in 1904 (Sonneck 1904). This set of cataloging rules, designed primarily for printed music, gave general advice that was subject to broad interpretation by catalogers (Bradley 1981). Sonneck saw music cataloging and book cataloging as "essentially the same. The differences between the two," Sonneck wrote, "are few and do not really affect the principles of bibliographic description" (Sonncek 1904, 138). Sonneck's guidelines for cataloging music did not address any cataloging issues specific to music recordings. Furthermore, libraries at that time were still debating whether or not sound recordings were acceptable as library holdings (Daily 1975).

As music, including sound recordings, began to gain an identity in U.S. libraries, the American Library Association (ALA) published a five-page chapter about the treatment of music in libraries in *Pamphlets and Minor Library Material* (American Library Association 1917). The discussion, however, was "superficial; in fact it was scarcely more than a catalogue of the problems of music in libraries" (Bradley 1981, 764). Although in subsequent years a number of organizations such as the ALA, the Special Libraries Association, and the Music Teachers' National Association continued to develop guidelines (e.g., American Library Association Committee on Catalog Rules 1920; Wallace 1927) for the care and treatment of music in libraries, the discussions remained quite gereal. For example, in *The Care and Treatment of Music in a Library* by Wallace, catalogers were given broad instructions about the handling of the note area for music (Wallace 1927, 26):

> Notes to amplify or explain the title should be added freely when likely to be useful to the person who consults the catalog.

General cataloging principles that lacked uniformity and consistency were of little help in alleviating the difficulties of music cataloging. The urgent need for expert advice from music specialists became increasingly evident to librarians in charge of music collections. In 1931, at a meeting of the ALA in New Haven, a group of music librarians convened to discuss the special problems of music and formed the Music Library Association (MLA). These newly affiliated music librarians identified the lack of standardized cataloging rules for music materials as their first and most important issue (Bradley 1981).

4.1.2 Development of Rules for Cataloging Sound Recordings

Although there had been much discussion of the cataloging of music materials in the early 20th century, the emphasis was on the cataloging process for printed music such as scores. Ellsworth's 1933 article on "Phonograph records in the library" was considered a landmark publication that addressed the problems of cataloging sound recordings and arranging them for retrieval in libraries. "Unlike books, for which LC had been issuing printed cards since 1901, card distribution for music was extremely limited until the late 1940s, and cards would not be available for recordings until 1958" (Smiraglia 1989, 16). Due to the lack of standardized cataloging rules for music, institutions were developing their own solutions to the basic problems of descriptive cataloging. Descriptive cataloging is the act of transcribing and annotating the inherent bibliographic data so that an item may be identified by reference to its description. After several discussions on standards for music cataloging, in 1936, the MLA finally appointed two special committees to prepare a code for music and a code for the cataloging of phonograph records (Bradley 1981). The results of these committees included the author rules that were published in the appendix section of the *ALA Catalog Rules: Author and Title Entries* (American Library Association Catalog Code Revision Committee and Library Association 1941) and the *Code for Cataloging Music; Preliminary Version Issued by Chapters* (Music Library Association Cataloging Committee 1941–1942). The preliminary code produced by MLA dedicated a chapter to the *Code for Cataloging Phonograph Records*.

In 1946, a Joint Committee of the MLA and the ALA worked together to revise the MLA's preliminary code. The LC, in the following year, also appointed a Music

Processing Committee to study the original MLA *Code*, the revisions by the Joint Committee, and LC's own rules for cataloging music based on the original MLA *Code.* The reports of these committees were presented at the MLA meeting in 1948 in Chicago (Bradley 1981). Consequently, the revised MLA rules for author-title entries were incorporated into the *A.L.A. Cataloging Rules for Author and Title Entries* (American Library Association Catalog Code Revision Committee and Library Association 1949), and the rules for description of music and sound recordings were published in the LC *Rules for Descriptive Cataloging in the Library of Congress* (Library of Congress Descriptive Cataloging Division 1949). Since the MLA code was never printed in a single publication, MLA and ALA jointly published a single volume entitled the *Code for Cataloging Music and Phonorecords* (Joint Committee on Music Cataloging 1958), which included a compilation of chapters from previous works by the ALA (*A.L.A. Cataloging Rules for Author and Title Entries* 1949) and the LC (Library of Congress Descriptive Cataloging Division 1949) that were accepted by the joint committee. Meanwhile, the International Association of Music Libraries began to publish the first of its five volume multilingual *Code international de catalogage de la musique* (International Association of Music Libraries 1957–1983), a massive international project initiated in 1951. Significant guidelines and rules of cataloging for music then became available. The instructions from the *Code* were later incorporated into the 1967 *AACR*, North American Text (Spalding 1967), which had been used by many U.S. libraries until the rules were superseded by the various editions of the *AACR* (Bradley 1981).

4.1.3 Computerized Cataloging of Music Materials: the MARC Format

Following the joint publication of the MLA and the ALA (Joint Committee on Music Cataloging 1958) there was a major technological development in libraries in the 1960s. This technological development included library automation via the construction of electronic catalog record formats. Book reviews and evaluations of music cataloging practices predominated in the literature and contributed to the next development in the bibliographic control of music. For instance, Mary Lou Little, a music librarian at the Harvard Music Library, studied the Harvard library catalogs of sound recordings in 1969 and pointed out two important deficiencies in the prevalent cataloging practices: the lack

of performer entries and the lack of access to the content of anthologies. Under Little's supervision, the Harvard Music Library initiated a computer-aided automation approach, adapting and expanding the MARC II Format for books (Avram et al. 1968), to the information retrieval of recorded music. Some important modifications that Harvard made to the cataloging practice of sound recordings included the additions of uniform titles, names of manufacturers, identification numbers of recordings, physical characteristics of recordings, performer information, and the languages of accompanying material. The Harvard Format was presented to the Music Section of the LC in 1970. As a result, a cooperative effort between the LC and Harvard was launched, and a first draft of the new format for music was prepared in 1971 (Seibert 1982).

The first draft, entitle *Sound Recordings: A MARC Format*, deviated from the original Harvard format in two aspects. First, the MARC draft was limited to sound recordings because the MARC office of the LC, at the time, saw printed music and sound recordings as two different materials. Second, the MARC draft did not adopt Harvard's technique for generating analytical entries, i.e., making detailed entries for works that are parts of a larger work. The first draft, moreover, included additional features not offered in the Harvard Format such as codes for the visual content of the sound recordings (e.g., libretto, biography of performer, and technical information about instruments used). The codes designed for visual content, to the dismay of many were eliminated in subsequent drafts (Seibert 1982).

The issuing of the first draft of the MARC format was presented to the MLA in 1971. Going against the wished of the MARC Office, the MLA Board passed a resolution and made a recommendation to add scores to the new MARC format. By "omitting scores from the format," the Board believed, "the MARC Development Office reduces the usability of the format and creates an artificial separation between scores and sound recordings" (Seibert 1982, 18).

Other remarks from the Board contributed to the subsequent development of the MARC format. These included the emphasis on musical form and genre and on the medium of performance (i.e., instrumentation). The second draft of the Format, issued in 1972, thus provided for scores as well as sound recordings and included codes for musical form, genre, and medium of performance. Issues concerning the inclusiveness of

the form/genre list, the provenance of the form and genre terms, and the problem of recognition and interpretation were controversial throughout the development of the code. The effort to develop a scheme for providing access to the instrumentation of musical works also involved lengthy discussions. The ambitious plan for developing a coded field for the array and combination of instruments, however, was put aside in the third (1973) and fourth (1975) drafts (Seibert 1982):

> It was recognized that providing this kind of access would be costly and time-consuming, and would involve much duplication of effort as, for instance, various editions of the Beethoven symphonies were cataloged (Seibert 1982, 37).

An alternative approach to coding the medium of performance was proposed by Little, who invented three supplementary codes to indicate special electronic, amplified, ancient, unusual, or unique instruments. Her proposal, however, was lost among the various drafts and committee deliberations. The MARC format for music went through several revisions in the 1970s. The various versions included *Music: A MARC Format* (Library of Congress MARC Development Office 1976), the MARC Formats for Bibliographic Data (Woods and Avram 1980), the USMARC Format for Bibliographic Data (Library of Congress 1988), and the MARC 21 Format for Bibliographic Data (Library of Congress et al. 1999).

4.1.4 *AACR2* for Music Materials

A year before the publication of the Music Format (Library of Congress MARC Development Office 1976), Jay Elwood Daily discussed the issues surrounding the challenges of classifying increasingly large collections of sound recordings in libraries and pointed out, as did many critics in the professional literature, the deficiency of the section in the *AACR* devoted to phonograph records (Daily 1975). Revised rules for cataloging sound recordings then appeared in 1976 in *Anglo-American Cataloging Rules. Chapter 14 Revised: Sound Recordings.* Two years after the publication of this revised chapter (Spalding 1967), *AACR2* was published (Gorman and Winkler 1978), which extended the cataloging rules of music and sound recordings and contained rules "to deal with a wide variety of types of sound recordings" (Smiraglia 2006, 11). In 1988, two chapters were dedicated to the cataloging of musical materials in the revision of the

AACR2 (Gorman and Winkler 1988): chapter 5 ("Printed music") and chapter 6 ("Sound recordings"). During this period, a new series of manuals for the use of *AACR2* and the MARC formats were produced, to assist in the cataloging of sound recordings. Among the many publications were manuals by the RLG (1980), Frost (1983), Smiraglia (1983; 1986; 1989; 1997), Weidow (1984), Holzberlein (1988), Weitz (1990), and Hartsock (1994).

4.2 Current Cataloging Practices for Music Sound Recordings

With the advent of computerized cataloging and in accordance with the MARC/AACR2 framework, catalogers of music sound recordings in most of North America's libraries today follow the conventions of the MARC 21 format for bibliographic data and the cataloging rules prescribed in the *AACR2* and the *Library of Congress Rule Interpretations* (*LCRI*) (Library of Congress Subject Cataloging Division 2005). Cataloging rules in *AACR2R* and *LCRI* (i.e., data content standards) provide instructions on when, where, and how to enter descriptive bibliographic information into specific parts of the catalog records in the MARC 21 format (i.e., a data structure standard). For instance, chapters 6, 21, 24, and 25 of *AACR2* set forth requirements for the description and identification of music sound recordings, delineate an orderly sequence for the elements of description to be transcribed, and specify a system of punctuation, format, and vocabulary for the designation of data. To be more specific, the provisions of chapter 6 follow the presentation of description of all library materials (chapters 2–13) for creating bibliographic data. The rules for description of non-music and music recordings are presented, in sequence, in the following areas: Title and statement of responsibility, edition, publication, distribution, etc., physical description, series, notes, and standard number and terms of availability. Special sections in chapter 21 show systematic approaches to making author-title entries for a variety of performance media that contain more than one work by more than one principle author (i.e., composers or performers). Chapter 24 and 25 contain rules for standardizing personal and corporate name headings. Rules about series statements from "Chapter 2: Books" and rules about the medium of performance from "Chapter 5: Music", which are also

applicable to recorded music furthermore, are also referenced for the description of music sound recordings.

In addition to *AACR2* and *LCRI*, other manuals such as *Cataloging Service Bulletins* (Hiatt 1978–) and *Music Cataloging Bulletin* (MLA 1970–) are important supplements that assist librarians in the cataloging of music sound recordings. The Bulletins, which report new LCRIs quarterly and monthly, serve as a communication channel by which the LC and music catalogers can discuss problems, solutions, and policies in a timely and effective manner.

4.2.1 Issues in Cataloging of Music Sound Recordings Using the MARC/AACR2 Framework

Although *AACR2*, the *LCRI*, and other cataloging manuals aimed at establishing standards and minimizing local practices have provided useful guidelines for the descriptive cataloging of recorded music, in some instances the rules still lack sufficient detail to allow librarians to produce useful and intelligible bibliographic records. The Archives of Traditional Music at Indiana University, as it prepared to catalog a unique collection of 78-rpm records, found little guidance in the existing cataloging rules for 78-rpm discs. Inevitably, the Archive developed local cataloging practices for 78-rpm music recordings and published its suggestions and guidelines for the cataloging of 78-rpm discs in Mudge and Hoek (2000), as an effort to clarify many of the rules in *AACR2*. Simpkins, similarly, noted the lack of detailed guidance for the entire cataloging process of popular music records, and described in great detail, the procedure for cataloging popular music recordings in Simpkins (2001). The complexity and inadequacies of the current MARC/AACR2 framework for cataloging music sound recordings can be highlighted in a number of areas.

4.2.1.1 Selecting a Chief Source of Information

Determining a primary source of information for cataloging music sound recordings has always been challenging. Unlike books, where bibliographic information such as title and author can be found in predictable locations (i.e., title page) in consistent forms, the title and author information of music recordings often appears in different locations and gives conflicting data. As Smiraglia explained (Smiraglia 1989, 19):

> The title, responsibility, and publication data might be printed on the object but are not presented as part of the recorded performance (as they are for other kinds of nonbook materials such as film). Cassettes and traditional grooved discs have labels that are more or less permanently glued to them. Digital discs have these details imprinted on their faces. Obviously, the small space available constricts the presentation of data, small type nonwithstanding. Containers and accompanying booklets have more space and can therefore hold more information, but have the disadvantage of being easily discarded.

To determine the source of information for providing authoritative bibliographic data, *AACR2* rule 6.0B1 puts forth a set of specifications for various types of sound recordings. The types of media covered include disc, open reel-to-reel tape, cassette tape, tape cartridge, roll, and sound recording on film. For example, record labels are preferred as the chief source of information for discs, unless the recording is part of a collection where the container provides a collective title for the anthology that is not available on the record labels. When two or more primary sources of information are present (e.g., two labels on a disc), however, *AACR2* rule 6.0B1 instructs catalogers to treat them as a single source, similar to the one-to-one correspondence data structure design of the MARC format for books. Moreover, when descriptive data are not available from the chief source, *AACR2* rule 6.0B1 instructs catalogers to take information from the accompanying textual material, container (e.g., sleeve, box), or other sources and cite a note about the provenance of data in the MARC 500 general note field to ensure that the MARC data structure format initially designed for books does not compromise the integrity of the basic description that is so vital to music sound recordings.

4.2.1.2 Transcribing Title and Statement of Responsibility

After the chief source of information has been determined, the next step involves the transcription of the title information. *AACR2* rules section 6.1 provides complex instructions for transcribing the title proper (in the MARC 245 title statement field), parallel titles (that apply to the recording as a whole in the MARC 246 varying form of title field, with notes about the variations in titles in the MARC 500 field), other title information (in the MARC 500 field), and items without a collective title. For older formats where labels on both sides are considered to be the chief source of information,

and the item as whole does not have a collective title, *AACR2* rule 6.1G offers two alternative approaches: transcribing the data from both labels as a single unit (in the MARC field 245), which reflects the physical nature of the music sound recordings as a single unit, in conformance to the MARC data structure, or making multiple individual entries for each separately titled work (in MARC 740 uncontrolled analytical titles field).

In addition to the transcription of the title, *AACR2* rule 6.1 also provides guidelines for cataloging the names of the artists responsible for producing the music. Although artists such as composers, lyricists, and producers, if prominently noted in the chief source of information, are routinely transcribed in the statement of responsibility area (in a subfield of the MARC 245 field), *AACR2* rule 6.1F instructs catalogers to transcribe performer names only when their participation "goes beyond that of performance, execution, or interpretation of a work." In all other cases, the participation of a performer is to be recorded in the note area (in the MARC 500 field). This rule causes much confusion in the cataloging of jazz, blues, and popular music where the roles of performers are difficult to define due to the rich diversity that these styles (e.g., interpreting the artistic and intellectual responsibility to the nature of musical improvisation) of music offer (Mudge and Hoek 2000; Simpkins 2001). Furthermore, the rule lessens the value of performer information as an important access point for the retrieval of music recordings.

4.2.1.3 Interpreting Publication Information

Another problematic area of the cataloging of music recordings is in the description of publication information, which is important for musical research and for discographical uses. *AACR2* rules section 6.4 provides rules for transcribing the place (6.4C), the name (6.4D), the statement of function (6.4D), and the date (6.4F) of publication, distribution, etc. The rules in section 6.4 refer catalogers to the general rules in chapter 1 of *AACR2* which provides guidelines for the transcription of publication and distribution information (i.e., *AACR2* rules 1.4) of all materials. However, the available guidelines in the general section are inadequate because the place and date of publication are rarely available on recordings. The *AACR2* does not provide a list of references for

discographies, record label guides, or other external sources which could properly determine the data (Mudge and Hoek 2000; Simpkins 2001).

Other confusing aspects in the publication area for music recordings are determining the various publication names, such as the publisher name, trade name, and distributor name and selecting the proper data for the name of the publisher. According to *AACR2* rule 6.4D2, when both the name of the publishing company and the name of a subdivision of that company, or a trade name or brand name used by that company, are available on a sound recording, the name of the subdivision or the trade name or brand name should be used as the name of the publisher in place of the name of the publishing company, i.e., the parent company (in MARC 260 field). Transcribing the details of publication is a confusing task because *AACR2* does not provide in-depth instructions for finding the available data. Conversely, *AACR2* assumes that the catalogers is an expert at reading information on music recordings, and also has a clear understanding of the historical structure of the recording industry.

4.2.1.4 Making Notes

One other complicated area of music cataloging within the MARC/AACR2 framework is the strategy for the designation of supplemental musical information in the MARC 500 series fields for general and specialized notes. *AACR2* rules section 6.7 gives extensive instructions for providing supplementary notes in an effort to clarify bibliographic characteristics specific to music recordings. This section includes rules for making notes of the artistic form and medium of performance (6.7B1); the language of the recording (6.7B2); important details such as the duration of each performance (6.7B10); and the publisher's number (6.7B19). Regardless of how detailed the rules are, special knowledge or techniques of transcribing notes for different types of music recordings is necessary. For example, entering notes about the publishers' numbers poses problems because errors on the publisher's numbers are possible (Simpkins 2001). In the case of phonograph records, three types of publishers' numbers may appear on the record labels: label number, matrix number, or other publishers' numbers. The label number is a unique identifier for a phonograph record and is usually printed on both sides of the record label; the matrix number is a unique identifier on each side of the disc and

generally appears on the ungrooved band at the center. Although *AACR2* rule 6.7B19 instructs catalogers to give the publisher's number as found on the recording, its lack of guidance for adding notes about important details of various types of recording media offers little value and confounds music catalogers.

4.2.2 Other Standards and Guidelines for Cataloging and Managing Music Sound Recordings

As librarians and archivists confront the challenges of organizing and cataloging music recordings, other organizations have also reassessed the cataloging treatments and management of recorded music, both within the role and function of music archives and in the context of building a music industry network.

4.2.2.1 Cataloging Rules of the International Association of Sound and Audiovisual Archives

The International Association of Sound and Audiovisual Archives (IASA) Cataloging Rules have been designed to harmonize with the *AACR2* and the *ISBD* (Non-book materials) in the format of MARC or other cataloging systems. These cataloging rules address the issues of sound recordings in more depth than *AACR2*. For example, extra emphasis is placed on the copyright and multilevel description of sound recordings. The work of the IASA focuses on many issues relevant to sound and audiovisual archives, and intends to complement the existing cataloging rules such as *AACR2* (IASA and Milano 1999).

4.2.2.2 Music Industry Integrated Identifiers Project

The Music Industry Integrated Identifiers Project (MI3P), started in 2000, was intended to support the management of online music e-commerce. Its objective is to build an infrastructure that enables record companies, music rights societies, music service providers, and others to communicate and exchange business information across networks using unique identification systems and standardized protocols. The Recording Industry Association of America (RIAA), the International Federation of the Phonographic Industry (IFPI), the Confédération Internationale es Sociétés d'Auteurs et Compositeurs (CISAC), and the Bureau international des Sociétés Gérant les Droits

d'Enregistrement et de Reproduction Mécanique (BIEM) are participants in this project. The primary MI3P standards include the Global Release Identifier Standard (GRid) and the Musical Work License Identifier Standard (MWLI). A data dictionary has also been developed to provide a common vocabulary for all MI3P standards (Paskin 2006).

4.2.2.3 International Standard Musical Work Code

The International Standard Musical Work Code (ISWC) published its first edition in 2001. The standard defines the format, administration, and rules for applying the ISWC to musical works. Its purpose is to improve efficiency in the administration of rights for musical works and to reduce the possibility of errors when information about musical works is exchanged among different parties internationally. Within the ISWC system, each musical work is assigned its own ISO standard identification number, in the same way that ISBN is the unique identifier for books or ISSN for magazines (Standards South Africa 2005).

4.2.2.4 International Standard Recording Code

The International Standard Recording Code (ISRC) is the international identification system for sound recordings and music video recordings. Each ISRC is a permanent identifier for a specific recording. The identification code can be permanently encoded into a product as a digital fingerprint, which provides the means to automatically identify recordings for royalty purposes (International Federation of the Phonographic Industry 2006).

4.2.2.5 CISAC's Common Information System

The aim of the Common Information System (CIS) is to create a worldwide digital rights management system. The CIS consists of two tools that provide the building blocks of global digital copyright administration. The first component features the integration of unique, ISO-certified, standardized international identifiers of works and parties relevant to the protection of intellectual rights. The second component pertains to a global network of databases that is a central repository of information on the creative process for all participating CISAC societies (Confédération Internationale es Sociétés d'Auteurs et Compositeurs 2006).

4.3 New Forms of Use and Access to Phonograph Records

The cataloging of music recordings is a dynamic profession; it continuously evolves, adopting new techniques as new communication technologies become available. With the advancements in digital imaging and audio technologies, institutions have initiated audio digitization programs for the preservation of their rare analogue holdings such as 78s and LPs. Many cultural institutions have come to support digitization as a viable preservation strategy for phonograph records because digital conversion preserves our valuable cultural heritage and provides wider access to the music, to the ultimate benefit of scholarship.

Although traditional standards for cataloging sound recordings exist, as presented in the preceding sections, these formats are inadequate for the online search of digitized phonograph records. The rigid data structure of the current MARC format makes the search for digital objects difficult. Also, the growing role of networks in accessing information has led to the need for music information about phonograph records other than those provided by traditional MARC records. Aspects of music information retrieval that are in need of further expansion for phonograph records include searching for artist names (e.g., performer, conductor, or recording engineer names as the performers often vary from track to track or movement to movement in classical recordings), instrumentation, performance date, on separate works in the same record album; full-text searches of liner notes (e.g., lyrics, artist biographies, program notes); and searching by description or keywords of photo and artwork on album covers, which reflect the social context of the recording era.

The metadata necessary for successful management and access to digitized phonograph records, however, will require new types of metadata in addition to the digital bibliographic description. Digital objects derived from phonograph records include not only sound files, but also digital images of album covers, record labels, and accompanying material such as liner notes. These digital objects are usually stored separately from traditional library catalog records. Therefore, for the description, discovery, management, control, delivery, and presentation of phonograph records in an online environment, a new set of metadata associated specifically with phonograph records is vital to binding these many digital objects together in a structured and

comprehensible manner. Structural metadata that tie the components of a compound resource together is crucial to grouping the audio, image, and text files that comprise the digital version of a phonograph record. Moreover, structural metadata supports many other functions such as browsing (e.g., viewing the different components that make up a record album) and navigation (e.g., turning the pages of a liner note) of phonograph records in a digital environment. Other types of metadata, such as technical metadata regarding the digitization process (e.g., the hardware used for digital transfer), are also essential. Technical metadata informs scholars and audiophiles how accurate a reflection of the original the digital version provides. Furthermore, technical metadata, which documents the actions taken to preserve a phonograph record, is important for maintaining and exploiting digital sound and for ensuring the long-term viability of digital libraries of phonograph records. Since digital objects are technology dependent, proper annotation of technical metadata has significant impact on the management, manipulation, and dissemination of digital libraries of phonograph records over time.

The next chapter describes the development process of comprehensive metadata for phonograph records. It presents the model of a new metadata design and provides information about the meaning of the semantic units of each metadata element.

Chapter 5 Metadata for Phonograph Records

This chapter introduces a new metadata design for phonograph records and explains in detail the development process, including the underlying data model and a metadata dictionary. The chapter stresses the usefulness of the metadata and the metadata dictionary as they form the cornerstone of efficient and effective retrieval of music information about phonograph records.

5.1 Purpose and Scope of the Metadata

The purpose of this new metadata design is to define a set of metadata elements (i.e., a metadata schema) for the description, discovery, management, control, delivery, and sharing of digital libraries of phonograph records. The metadata design is the outcome of two pilot projects for the digitization of phonograph records that took place at the Marvin Duchow Music Library at McGill University. The objective of the digitization projects was to preserve and improve the access to rare collections of physically fragile phonograph records in the music library. The metadata design assists digitizers in the encoding of metadata for digital phonograph recordings. The metadata offers a new approach to maintaining and using digital sound and ensures the long-term viability of digital libraries of phonograph records.

The Metadata presents a comprehensive list of metadata elements vital to the retrieval of music information about phonograph records. The Metadata focuses solely on digitized representations of phonograph records of music. Sound recordings in other formats such as CDs, tapes, cylinders or phonograph records of speech or animal sound, which may include metadata elements such as species name, habitat, and weather conditions, are beyond the scope of this schema. The Metadata pertains to the phonograph record itself as well as to the content of the recording.

5.2 Design Rationale

Although various metadata standards have been developed for the use and management of heterogeneous information resources across networks (Goldsmith 2006),

the most prominent metadata systems developed up-to-date have been in the area of digital imaging. A new set of metadata associated specifically with phonograph records is therefore necessary to guide libraries, archives, museums, and other historical societies engaged in digitization projects of phonograph records.

In the absence of a satisfactory metadata model that is characterized by precision and detail for phonograph records at the inception of the digitization projects at McGill University, a wide variety of metadata anticipated to facilitate and to optimize the long-term management of and continuing access to digital phonograph recordings was investigated. The new metadata design guides digitizers to create sufficiently rich metadata records of phonograph recordings. Comprehensive annotation of digitized representation of phonograph records assures scalability for unforeseen needs in the design of future digital library systems and tools.

5.3 Development Process of the Metadata

The implementation of the Metadata involved the following steps: functional requirements for the uses of metadata, survey of existing metadata standards, compilation of metadata elements, data modeling, and implementation of a metadata dictionary.

5.3.1 Functional Requirements for the Uses of Metadata

The design of the Metadata began with functional requirements for the uses of metadata. Definitions for the functional requirements included the answers to several key questions:

- How would users locate a digital phonograph recording?
- What information resources do users need to have access to a phonograph record?
- How would users interact with image and audio files in both streaming and higher resolution formats?

To determine the use cases of digital libraries of phonograph records, potential users and their typical search scenarios were observed and identified by professional academic librarians at the Marvin Duchow Music Library. The primary digital phonograph record library users were identified as scholars, researchers, and music

students. This group of users often has specific goals when they search for phonograph records. For example, a musicologist might search for information about the photos or artwork on album covers, which reflect social context, to study the cultural implication in the era that the performance was recorded. An audiophile might search for a phonograph record by the matrix number, which uniquely identifies a particular performance. And a music student might search for a musical composition performed by a particular artist on a specific date.

Other possible information access points for phonograph records were identified by thorough examinations of all the information components that appear on different parts of phonograph records. New access points, such as artwork type, circumstance of recording, and librettist, lyricist, and illustrator information, were identified by content analysis of the visual and textual components on album cover, record labels, and liner notes. In addition, MARC 21, which is the current bibliographic data format that carries the catalog records of phonograph records in most music libraries today, also served as a basis for the functional requirements for the uses of metadata.

Since recordings in digital libraries have different legal rights conditions attached to them which require a different management context, metadata required to support the rights management of digital phonograph recordings was also investigated. Accordingly, additional rights metadata vital to the management, control, and delivery of digital phonograph recordings was incorporated. Other types of metadata, such as technical information metadata that relates to the process of digital transfer, were also explored and incorporated into the new metadata design.

5.3.2 Survey of Existing Standards

The investigation was followed by a survey of current metadata efforts (Lai et al. 2005a) because embracing common semantics and rules for metadata creation will ease the exchange of metadata among collaborating communities (Kenney and Rieger 2000). A wide spectrum of metadata schemas was examined. Library-based metadata standards studied included the DCMI (see Section 2.3), *AACR2* (see Section 2.4.1.1), IASA cataloging rules (see Section 4.2.2.1), MARC 21 (see Section 2.2), EAD (see Section 2.4.2), MODS (see Section 2.4.2), METS (see Section 2.5.2.2.), and TEI (see Section

2.4.2). Other metadata models that offer metadata applications and topics of common interest to the design of a metadata model for phonograph records include the Art Museum Image Consortium Data Dictionary (see Section 1.1), the *Making of America II* project (see Section 1.4), Digital Audio-Visual Preservation Prototyping Project of the LC (see Section 3.4.4), the *Sound Directions* project of Harvard University and Indiana University (see Section 3.3.3), the data model for Indiana University's *Variations2* digital music library project (see Section 3.3.2), the administrative metadata developed by the APS of Harvard University (see Section 3.3.1), the *Virtual Gramophone* project of the Library and Archives Canada (see Section 3.3.5), NISO Z39.87 (see Section 2.5.3.1), MPEG 7 (see Section 2.5.3.3), MPEG 21 (see Section 2.5.3.3), ISWC (see Section 4.2.3), ISRC (see Section 4.2.4), the OCLC/RLG PREMIS Metadata (see Section 2.5.2.1), CDWA (see Section 2.5.1.1), and VRA Core (see Section 2.5.1.2).

After a comprehensive survey of metadata schemas relevant to digital phonograph recordings, a comparison chart was created to map equivalent metadata elements from the different metadata schemas studied. Table 2 shows an example of metadata equivalences for technical information metadata:

Virtual Gramophone	**IASA**	**Indiana University**	**Library of Congress**
Playback or project speed			Speed
			Speed adjustment
			Speed note
Digital noise reduction	Reproduction characteristics		
Digital recording and editing			
Sampling frequency and quantization		Sample rate	Sampling frequency
	Bit rate reduction	Compression	
		Number of channels	Number of channels
		Bit depth	Bit per sample
Format of file		File format	
		File location	
		File size	
Copy source		Physical format	
Date of copying		Date digitized	
System requirement		Hardware/software	

Table 2: Example of audio technical information metadata equivalences.

5.3.3 Metadata Design

Depending on practicability and suitability, the Metadata partially incorporates features from the metadata schemas listed in Section 5.3.2. The Metadata is designed to be as comprehensive as possible in order to optimize the search and retrieval of

phonograph records. Metadata has usually been divided into three- to five-category taxonomies in the literature (Inter et al. 2006) to differentiate between their types of function. The Metadata has been classified into five categories, based on the taxonomies developed by Tennant (1998), de Carvalho Moura et al. (1998), and Gilliland-Swetland (1998). The five different types of metadata include description metadata (enabling discovery and identification of resources), administration metadata (supporting management of resource), structure metadata (describing font and layout characteristics of texts as well as logical organization of objects), legal rights (protecting intellectual property rights), and technical information (recording the capture process and technical characteristics of the digital objects). Table 3 shows examples of metadata from each category:

Metadata type	**Examples of metadata**
Description	Album set title; Label number; Circumstance of recording; Language
Administration	Extent of collection; Public domain; File locator; Last record update
Structure	ID; Sequence; Owner ID; Equivalents
Legal rights	Copyright/restrictions statement; Registration number; Registration type
Technical information	Stylus shape; Bass turnover; Image capture device; Image bit depth

Table 3: Examples of different types of metadata

Types of metadata and their functions sometimes overlap because different types of metadata do not always have well-defined boundaries. The metadata "image bit depth," for example, is categorized as administrative metadata in CDL but is categorized as technical metadata in NISO. In the Metadata, types and functions of metadata are classified based on practicality that best matches the structural complexity of digitized representations of phonograph records. The Metadata currently contains 213 description metadata, 69 administration metadata, 11 structure metadata, 9 legal rights metadata, and 55 technical information metadata, with a total of more than 350 metadata elements. The Metadata provides for complete auditory, pictorial, and textual content analysis. The model has continued to expand since its initial design. The current version is presented in Appendix A.

5.3.4 Data Modeling

Since a logical organization can greatly enhance the utility of metadata, after a comprehensive list of metadata elements has been identified for digital phonograph recordings, a data model was developed to define the relationships among these metadata elements. The data model designed for the Metadata incorporates the conceptual data models in the FRBR (see discussion in Section 2.2) and PREMIS frameworks (see discussion in Section 2.5.2.1) and facilitates the management of the wide variety of objects (e.g., tracks, discs, performers) that comprise phonograph records. The data model represents 13 classes of entities: Digital Library Entity, Digital Object of Phonograph Record Entity, Digitization Event Entity, Phonograph Record Entity, Album Entity, Artwork Entity, Accompanying Material Entity, Audio Disc Entity, Track of Performance Entity, Musical Work Entity, Creation/Performance/Recording/Production Event Entity, Person/Organization Entity, and Right Entity.

As shown in the entity-relationship data model of the Metadata in Appendix B–1, a Digital Object of Phonograph Record Entity is the digitized representation of a phonograph record, which can be a digital audio object or a digital image object. A Digitization Event Entity is an action that produces the digital representations of phonograph records. A Digital Library Entity is a coherent set of content that holds various digital representations of phonograph records such as a database. A Phonograph Record Entity refers to a physical object of phonograph album, which, in turn, comprises an Album Entity, an Accompanying Material Entity, and an Audio Disc Entity. The Album Entity in this data model is a visual work of art, which may contain other artwork such as photographs or images of paintings.

Incorporating the FRBR conceptual data model, as illustrated in Appendix B–2, a Phonograph Record Entity is an exemplar of an Audio Disc Entity, which is the physical embodiment of a Performance Entity, through which a Musical Work Entity is realized. Incorporating, also, the PREMIS preservation data model, as illustrated in Appendix B–3, a Phonograph Record Entity is the result of an action of a Creation/Performance/Recording/Production Event Entity; this action is carried out by a Person/Organization Entity, who may have varied rights (represented by a Right Entity)

to the artistic creation, which, in turn, may impose restrictions on a Phonograph Record Entity.

5.3.5 Metadata Dictionary

A metadata dictionary, which assigns semantic meanings and syntactic rules to metadata elements, is equally important as, if not more important than the list of metadata elements. Unlike in the library community where catalogers are professionally trained and have content rules for cataloging bibliographic records, such as in the form of the *AACR*, staff members in charge of data entries in digitization projects often lack the professional training required in the tasks that digital library projects demand (Hasting and Tennant 1996; Kuny and Cleveland 1998; Sreenivasulu 2000). Especially without an authoritative manual to guide them for the encoding of metadata, digitizers may encode the same data element using different metadata elements or they may encode different data elements using the same metadata element. As a result, digital libraries may not combine or map their metadata across metadata repositories because the definitions used are not consistent.

To help digitizers achieve a high rate of encoding consistency a metadata dictionary is needed. A metadata dictionary assigns formal definition, specifies data type to each metadata element, and provides examples of metadata usage. The formal definitions make useful distinctions between metadata terms (e.g., label issue number vs. matrix number) thus avoids confusion and errors in the meaning and use of metadata elements. Moreover, the metadata dictionary reinforces vocabulary control for data values. Assigning keywords from controlled vocabulary such as for the description of album artwork and the genre of music improves the retrieval rate of digital phonograph recordings. As digital libraries are likely to adopt different metadata systems for the encoding of their digital collections, a metadata dictionary that assigns precise semantic meanings, clear syntactic rules, and consistent use of controlled vocabulary is necessary to achieve metadata interoperability between heterogeneous metadata repositories.

5.4 Development Process of the Metadata Dictionary

5.4.1 Methodology

To develop a metadata dictionary for the Metadata a comparative study of current data dictionaries in closely related fields was conducted. The data dictionaries studied included:

- AACR2r (bibliographic metadata)
- *Making of America II* (administrative and structural metadata)
- CDWA (arts metadata)
- DCMI (basic resource discovery metadata)
- EAD (archival description metadata)
- IASA cataloging rules (digital audio metadata)
- MARC 21 (bibliographic metadata)
- NISO Z39.87 (digital still image metadata)
- PREMIS (preservation metadata)
- *Variations2* (musical work metadata)
- VRA Core 4.0 (cultural work and images metadata)

5.4.2 Implementation Considerations

In addition to the reference models presented in Section 5.4.1, the following guidelines were used to implement the metadata dictionary for phonograph records:

5.4.2.1 Flexibility

The metadata dictionary should handle fine granularity of metadata and should directly use or modify from current establishments whenever possible.

5.4.3.2 Extensibility

The metadata dictionary should allow for extensions and support changing user needs and technology.

5.4.2.3 Effectiveness

The creation and maintenance of the metadata dictionary should be as economical and efficient as possible without sacrificing the usability.

5.4.2.4 Unambiguity

The metadata dictionary should provide for consistent and unique interpretation and should employ controlled vocabularies to increase accuracy, precision, and recall of records.

5.4.2.5 User Needs

The metadata dictionary should meet users needs and not be based on the ease of implementation.

5.4.2.6 Openness

The creation and management of the metadata dictionary should be as cooperative and inclusive as practicably possible.

5.4.3. Fields Reference Guide

Each entry in the Metadata Dictionary offers the following attributes of a semantic unit:

5.4.3.1 Field Name

The field name is devised to be descriptive and unique within the Metadata Dictionary. This name is different from the display name (see the Label field below) presented on a computer display interface.

5.4.3.2 Definition

The definition field provides semantic meaning of metadata elements with the intention of making useful distinctions between metadata terms, thereby clarifying the conceptual intent of each metadata term.

5.4.3.3 Multiplicity

The multiplicity field indicates the possible number of data entries for each metadata element. This field combines two commonly used fields in other data dictionaries: requirement and repeatability. For example, the value "0...many" indicates that the metadata is not required and may be repeated, the value "0...1" indicates that the

metadata is not required and may not be repeated, and the value "1" indicates that the metadata is required and may not be repeated (Davidson et al. 2002).

5.4.3.4 Data Type

The data type field indicates the format in which the data is to be entered into the system. It also recommends controlled vocabulary (e.g., Library of Congress Subject Headings) for the encoding of data value.

5.4.3.5 Label

The label field refers to the contextual instance of a metadata element. This field dictates the way that a metadata element is presented on a computer display interface. The field provides an easy mechanism to change its display name to a variant name while still pertaining to the same semantic meaning. Although the goal of the metadata dictionary is standardization because global resource discovery across the network is most effective by internationalization, i.e., adopting common conventions of practices, languages, and character sets (Duval et al. 2002), the label field offers flexibility which allows terminologies to be renamed so vocabularies that are special to the field appear natural and logical to users.

5.4.3.6 Provenance

The provenance field pertains to the derivation history of a metadata element from its original source(s), including its unique identification. This information can help validate and determine the quality of the Metadata Dictionary.

5.4.3.7 Examples or Notes

The examples or notes field provides encoding guidelines and gives concrete examples of usage.

5.4.3.8 Data Constraints

The data constraint field indicates the scope (e.g., musical work level, audio disc level, or artwork level) of each metadata element.

5.4.3.9 Version Tracking

The version-tracking field supports changes in data management, semantic evolution, and new technical requirements. The issued date, modified dates, replacement, or the deprecation of fields are provided when applicable.

5.5 Discussion

A variety of metadata schemas have been surveyed to create a new metadata design for phonograph records. To maximize semantic and syntactic interoperability between metadata systems, metadata elements from previously established metadata schemas have been incorporated into the new design in the most appropriate way. In order to benefit from the best features of each schema, the differences and merit of each metadata schema have been carefully studied.

Important metadata schemas in digital imaging that offer applicable features to the design of a metadata design for phonograph collections include CDWA, VRA Core, and NISO Z39.87. CDWA and VRA Core are specially designed for describing works of art. Metadata elements from these schemas, therefore, have been incorporated for the description of artwork on album covers and accompanying material. NISO Z39.87 contains only technical metadata elements that pertain to the production of digital images; therefore, metadata elements in NISO 39.87 have been incorporated to describe the technical attributes related to the scanning of album covers, record labels, and accompanying materials. CDL and Indiana University's *Variations2* projects have both developed structural and administrative metadata to support the navigation of digital objects in sequential or logical order that many of the schemas do not currently support. Features from these schemas, therefore, have been incorporated for the logical organization of digital phonograph recordings. Moreover, relevant attributes in MARC 21, AACR2, EAD, and DCMI have also been incorporated because they continue to be the bibliographic standard for describing archival collections in major libraries. In addition, preservation metadata elements from PREMIS have also been incorporated for documenting digitization events. Lastly, metadata schemas that describe audio features such as the IASA cataloging rules for digital audio objects and Indiana University's

Variations2 musical work metadata have also been incorporated, whenever applicable, into the design.

Although the number of metadata elements in the current version of the Metadata may seem daunting (a total of more than 350 metadata elements), a large number of the metadata elements will stay the same during the same session of digitization. Metadata about the scanning device, digitization date, and producer information are mostly likely to stay unchanged for one entire scanning session and can be recorded by batch-loading, without manual typing. Depending on the needs of the intended users and the purpose of the digitization projects, different types and level of granularity of metadata may be appropriate. With further studies on the different uses of the Metadata, common core sets of metadata elements from the Metadata can be identified for different types of application.

The complete Metadata Dictionary for phonograph records is included in Appendix C. As originally intended, the design of the Metadata and the Metadata Dictionary were developed to assist the pilot digitization projects of phonograph records that took place at the Marvin Duchow Music Library at McGill University. The next chapter presents two case studies of digitization projects that use the Metadata and the Metadata Dictionary.

Chapter 6 Case Studies of Digitization Projects of Phonograph Records

This chapter presents two case studies of digitization projects of phonograph records and describes in detail the conversion process. As little literature and guidelines are currently available for creating digital phonograph recordings, the chapter brings together information on best practices based on the outcome of two pilot projects for the digitization of phonograph records that took place at the Marvin Duchow Music Library at McGill University.

6.1 Overview

With the advancements in digital imaging and audio technologies, libraries, archives, and other cultural institutions have initiated digitization programs for the preservation of their analogue holdings. The digital preservation efforts to date, however, have primarily focused on the digital imaging of photographic materials and archival documents, and little literature was available to guide the conversion process of phonograph records at the inception of the digitization projects at McGill University. In response to the pressing need for guidelines for creating digital phonograph recordings, the projects explored best practices for integrating digital technology into the preservation, management, and access of phonograph records, focusing on digital benchmarking for conversion and access.

6.1.1 Project Implementation

The process of digitizing phonograph records involves many decisions that require an understanding of preservation issues and key digital principles. The following sections discuss a wide range of issues related to the digital preservation of phonograph records.

6.1.1.1 Selection for Digital Conversion

A number of institutions have developed guidelines for selecting materials for digitization (Columbia University Digital Library Collections 2001; Gertz 1998; Hazen et al. 1998; Library of Congress National Digital Library Program 1997). Selection criteria for digital conversion vary, however, depending on institutional settings (Vogt-O'Connor 2001) and the purpose for which digitization is proposed (de Stefano 2000). As creation of digital phonograph recordings may be undertaken for a variety of purposes, ranging from in-depth research to popular entertainment, different selection criteria will be appropriate to "ensure that resources are invested wisely in digitizing the most significant and useful collections at the lowest possible cost without placing the institutions at legal or social risk" (Vogt-O'Connor 2001, 45). Some of the issues that determine the selection of phonograph records for digital conversion include the scholarly value of the recordings, sources of funding, the need to reduce handling and use of fragile or heavily used recordings, and copyright status (de Stefano 2000).

The Marvin Duchow Music Library at McGill University holds a large number of phonograph collections that would be appropriate for digitization and online access. However, due to legal and copyright considerations, the library selected two sets of phonograph collections that are no longer covered by copyright for digitization. The two collections of recordings include a unique set of Handel LPs released before 1956 and a special set of Jazz 78s.

6.1.1.2 Legal Issues Relevant to Digital Audio Preservation

Determining the legal status of the candidate materials for digitization can be challenging. Issues to consider include copyrights, publicity and privacy rights, issues of obscenity and defamation, and sensitivity to content (Levine 2001).

Copyright law relevant to phonograph records is extremely complex. Since phonograph records are often the aggregate creation of several parties, determining the copyright status of a recording involves the verification of the copyright status of all the copyright holders.

The term of copyright protection in Canada lasts for the lifetime of the author, the remainder of the calendar year in which the author dies, and the 50 years following the

end of the calendar year the author dies. In the case of phonograph records, the authors include the composer, lyricist, writer of program notes, designer of album artwork, and photographer. In addition to the copyrightable authorship, copyright in phonograph records also applies to sound recording makers and performer's performance. For sound recording makers, the term of copyright lasts for 50 years after the end of the calendar year of the first fixation of the recording. Similarly for performer's performance, the term of copyright lasts for 50 years after the end of the calendar year in which the performance was first fixed or, if not fixed, 50 years after it was performed. Unless all the rights and restrictions associated with phonograph records have lapsed, permissions from rights holders must be sought (Canadian Intellectual Property Office 2007) before making digital phonograph recordings accessible online.

6.1.1.3 Conservation Assessment and Treatment

A phonograph record must be as clean as possible to achieve optimum audio quality. Cleaning discs in preparation for digitization, however, must be carried out with caution. Methods and techniques of cleaning phonograph discs have been a controversial topic among audiophiles, engineers and archivists, because inadequate use of washing solution may cause growth of foreign matter such as fungi and mold in the grooves of discs (Willens 1991), which will have adverse effect on the phonograph record. McWilliams (1979) and Powell (1992) provide guidelines on record cleaning and repair. Their manuals should be consulted for proper methods of record cleaning.

6.1.2.4 Digital Image Production

Best practices for digital imaging have been published by a number of digital library research programs (California Digital Library 2007; Kenney and Reiger 2000; Humanities Advanced Technology and Information Institute and National Initiative for a Networked Cultural Heritage 2002–2003; Puglia et al. 2005; Technical Advisory Service for Images 2002–2006). These quality control programs establish guidelines for setting digitization environment (e.g., monitor settings and calibration), selecting raster image characteristics (e.g., resolution and bit depth), quantifying scanner performance (e.g., color space), using reference targets (e.g., for color consistency), producing master image files, creating derivative files from master copies (i.e., access files for distribution

online), and inspecting digital image files (e.g., file size and color appearance). Since the process of image capture is very time-consuming and labor intensive, Lesk (1990) recommended the good economics of converting once and producing a high-level image that avoids the expense of reconverting when technologies can support higher-quality versions. Ester (1996) also argued for the creation of rich digital masters in order to safeguard the long-term value of images and the investment in acquiring them. To be cost-effective and useful over time, digital images of phonograph records were scanned at the highest resolution possible for master preservation copies for the digitization projects of Handel LPs and Jazz 78s.

6.1.2.5 Digital Audio Production

While a number of guidelines for digital imaging have been published, little literature is currently available on digital conversion of phonograph records. The LC (Library of Congress 2005), the CDP Digital Audio Working Group (2005), and the IASA (IASA and Bradley 2004) have published guidelines for digital audio conversion. These guidelines, however, do not cover in-depth the technical details required for faithful reproductions of phonograph records. To authentically reproduce the original performance, disc cleaning, stylus selection (e.g., stylus shape, stylus size), stylus tracking, cartridge orientation, proper playback speed, equalization settings, and other equipment configuration are important factors in restoring audio from phonograph recordings (National Recording Preservation Board of the Library of Congress 2006a; Powell 1992). Although the topics on record cleaning (Powell 1991; Willens 1991), playback equipment configuration (Powell 1992), cartridge and stylus selections (Powell 1992; Willens 1991), and equalization settings of 78-rpm recordings (Powell and Stehle 1993) have been discussed in the audiophile arena, the discussion has remained esoteric. The digitization projects of Handel LPs and Jazz 78s carried out the conversion process, as will be described in the following sections, with meticulous attention to detail.

6.1.2.6 Creation of Metadata

The creation of quality metadata is vital to the use, management, and long-term preservation of digital phonograph recordings because the success of digital preservation efforts, to a significant degree, rests on the scope and completeness of the metadata

created. For comprehensive and consistent annotations of metadata, a metadata dictionary, which assigns precise syntactic and semantic meanings to metadata elements, should be used. For the digitization of Handel LPs and Jazz 78s, metadata records were created in accordance with the specification in the Metadata Dictionary developed here for phonograph records (see Appendix C).

6.1.2.7 File Naming and Directory Management

Prior to digital capture of image and audio, a file naming system should be established to ensure consistency. A number of principles have been recommended in (Puglia et al. 2005) and were incorporated into the projects' file naming systems. Puglia et al. (2005) recommend that file names be:

- unique
- consistently structured
- taking into account the maximum number of items to be scanned and reflect that in the number of digits used
- using leading 0's to facilitate storing in numerical order
- avoiding an overly complex or lengthy naming scheme that is susceptible to human error during manual input
- using lowercase character and file extensions
- using number and/or letters but not characters such as symbols or spaces that could cause complications across operating formats
- including explicitly sequential information and major structural divisions of multi-part objects
- recording metadata embedded in file name such as scan date and compression detail

A directory structure, similarly, should be created before digitization because digitization projects tend to generate many files. The file system used for the digitization of phonograph records contained three levels of directories. The top-level directory organized digitized files by album, the second-level directory organized files by multimedia type (e.g., audio or image), and finally, the third-level directory organized

files by file type (e.g., digital master file, derivatives of print file, thumbnail file). The file names were unique within each directory and across directories.

When access restrictions to files were necessary due to legal rights, an additional level of directory was created below the top-level directory. The additional directory contains two folders, copyrighted and non-copyrighted. Depending on the legal rights associated with a file, the file was placed either under the subdirectories of the copyrighted folder or the subdirectories of the non-copyrighted folder.

6.1.2.8 Integration of Resource Files and Metadata into a Database

To facilitate the search and retrieval of metadata associated with digital phonograph recordings without the possibility of altering the content of digital images and audio, metadata can be stored in a database detached from the digital files (Duval et al. 2002). Although the separation necessitates the co-management of multimedia files and metadata, via structural metadata, metadata records and digital phonograph recordings can be hyperlinked and managed effectively.

6.1.2.9 Online Delivery of Digital Libraries of Phonograph Records and Benchmarking for Access

When the digital conversion of phonograph records has been completed, a website must be developed to make the digital phonograph recordings accessible online. A number of factors can affect the usability of the website. These factors include the popularity of file formats, the speed of file delivery, and the quality of digital images and audio. Since no standards currently govern the creation and use of digital phonograph recordings, benchmarking for the various components of phonograph records (e.g., album covers, disc, record labels) using measurements such as resolution or speed of delivery across and within collections is necessary to determine technical specifications for creating digital master and derivative files.

The remaining sections of this chapter describe the production details in the digitization of Handel LPs and Jazz 78s, bringing together information on recommended best practices for developing digital libraries of phonograph records.

6.2 Preservation Digitization of David Edelberg's Handel LPs

One of the most precious holdings of McGill University's Marvin Duchow Music Library is the irreplaceable analogue sound recordings of Handel's music assembled by David Edelberg (1939–1989). David Edelberg started assembling Handel LPs in the mid-1970s and over the subsequent fifteen years, his collection grew to nearly 3,000 sound recordings (Marvin Duchow Music Library). Among these analogue recordings, more than 130 of the LPs are now in the public domain as they are recordings of Classical music released before 1956 (see Section 3.3.4). To improve access to these phonograph recordings, approximately thirty LPs from the collection have been digitized as a pilot study.

6.2.1 Production Workflow

To assure the quality of preservation and facilitate new forms of use and access, an extensive digitization workflow management system has been developed for the Handel LP digitization project. The workflow involves hardware acquisition, installation, and configuration; software installation and development; copyright and rights management; metadata scheme design; analogue-to-digital (A/D) audio conversion; audio track separation; image scanning of record labels and packaging (album covers and liner notes); metadata extraction; text conversion; creation of derivatives; database design, implementation, and maintenance; website design, development, and maintenance; and review and evaluation of the system. Detail of the workflow management system for the digitization of phonograph records is included in Appendix D.

The production workflow of the Edelberg Handel collection is unique for several reasons. The archiving project develops an efficient and economical framework to manage large-scale digitization of musical material—LPs, and the production involves digitization of both audio and visual components (i.e., album covers and liner notes). Furthermore, the workflow management system provides benchmarking for conversion and access and creating ground-truth data to train and test content analysis systems (Li et al. 2006).

6.2.2 Equipment and Quality Control

The quality of digital reproduction, to a significant degree, depends on the quality control of the device and software used in the chain of digitization (Kenney and Rieger 2000). The Handel digitization project uses state-of-the-art digitization equipment and software tools. The multimedia digitization workstation consists of professional models of a record cleaning machine (VPI HW-17F Professional Record Cleaning Machine), a turntable (VPI Aries 2 Black Knight Turntable), a phono-preamplifier and A/D audio converter (GSP audio Jazz Club), and a large-format flatbed scanner (Graphic Arts Epson Expression 1640XL) connected via Firewire to a Power Mac G4 workstation with dual monitors for close visual inspection of image quality (Samsung SyncMaster 955DF). Software tools used to adjust image-display conditions include color management (Monoco EZcolor and SilverFast 6.5), which ensures color consistency from image capture through display, and monitor calibration/optimization, which ensures onscreen accuracy by setting white and black point, gamma, and color balance.

6.2.3 Copyright and Rights Management

Since the dates of LP release were not widely indicated on LP labels or album covers before the inclusion of phonogram dates, which began in 1976 (Sistrunk 2004), and renewed or extended copyrights due to re-release of album records sometimes occur, legal clearances of LPs for digitization required complex rights management checks via various sources such as the WorldCat OCLC Union Catalog, the Bielefelder Catalog, the Diapason Catalog, the Schwann Catalog, and the Gramophone Catalog. In addition to finding out the album release date to determine the legal status of the LPs, verifying the status of all the copyrighted materials (e.g., photographs, program notes) that appear as an integral part of the album was also necessary (see as discussed in Section 6.1.2.2).

6.2.4 Digitization

6.2.4.1 Image Scanning

Image digitization of LPs included scanning the album covers, audio discs, and all accompanying material. The LPs were in the standard size, i.e., 12 inches on each side and 12 inches in diameter for the covers and discs. To ensure consistency and improve

the exchange of images across a wide range of display equipment, a small color separation guide (Kodak No. Q-13) composed of a set of standard color patches (primaries, white, and black) was always placed in the same position relative to the scanned objects. To exploit the best resources (e.g., storage space and computing power) and utilize the current state-of-the-art scanning technology (e.g., scanning resolution and depth), master image files were created at 24bit/1200dpi.

For the file format of the preservation copy, two lossless compression formats, TIFF and PNG, were examined. Although TIFF has been the preferred format for long-term retention in the digital library community, some groups, such as the Technical Advisory Service for Images, favor PNG and other formats such as SPIFF because they are open formats, offer good metadata, and use better lossless compression (Kenney and Rieger 2000). A comparison of the file size among non-compression TIFF, lossless compression TIFF (i.e., TIFF LZW) and lossless compression PNG was made. The significance in file size reduction (e.g., 863MB vs 400MB vs 337MB) informed the decision to save digital masters in the PNG lossless compression format. Scanning an image at 24bit/1200dpi took approximately 13 minutes and saving the file to disk took an additional 12 minutes.

6.2.4.2 Audio Digitization

An LP must be as clean as possible to achieve optimum audio quality. Therefore, each side of the records was thoroughly vacuum cleaned using VPI HW-17F professional record cleaning machine and VPI specially formulated record cleaning fluid before each audio digitization session to remove accumulation of dirt that may consist of grease, dust, or surface particles. Few general guidelines for creating digital audio have been published. The audio-visual prototyping project of LC is one of the few research projects that has put forward recommended technical specifications for audio digitization requirements (Library of Congress 2005). IASA (IASA and Miliano 1999) and the CDP Digital Audio Working Group (2005) are the other research groups that have published guidelines on the production and preservation of digital audio. Although at the roundtable discussion of best practices for transferring analogue discs and tapes (National Recording Preservation Board of the Library of Congress 2006a), in 2004, some audio experts

disagreed about setting 24bit/96kHz as the digital audio preservation standard because of the complexities involved in down sampling from 96kHz to 44.1kHz for audio CDs and thus recommended 88.2kHz instead of 96kHz, most published standards to date, including the IASA, still embrace sampling rate of 24bit/96kHz as the audio preservation standard. For the audio digitization of the Handel LPs, preservation master files were captured at the minimum of 24bit/96kHz in mono or stereo, depending upon the characteristic of the LP, and saved in the industry standard AIFF format. Equipment used for the audio conversion included the VPI Aries 2 Black Knight Turntable (powered by VPI SDS for voltage cleaning and stabilization) with JMW-9 Tonearm and Shure V15VxMR audiophile phonograph cartridge; GSP Audio Jazz Club switched EQ phono preamp with Creek OBH-10 for level control; and M-Audio Firewire Audiophile 4-in/6-out audio/MIDI Interface. The cleaning and digitization of one side of audio disc took approximately 30 minutes.

6.2.5 Content Management

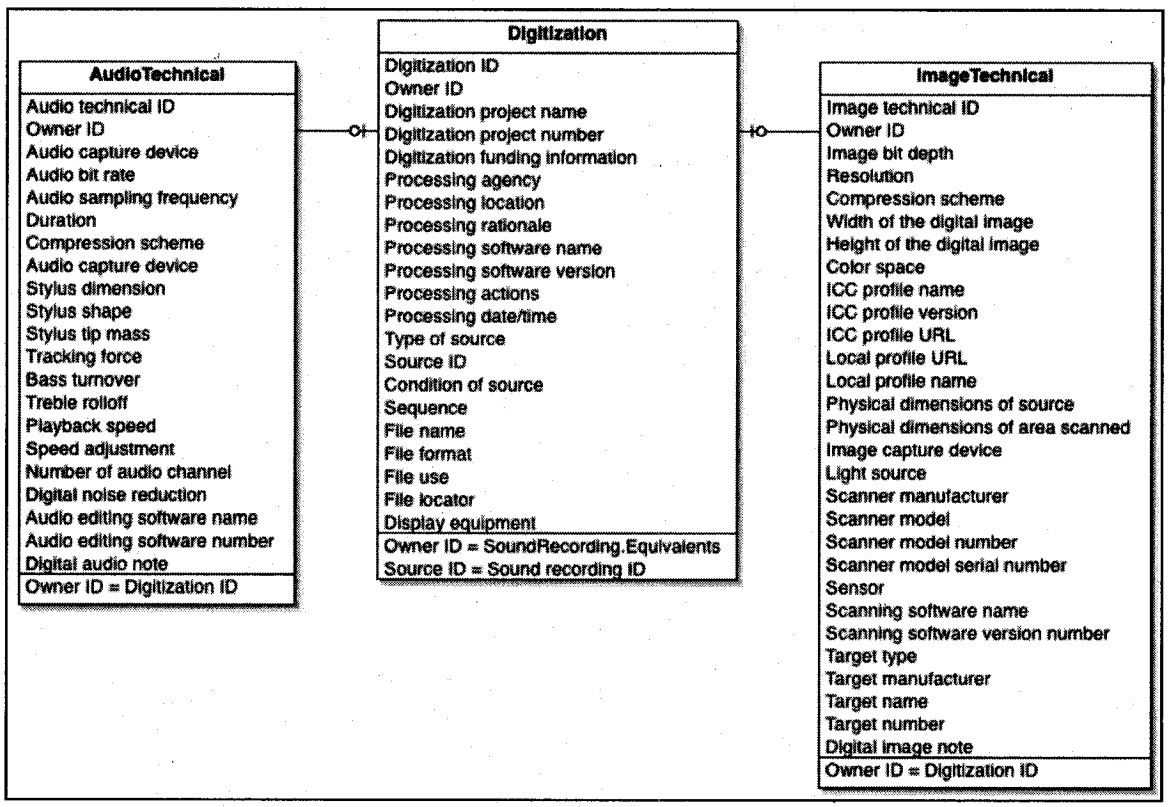
A web data-entry form was implemented in PHP 4.4.1, under OS X, for data and metadata entry. The entry form used check boxes and option buttons whenever possible to reduce typing errors. The form also incorporated dynamic features, allowing multiple entries of one metadata element (e.g., tracks). For data-entry fields that stay unchanged throughout one entire digitization session (e.g., scanning equipment), the form provided auto-fill options to populate the repeating data values. The form, moreover, employed error checking to validate data before submission to a relational database. The data-entry form also provided easy-to-update features to modify existing records stored in the database. A screen shot of the data entry form is included in Appendix E.

6.2.6 Database Design

A relational database in MySQL 4.1.13 was designed and implemented to hold the metadata of phonograph records. The database model reflected class hierarchies presented in the metadata schema designed for phonograph records, using an advanced data modeling tool known as the enhanced entity-relationship (EER) model (Teorey et al. 1986). The EER model is an extension to the entity-relationship (ER) model (Chen 1976) and supports specialization and generalization for class inheritance. The model specifies a

class hierarchy by the creation of a superclass from the common attributes of a collection of subclasses; specialization recognizes a class hierarchy by creation of one or more subclasses of a class with their own individual attributes (Riccardi 2001).

Audio digitization technical metadata and image digitization technical metadata both share some common metadata elements such as project name, project number, producer, and date of digitization. Audio digitization technical metadata and image digitization technical metadata, however, also include metadata elements that only make sense to the individual counter-part (e.g., "audio bit rate" in AudioTechnical and "image bit depth" in ImageTechnical). These properties correspond to the notion of class hierarchies. Therefore, audio digitization technical metadata and image technical metadata were divided into subclasses, AudioTechnical and ImageTechnical, respectively, sharing a common superclass, Digitization. This hierarchy is illustrated in the UML diagram below:



UML diagram showing the Digitization specialization hierarchy.

The design of a specialization hierarchy has several advantages. First, it avoids ambiguity of attributes; for example, differentiating "audio sampling frequency" in AudioTechnical and "resolution" in ImageTechnical is less ambiguous than using a generalized attribute "resolution" with mixed meanings. Second, specialization eliminates unnecessary empty values in database records. For instance, an alternative design model that avoids attribute ambiguities is to include all AudioTechnical and ImageTechnical metadata elements in the same table. When an audio digitization record is created, for example, all the ImageTechnical metadata fields receive empty values, and vice versa. Although storage space is not a major concern, a specialization hierarchy does present a better style of design, encapsulating common properties into superclasses and unique properties into subclasses.

Another enhancement to the EER model was to use union specialization to further specify the information content and behavior of the collection of sound recordings (Riccardi 2001). Modeling unions with specializations allows a class (e.g., Track) to be a subset of a union of super-classes (e.g., Disc, Album, Accompanying Material, SoundRecording, Collection), where the superclass SoundRecording is a union type, including digital objects of various combination of Disc, Album, and Accompanying Material, to represent a Collection as a whole.

However, due to issues of practicability, extensibility, management, and performance, a variation to the data modeling using the union inheritance model with three categories (i.e., Disc, Album, and Accompanying Material) was used. An important component in the initial stage of this pilot project was to record information such as the location of diverse material on the album covers (e.g., photographs) and the text column and typography of the text of the printed material. To capture this structure information, including the placement and typography, Album was further divided into three tables: AlbumFieldData, AlbumCredit, and AlbumImage.

As the figure shown in Appendix F, AlbumFieldData contains the data values of any metadata elements defined in the AlbumField table. Album set title or language are two examples. This structure provides flexibility to include additional metadata elements with no significant changes to the database model, thus ensuring extensibility as the metadata scheme expands. For management consideration, metadata related to album

credit (e.g., name, role, and date associated with name) and album image (e.g., keywords, function, and caption) was encapsulated in two separate tables because these metadata elements become the most usable and meaningful when present in these aggregates. Lastly, managing album information in tables of three different categories facilitates easy information query and retrieval based on metadata type. For example, AlbumFieldData contains description metadata while AlbumCredit contains rights management metadata. Appendix F shows the UML diagram for the Handel LP database design.

To guarantee data accuracy and attain transparency in database design, data verification and database tuning (i.e., configuration of the database to optimize its performance) were conducted iteratively throughout the digitization process for quality assurance and performance considerations.

6.2.7 Metadata Extraction and Text Conversion

Metadata extraction and text conversion, which required much human intervention and a high-level musical and bibliographic knowledge, were performed to facilitate metadata and full-text search and provide ground truth data for future development of automatic document analysis software (Droettboom et al. 2003). Information such as the location of diverse material on the album covers (e.g., phonographs) and the text column and typography of the text of the printed material was meticulously recorded. Text conversion of program notes on album covers and all accompanying material, including markup of font characteristics and structural layout, furthermore, were also manually conducted. Text conversion required typing columns of text that took at least 20 minutes per column of text of approximately 670 words. An average of six hours was needed to process a phonograph album during the pilot study. Although taking the physical measurement was extremely time consuming, even without this requirement, the process would still take about three hours per phonograph album.

6.2.8 Creation of Derivatives

To determine the optimal technical parameters for the creation of derivative service files from the master image and audio files, different technical specifications were examined and developed.

6.2.8.1 Requirements and Evaluation of Digital Images

Three types of derivative files, or access files, were automatically generated: print file (300dpi), web display file (96/120dpi), and thumbnail file (72dpi) with its popup image (600x600 pixels). The requirements for the access file were to meet legibility of the smallest text when displayed online, preserve color appearance, and meet a reasonably fast speed of delivery. A good access image conveys the most desired information given the constraints such as the speed of delivery and user tolerance. Two different specifications, however, were adopted for the creation of access files for images of album covers and images of audio discs due to the inherent differences in the nature of the two types of material. For the album cover, for example, the smallest text was becoming illegible on a standard computer screen at a resolution less than 24bit/96dpi. Therefore, a resolution at 96 dpi was chosen for the access files of album cover images while 120dpi was chosen for the label of the audio disc that often contained very small texts. A special consideration, moreover, was given to the images of audio discs. Specifically, each audio disc was scanned and saved in its entirety during archiving. However, for better display purposes, the access and thumbnail files of audio discs included only the label of the disc, which was cropped from the original scanned images.

To determine the choice of image format for the derivatives, two lossy compression formats, JPEG and GIF, were examined. Since album covers often contain art that consists of many colors, and because GIF is usually recommended for compressing graphics that have large areas of the same color, JPEG was preferred over GIF.

6.2.8.2 Batch-processing of Image Derivatives

The process of creating different versions of images from master files were accomplished automatically using the open-source, cross-platform software ImageMagic. Using UNIX shell scripting, the color separation guide that was included in the original scan was cropped and different versions of derivatives were created. The time to convert a 1200dpi PNG format to JPEG format, for image of one side of an album cover, was about 30 minutes on a computer (2.8GHz Pentium 4) running RedHat Linux 9.0.

6.2.8.3 Requirements Definition and Evaluation of Digital Audio

To provide convenient access over the network, derivative service files of digital audio were created in various levels of fidelity in different formats: WAV files of 16bit/44.1kHz, MP3 files of 192kbps and 112kbps, and Ogg Vorbis files of quality 5. WAV files were created to offer high-quality audio that can be easily used on both Macs and PCs. Access files in MP3 were created in higher and lower fidelities to provide good-quality audio with smaller file sizes. Ogg derivative files were created because the format is completely free, open, unpatented, and it is recently gaining popularity in being included in popular players of both Windows and Mac OS X. Furthermore, Ogg quality 5 is the official setting recommended for representing music of CD quality (Xiph.org 2007).

6.2.8.4 Batch-processing of Audio Derivatives

The process of creating different versions of audio derivatives was accomplished automatically by using the open-source, cross-platform software sndfile-convert, SoX, and LAME. The first step in audio derivative creation was to convert the original 24bit/96kHz AIFF files to 16bit/96kHz AIFF files, which took approximately 50 seconds for one side of an LP disc (about 25 minutes). The second step was to convert the audio sampling rate to 44.1kHz, which took approximately 12 minutes. Derivative files of lower fidelities were subsequently created (i.e., Ogg quality 5 and MP3 of 112kbps and 192kbps). SoX was used to derive Ogg Vorbis files from WAV files and LAME was used for WAV to MP3 con-version. The time needed to convert the specified Ogg file from a 16bit/44.1kHz WAV file of approximately 25 minutes of music was about 4 minutes, and the time used to convert 112kbps and 192 kbps MP3 files was about 3 and 5 minutes, respectively.

6.2.9 Web Delivery

A website implemented in PHP facilitates easy access to the digitized recordings of David Edelberg's Handel LPs. The digital archive is accessible by browsing or searching on any word in the metadata database. Brief records appear in search results and display summaries of the records, including the collection number, album title, series

information, and label issue number. Full records feature the complete record, including all the metadata associated with an LP, links to separated and continuous audio tracks, as well as scanned images of album covers and any accompanying material. Due to variations in computer platform and connection bandwidth, multimedia files in different formats and resolutions are offered to meet diverse user needs. The website is hosted on a RAID 5 server and is mirrored on a duplicate system in a separate building for redundancy and backup.

6.3 Preservation Digitization of a Jazz 78-rpm Collection

A unique set of approximately 3000 jazz recordings from 1930s, 1940s and 1950s in 78-rpm format is currently housed in the Rare Books and Special Collections Room in Marvin Duchow Music Library at McGill University. To improve access to these rare and unique jazz recordings, more than sixty shellac-based 78-rpm records have been digitized.

6.3.1 Planning and Implementation

The digitization workflow of the 78-rpm is similar to that of the David Edelberg Handel LP and involved the following steps: copyright and rights management; 78-rpm equalization curve and 78-rpm playback speed research; analogue-to-digital (A/D) audio conversion; image scanning of record labels; metadata extraction; creation of derivatives; database design, implementation, and maintenance; website design, development, and maintenance. The workflow management system for the digitization of 78-rpm records is included in Appendix G.

6.3.2 Copyright and Rights Management

Although the dates of 78-rpm release were not widely indicated on record labels or album covers, unless renewed or extended copyrights of album records had taken place, most 78s are in the public domain for digitization because the production of 78s had ceased by 1955 (see Chapter 3).

6.3.3 Technical Aspects

Transferring obsolete 78-rpm discs properly requires historical knowledge of the conditions prevailing in and the parameters varied during the generations of these recordings. Some of the most important criteria to consider in efforts to reproduce 78-rpm recordings faithfully include proper playback speed, stylus size, tracking force, and replay equalization.

6.3.3.1 Playback Speed

Although the 78s are referred to as 78-rpm records, the recording speed was not always standardized. The speed varied considerably in the acoustic era because recordings were not produced by electric means until 1926, where prevailing practices were standardized on 78-rpm for electric recordings (more precisely, 78.26 rpm). Determining the correct reproduction speed for a 78-rpm record is time-consuming but critical because slight variations in playback speed affects the recording pitch and can make a noticeable difference to the timbre of a recording. For example, a 5% difference in playback speed results in a difference of approximately a semitone (Library and Archives Canada 2006).

For the digitization of the Jazz 78-rpm recordings, the proper playback speed was determined by first consulting discographies (Bruyninckx 1979; Ruppli 1996; Rust 1982) for the recording date. Recording dates can be found by matching the record label number and matrix number of a phonograph record. When the recording date of a specific phonograph recording was not available, a date was approximated by the record label and matrix numbers in close range, as these numbers were often assigned sequentially. Then guidelines and discussions, such as in (Powell and Stehle 1993), where record label names are typically arranged alphabetically, were used to determine the recording speed by using the recording date and the record label number for the closest match.

6.3.3.2 Stylus Size and Shape

Choosing the appropriate stylus with the proper size and shape is important in obtaining optimum sound quality during reproduction. Depending on the different types

of wear on the discs, tracking different parts of the groove can make a remarkable difference in the quality of reproduction. A variety of stylus sizes have been recommended for 78-rpm records, including spherical or conical styli with a tip radius of 2.5, 2.7, 3.0, or 3.3 mils (Powell 1992). For the digitization of the Jazz 78-rpm recordings, a 2.5 mil spherical stylus was preferred based on a number of subjective aural evaluations (e.g., the presence of noise in sound recordings) by experimenters who have relatively extensive listening experience.

6.3.3.3 Tracking Force

In comparison to the selection for proper playback speed and stylus size and shape, setting the tracking force, i.e., the downward pressure on the stylus, is less controversial. The tracking force is adjusted according to the turntable cartridge and stylus being used. Usually the tracking force lies between 2.5 to 5 grams for 78-rpms whereas the forces used to play LPs typically lies between 0.5 to 1 gram (Willens 1991). To determine and set the tracking force for reproduction of the Jazz 78-rpm recordings, both the turntable manual and the cartridge and stylus manuals were consulted for proper specifications. In order for the stylus to stay and follow properly in the groove while minimizing destruction to the record groove of the 78-rpm records, a tracking force of 2 grams was required for the stylus chosen.

6.3.3.4 Replay Equalization

Reproducing 78-rpm records on modern equipment to get the best sound possible requires matching the playback system to the recording characteristic of the records. For years, due to mechanical reasons, manufacturers of phonograph records reduced the frequencies below 500 Hz (of recorded bass) in electrically recorded discs so that the vibrations of the record grooves would not over cut one another. Some manufacturers, for a different technological reason, also strengthened the frequencies above about 2 kHz (of recorded treble) to provide a clearer and more brilliant sound. To obtain authentic playback of sound as heard during the original recording session, proper playback technique, which applies the exact inverse of the curve used for recording, is necessary to compensate the recording characteristics to restore the bass, midrange and treble balance (Powell and Stehle 1993). The settings and techniques used to achieve the faithful

reproduction of sound from phonograph records are referred to as bass turnover and treble rolloff equalizer settings.

Selecting the proper turnover and rolloff playback equalizer setting is critical but difficult for sound recordings made prior 1953, i.e., because a playback curve, or an equalization curve, was not administered by the Recording Industry Association of America (RIAA) until 1952. Although some manufacturers provided equalization information on the album cover or jacket, often details of a given company's recording techniques were proprietary, thus rarely publicly available. Moreover, some manufacturers even reported use of two or three equalization curves during the period for the purpose of experimentation (Powell and Stehle 1993). If the turnover and rolloff settings are neglected in the reproduction of 78-rpm records, however, the audio characteristics can result in muddy, harsh, or tonally unbalanced sound.

To determine the proper bass turnover and treble rolloff settings for the digital conversion of the Jazz 78-rpm records, label name, label number, matrix number, and issuing company were first obtained from individual records. This information was necessary to determine the dates of recording (rather than the date of release) using discographies such as Bruyninckx (1979), Ruppli (1996), and Rust (1982). When dates were not readily obtainable from discographies, recording dates were either estimated by interpolating dates from known matrix sources or by using the publication date of the music. Equalization was then selected according to the playback equalizer settings recommended in Powell and Stehle (1993) using the exact or closest match to the label name, label number, matrix number, issuing company, and recording date of 78s.

6.3.3.5 Other Equipment Configuration for Proper Playback

Other technical aspects essential to proper playback of phonograph records include details to record cleaning, pickup arm adjustments, cartridge orientation, and correct stylus overhang (e.g., aligning the cartridge to follow the ideal arc across the record to achieve a 1% or lower tracking error). Details concerning the proper equipment setup are available in Powell (1992).

6.3.4 Digitization

The digitization procedure for the reformatting of the Jazz 78-rpm records was similar to the production workflow of the digital archive of the Handel collection (see Section 6.2.4). Special technical attention, however, was placed on fine-tuning the speed of the turntable using a strobe disc and a neon or fluorescent light to set the proper equalization for playback.

6.3.5 Content Management

Since some of the records in the Jazz 78-rpm collection have already been cataloged in the online library catalog MUSE of McGill University, a program written in PHP 4.4.1, under OS X, was implemented to automatically transfer the existing bibliographic records into a database dedicated for the digital archive of the Jazz 78-rpm collection. A web data-entry form, which was similar to the data entry form developed for the digitization of the David Edelberg Handel LP (see Section 6.2.5), was also implemented in PHP for additional data and metadata entry,

6.3.6 Database Design

A relational database in MySQL was designed and implemented to hold the metadata of the digitized material. A simplified database design was adopted for the digital archive of the Jazz 78-rpm Collection, in comparison to the digital archive of the Handel LP Collection. The EER model, which supports specialization and generalization for class inheritance as previously discussed in Section 6.2.6, was reduced to a minimum hierarchical model, consisting of five relational tables: phonograph record, digital phonograph recording, metadata, instances of metadata, and provenance of data. Although this relational design follows loosely to the categorization of the underlying data model of the metadata for phonograph records, the database design minimizes complex dependencies among database tables and improves retrieval performance, in the case of advanced search, via indexing by metadata field. The relational database design for the digital archive of the Jazz 78-rpm records is included in Appendix H.

6.3.7 Metadata Extraction and Text Conversion

The manual entry of metadata for the collection of 78-rpm Jazz records took considerably less time in comparison to the metadata extraction and text conversion of the Handel digitization project because bibliographic data readily available in the online library catalog MUSE of McGill University were imported into the database automatically. Moreover, since a 10-inch 78-rpm record can hold only about three minutes of music on a side in comparison to a 12-inch LP disc, which can provide up to one half hour of music per side, the efforts required to enter metadata for 78-rpm discs were relatively less intense.

6.3.8 Creation of Derivatives

Image and audio formats were optimized for different purposes. Different technical specification were examined and developed for the derivative files for web access and print, using the same methodologies described in Section 6.2.8. Evaluation criteria for technical specification for image derivatives included attention to the legibility of the smallest text, preservation of color appearance, and speed of delivery. Four types of derivative files were generated in JPEG: A print file (300 dpi), a web display files (90 dpi), and a thumbnail file (72 dpi) with its popup image (600x600 pixels). In addition, access or derivative audio files were created in various levels of fidelity in different formats: MP3 files of 112kbps and 192kbps, WAV files of 16bit/44.1kHz, and Ogg Vorbis files of quality 5.

6.3.9 Web Delivery

A website implemented in PHP was developed to facilitate easy access to the digitized recordings of jazz 78-rpm records. The digital archive is accessible by browsing song titles or searching on any word in the metadata database. Brief records appear in search results and display summaries of the records, including the collection number, titles of musical works, label name and issue number, and artist information such as composer and instrument group. Full records feature the complete record, including access to image and audio files, all the metadata associated with the record, as well as the provenance of data. Documenting the provenance of data is important in the context of

digital preservation because it reveals the authenticity and credibility of the data derived from external sources (e.g., recording date information from discographies, equalization settings from audiophile's guide) and the quality of the decisions made regarding technical parameters, which often involved subjective evaluations (e.g., selection of stylus), which, in turn, enables an ethical approach to music archiving.

Chapter 7 Conclusions and Future Work

7.1 Summary and Conclusions

The preservation needs of historical and rare collections of phonograph records have recently been acknowledged at the highest levels of government in the U.S. (Library of Congress 2006a) and Canada (Audio-Visual Preservation Trust of Canada; Library and Archives Canada 2006). Cultural heritage institutions have initiated programs for digital audio preservation because the endangered state of the world's audio heritage and the growing acceptance that audio materials form an essential component of the collective memory confirm the need for active preservation in the digital domain (Pymm 2006). Unlike the generational losses inherent in the duplication of analogue media such as discs and cassette tapes, digitization provides substantial improvements in features with no loss of content information (Gladney 2001; Smith 1999). Cultural institutions, thus, have come to support digitization of phonograph records as a viable strategy for preserving their cultural value and providing wider access to these records at the same time. The digitized phonograph records described here include not only collections of sound files but also digital images of album covers, record labels, and accompanying materials such as liner notes. Due to the complexity of the interdependencies and loose coupling between these digitized representations of phonograph records, building digital libraries of phonograph records requires a different approach and considerably more extensive metadata than the typical system in use today to manage collections of physical materials.

This dissertation presents a new metadata design to assist in the consistent creation of digital libraries of phonograph records. The Metadata provides digital libraries with an effective tool for the description, discovery, management, control, delivery, and sharing of digital phonograph recordings. This new design offers a better approach for maintaining, using, and ensuring the long-term viability of digital phonograph record libraries. The Metadata encompasses traditional cataloging information and also additional information needed to construct, preserve, and control access to the presentation of phonograph records online. The Metadata is accompanied by a Metadata Dictionary, a descriptive source providing precise syntactic and semantic meaning of the

metadata elements to guide digitizers working on the digitization projects in the libraries, archives, museums, and other heritage sectors.

7.2 Research Contribution

The Metadata and Metadata Dictionary aim to promote the advancement of efficient and effective retrieval of music information about phonograph records. Although traditional standards for cataloging music recordings exist, they only provide rules for annotating basic physical and bibliographic attributes of music recordings, and are inadequate for digitized representations of phonograph records. Moreover, the conventional online catalogs of musical works to date do not have the capability to allow comprehensive searching of music attributes on music recordings. The Metadata addresses these problems and is designed to optimize the search and retrieval of phonograph records and captures data in the finest level of granularity possible to provide search features currently missing in modern-day online catalogs. These features include searching for performer or conductor names on separate works in the same album, performing full-text searches of liner notes, and searching by description or keywords of photos and artwork on album covers. In addition to improved search functionalities, the Metadata and Metadata Dictionary also act as an intermediary for semantic interoperability between heterogeneous resource description models. In the construction of distributed digital music libraries and archives, institutions are likely to use different metadata standards for the encoding of their information resources. The creation and maintenance of the Metadata Dictionary improve data validity and reliability within and across metadata systems. The specifications for each metadata element in the Metadata Dictionary, for example, standardize data and enhance interoperability across and outside the systems. Standardizing data content and data definitions, furthermore, provides a common roadmap among digital repositories, promoting consistency across applications in support of interoperable digital library services.

The Metadata and Data Dictionary developed here not only facilitate the digitization process for building online collections of phonograph records, but they also provide annotation framework tools for creating ground-truth data essential for developing an automated metadata and content capturing system. Much of the efforts in

the initial stages of the pilot digitization project went into creating ground-truth data, and metadata such as the location of a photo on the album cover and the text column and typography of the title on the record label had been encoded for analysis in automatic document analysis software. The design of the Metadata and Data Dictionary enables the capture of ground-truth data and provides a foundation for facilitating automatic extraction of metadata from record labels (Li et al. 2006), album covers, or liner notes.

Finally, the usefulness of the Metadata and Metadata Dictionary has been demonstrated in the completion of McGill University's Handel LP (Lai et al. 2005; Lai and Fujinaga 2006a) and Jazz 78-rpm digitization projects. These projects used the Metadata and Metadata Dictionary developed for the encoding of metadata about LPs and 78s. The results of these projects are two unique and valuable digital music archives, with unprecedented features such as searchable metadata that describe information pertaining to the digital phonograph recordings and full-text searching of content in historic audio collections. As librarians and archivists continue to recognize the need to digitize their analogue sound recordings, the need for digitization tools will increase. The methodology and tools developed here are valuable to other libraries and archives, and will hopefully promote similar digital archiving projects.

7.3 Future Research

The pace of change in digital library technology and its applications has accelerated in recent years, shifting from text and image-based systems to audiovisual multimedia solutions. As more institutions adopt best practices for digitization, metadata encoding, and other key digital library processes, other emerging digital library trends will become available and continue to expand. When these digitization projects shift from experimental prototypes to mainstream libraries, the research to support these next generation digital libraries will focus on standardization, usability, a metadata infrastructure for sound recordings, and the development of digital library tools.

7.3.1 Standardization

The preliminary versions of the Metadata and Metadata Dictionary are subject to review and modification because they present only a basis for future standardization

within the archival context of phonograph records. Although the Metadata and Metadata Dictionary have been used and tested for McGill University's two pilot projects for the digitization of phonograph records, the Metadata Dictionary still needs to be evaluated in future digitization projects (Lai et al. 2005; Lai and Fujinaga 2006a). The design is not intended to be final but, rather, to provide a starting point for making improvements to digital library services. The most immediate future research to be performed involves the implementation of the Metadata Dictionary in an XML-based format that facilitates the exchange of metadata information between digital repositories.

7.3.2 Usability

While best practices for digitization and metadata standards are crucial to libraries and other institutions in their preparation of undertaking digital conversion of collections, formal measure initiatives and statistics must also exist for these institutions to assess the benefits and effectiveness of an implemented system. Although libraries have excelled at evaluating the development and use of their traditional collections and services, comparable assessment of the usability of digital libraries is more complex and less well understood (Covey 2002). Since the needs and expectations of digital library users are new and changing, libraries must acquire effective methodologies to capture new user requirements and evaluate implemented services. A standardized evaluation guideline based on empirical evidence is necessary to determine the best practices and develop systematic guidelines for developing digital libraries of phonograph records. These guidelines should focus on areas such as the effectiveness of the overall digitization workflow management system, the effectiveness of the new metadata design, ease of use (user friendliness) of the web delivery system (e.g., validating metadata names tailored to human-oriented label with real users), and the usability (e.g., eligibility of images and quality of audio) of the digital surrogates created.

The challenges in evaluating digital libraries involve gathering meaningful and purposeful data, acquiring methodological guidance to conduct needs assessment, and managing, organizing, and interpreting statistics for evaluation (Covey 2002). Therefore, an avenue for future research is the development of effective methods to capture the needs requirements and to evaluate the usability of features offered in digital libraries of

phonograph records. Methods such as transaction log analysis (Bainbridge 2000), heuristic evaluations (Nielsen 1993), competitor analysis of similar websites (Hackos and Redish 1998), online and offline surveys and questionnaires (Shneiderman and Plaisant 2005), interviews of representative research subjects with defined user tasks, scenario, and persona (Hackos and Redish 1998), and focus group where subjects are asked to think aloud while performing designated tasks (Nielsen 1993), can be used in a sequence of studies to create a better understanding of users needs in the context of digital libraries of phonograph records.

7.3.3 Metadata Infrastructure for Sound Recordings

Another direction for future research is to provide better services for library patrons by building a metadata infrastructure for sound recording collections. Recently, new technologies have been developed to support the digital libraries of the future, where digitized objects can be easily searched and located. For example, affiliates of the Sheet Music Consortium have digitized large quantities of sheet music, and a significant percentage of this digitized material is currently accessible via an online portal at UCLA, providing patrons with access to seven sheet music collections (i.e., Duke University, Indiana University, Johns Hopkins University, Maine Music Box, National Library of Australia, UCLA Archive of Popular American Music, and Library of Congress) from one location. Unlike the sheet music collection, no infrastructure is currently in place to support searching multiple digital collections of sound recoding from one central portal. (e.g., Digital libraries of sound recordings from the Frontera Collection of Mexican Music, FolkwaysAlive! project at University of Alberta, and the Variations and Variations2 projects at Indiana University exist, but no interface exists to search all of these digital contents at the same time). As more digital sound recording collections emerge, the task of searching each individual site becomes laborious and impractical for end-users. Users have to use distinct interfaces located at different sites, having to learn multiple interfaces that may be designed with different features, functionalities, and interaction metaphors. Users must also manually combine search results and merge results from applications. Moreover, users may have to meet repeated authorization requirements (i.e., enter logins and passwords) and learn to modify search queries in

different ways in order to search from different content providers. The benefits of a distributed search (i.e., a Web portal) that hides the difference in the mechanics of interactions from users and facilitates the flow of data across multiple repositories in the background are clear. Therefore, a metadata infrastructure that improves and enables interoperability among digital collections of sound recordings via an integrated search portal across multiple repositories will be an exciting avenue of future research.

7.3.4 Development of Digital Library Tools

Lastly, due to the enormous quantity of existing phonograph records and the time required to properly and faithfully digitize them, another future area for research is in the development of cost-effective tools for institutions interested in starting digitization programs. Building upon the ground-truth data of phonograph records already captured, similar software tools to automatically or semi-automatically perform metadata extraction can be developed. By integrating sophisticated pattern recognition systems or document analysis techniques, metadata from the captured images of album covers and liner notes can be extracted automatically, thus reducing the amount of time investment and human labor required for the task. As new digital library tools become available to assist digitization projects, more collections of phonograph recordings may be digitally preserved in a more cost-effective manner and be made available online for the ultimate benefit of scholarship and learning.

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Appendix A

The metadata for phonograph records currently contains more than 350 metadata elements. The metadata schema provides for complete auditory, pictorial, and textual content analysis. The complete set of metadata elements describing phonograph records is listed below by type:

1. Administration Metadata (Total: 69)
1.1 Administration Metadata: General
Transcriber Information
Transcription Date/Time
Provenance of Data
Type of Provenance of Data
Provenance of Data Note
Last Record Update
Record Status

1.2 Administration Metadata: Digital Library Entity
Digitization Project Name
Digitization Project Number
Digitization Funding Information
Abstract of Collection
Extent of Collection
Appraisal Information of Collection
Processing Information of Collection
Restrictions on Access to Collection
Restrictions on Use to Collection

1.3 Administration Metadata: Phonograph Record Entity
Physical Identification
Archival Reference
Bibliographic Reference
Restrictions on Access to Item
Restrictions on Use to Item
Alternative Form Available
Condition
Holding Status of Item
Source of Acquisition of Item
Custodial History of Item
Public Domain

1.4 Administration Metadata: Digitization Event Entity
Processing Agency
Processing Location
Processing Rationale
Processing Software Name
Processing Software Version
Processing Actions
Processing Date/Time
Type of Source
Type of Source ID
Source ID
Condition of Source

1.5 Administration Metadata: Digital Object of Phonograph Record Entity
Object Identifier Type
Object Identifier Value
File Type
File Sequence
File Size
Format Name
Format Version
Format Registry Name
Format Registry Key
Byte Order
File Name
File Use
File Locator
Display Equipment
Number of Accesses
Restrictions on Access to File

1.6 Administration Metadata: Person/Organization Entity
Uniform Name
Variant Name
Transcribed Name
Date
Dates of Flourishing
Variant Date
Place of Origin
Address
Email
Phone
Person/Organization Note
Related Resources

1.7 Administration Metadata: Creation/Performance/Recording/ Production Event Entity
Event Date/Time
Event Participation/Role
Event Participation Detail

2. Description Metadata (Total: 213)
2.1 Description Metadata: Phonograph Record Entity
Album Set Title
Album Set Alternative Title
Album Set Parallel Title
Album Set Variations in Title
Other Title Information
Statement of Responsibility
Title of Larger Work
Series Title
Parallel Title of Series
Other Title Information of Series
Numbering within Series
Statement of Responsibility relating to Series
Language
Medium of Performance
Alternate Issues
International Standard Recording Code (ISRC)

International Standard Serial Number (ISSN)
Generic Label/Publisher Name
Transcribed Label/Publisher Name
Label Number
Matrix Number
Miscellaneous Number
Edition
Edition Statement
Edition, Issue, and History Notes
Parallel Edition Statement
Additional Edition Statement
Local Subject
Place Name Subject
Other Geographic Subject
Temporal Subject
Form/Genre
Topical Subject
Name as Subject
Number of Audio Disc
Number of Accompanying Material
Extent
Price Information
Program Note
Musical Work Note
Artist Note
Lyric Note
Libretto Note
Composer Information
Composer Participation Information
Performer Information
Performer Participation Information
Conductor Information
Conductor Participation Information
Instrument Group Information
Instrument Group Participation Information
Chorus Information
Chorus Participation Information
Recording Engineer Information
Recording Engineer Participation Information
Librettist Information
Librettist Participation Information
Lyricist Information
Lyricist Participation Information
Arranger Information
Arranger Participation Information
Accompanying Material Writer Information
Accompanying Material Writer Participation Information
General Material Designation
Specific Material Designation
Statement of Speed
Statement of Configuration of Playback Channels
Statement of Groove width
Statement of Dimension
Statement of Kind of Material
Statement of Kind of Cutting
Statement of Special Playback Characteristics

Statement of Capture and Storage Technique
Date of Publication
Date of Recording
Date of Copyright
Date of Creation (of unpublished item)
Publication Place
Distributor
City (where distributor based)
Manufacture Name
Manufacture Place
Manufacture Date
Recording Location
Recording Company
Circumstance of Recording
Copyright/Restrictions Information
Statement of Advertisement
Statement of Warning
Statement of Handling Instruction
Statement of Reviews
Statement of Disclaimer
Statement of Attribution and Conjectures
Duration
Phonograph Record Note
Phonograph Record Peculiarity Note

2.2 Description Metadata: Album Entity
Classification
Album Designer Information
Album Designer Participation Information
Place of Creation
Creation Culture
Styles/Periods/Groups/Movements Description
Styles/Periods/Groups/Movements Indexing Terms
Measurements/Dimension Description
Material and Techniques Description
Subject Matter Display
Subject Matter Indexing Terms
Subject Matter Interpretive History
Album Note

2.3 Description Metadata: Artwork Entity
Artwork Type
Artwork Measurements
Artwork Technique
Caption
Artist Information
Artist Participation Information
Style/Period
Culture
Subject
Relation
Description of Artwork
Artwork Note
Artwork Peculiarity Note

2.4 Description Metadata: Accompanying Material Entity
Accompanying Material Type
Accompanying Material Content
Language Usage
Physical Dimension of Accompanying Material
Statement of Responsibility of the Accompanying Material
Librettist Information
Librettist Participation Information
Lyricist Information
Lyricist Participation Information
Accompanying Writer Material Information
Accompanying Writer Material Participation Information
Designer Information
Designer Participation Information
Illustrator Information
Illustrator Participation Information
Accompanying Material Note
Accompanying Material Peculiarity Note

2.5 Description Metadata: Audio Disc Entity
Disc Number
Side
Number of Tracks
Matrix Number
Miscellaneous Number
Type
Dimension
Groove Characteristics
Playback Speed
Playback Mode (mono, stereo)
Statement of Responsibility
Statement of Production Information
Statement of Publication Information
Statement of Distributor Information
Statement of Manufacture Information
Date of Recording
Recording Location
Recording Company
Circumstance of Recording
Recording Engineer Information
Recording Engineer Participation Information
Performer Information
Performer Participation Information
Duration
Statement of Copyright/Restrictions on Audio Disc Label
Audio Disc Note
Audio Disc Peculiarity Note

2.6 Description Metadata: Track of Performance Entity
Track Title
Track Number
Date or Recording
Recording Location
Place of Recording
Recording Company
Circumstance of Recording

Performer Information
Performer Participation Information
Conductor Information
Conductor Participation Information
Instrument Group Information
Instrument Group Participation Information
Recording Engineer Information
Recording Engineer Participation Information
Arranger Information
Arranger Participation Information
Other Contributor Information
Other Contributor Participation Information
Track Duration
Track Note
Track Peculiarity Note

2.7 Description Metadata: Musical Work Entity
Type (single or collective)
Uniform Title
Variant Title
Composer Information
Composer Participation Information
Librettist Information
Librettist Participation Information
Lyricist Information
Lyricist Participation Information
Date of Composition
Place of Composition
International Standard Work Code (ISWC)
Performing Rights Society Work Number
Date of First Performance
Date of First Publication
Language
Subject Heading
Instrumentation
Form/Genre/Style
Key
Topical Subject
Name as Subject
Place Name Subject
Other Geographic Subject
Temporal Subject
Musical Work Note

3. Legal Right Metadata (Total: 9)
3.1 Legal Right Metadata: Right Entity
Copyright/Restrictions Statement
Licensing Statement
Registration Notices Statement
Copyright/Restrictions Inception Date
Copyright/Restrictions Expiration Date
Restriction Territory
Registration Number
Registration Type
Copyright/Restrictions Note

4. Structure Metadata (Total: 11)
4.1 Structure Metadata: General
Font
Font Style
Font Size
Width of the Structural Dimension of a Unite/Block/Section of Data
Height of the Structural Dimension of a Unite/Block/Section of Data
X Coordinate of the Top Left Corner of the Unit of Data
Y Coordinate of the Top Left Corner of the Unit of Data

4.2 Structure Metadata: Digital Object of Phonograph Record Entity
ID
Sequence
Owner ID
Equivalents

5. Technical Information Metadata (Total: 55)
5.1 Technical Information Metadata: Digital Object of Phonograph Record Entity- General
Conservation/Preservation Treatment
Conversation Treatment Note
Post Processing
Post-Processing Note
Change History
Display Equipment

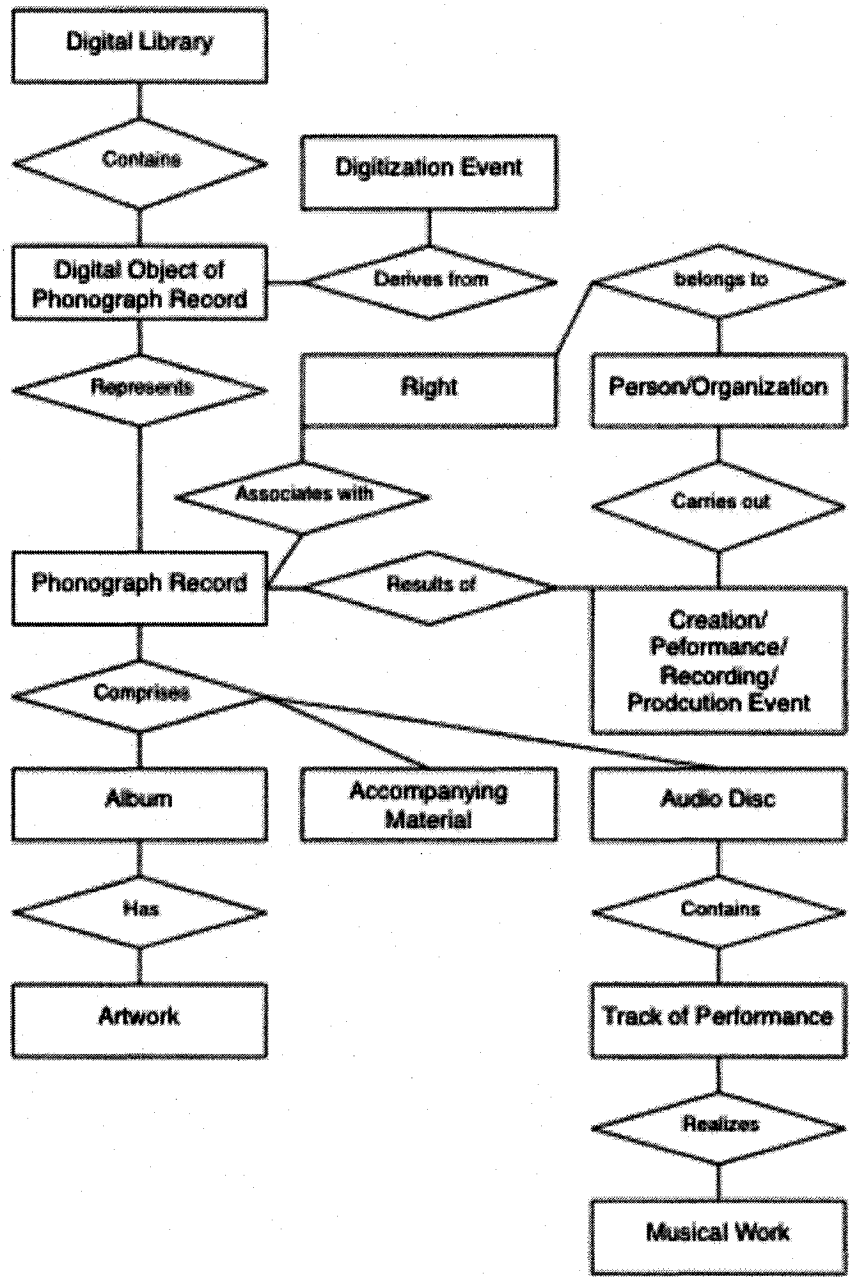
5.2 Technical Information Metadata: Digital Object of Phonograph Record Entity- Audio
Audio Bit Depth
Sampling Frequency
Duration
Compression Scheme
Audio Capture Device
Stylus Dimension
Stylus Shape
Stylus Tip Mass
Tracking Force
Tonearm and Cartridge Alignment
Anti-skate
Bass Turnover
Treble Rolloff
Playback Speed
Speed Adjustment
Number of Audio Channel
Digital Noise Reduction
Audio Editing Software Name
Audio Editing Software Version Number
Digital Audio Note

5.3 Technical Information Metadata: Digital Object of Phonograph Record Entity- Image
Image Bit Depth
Resolution
Compression Scheme
Width of the Digital Image
Height of the Digital Image
Display Orientation
Color Space
ICC Profile Name

ICC Profile Version
ICC Profile URL
Local Profile URL
Local Profile Name
Physical Dimensions of Source
Physical Dimensions of Area Scanned
Light Source
Image Capture Device
Scanner Manufacturer
Scanner Model
Scanner Model Number
Scanner Model Serial Number
Maximum Optical Resolution
Sensor
Scanning Software Name
Scanning Software Version Number
Target Type
Target Manufacturer
Target Name
Target Number
Digital Image Note

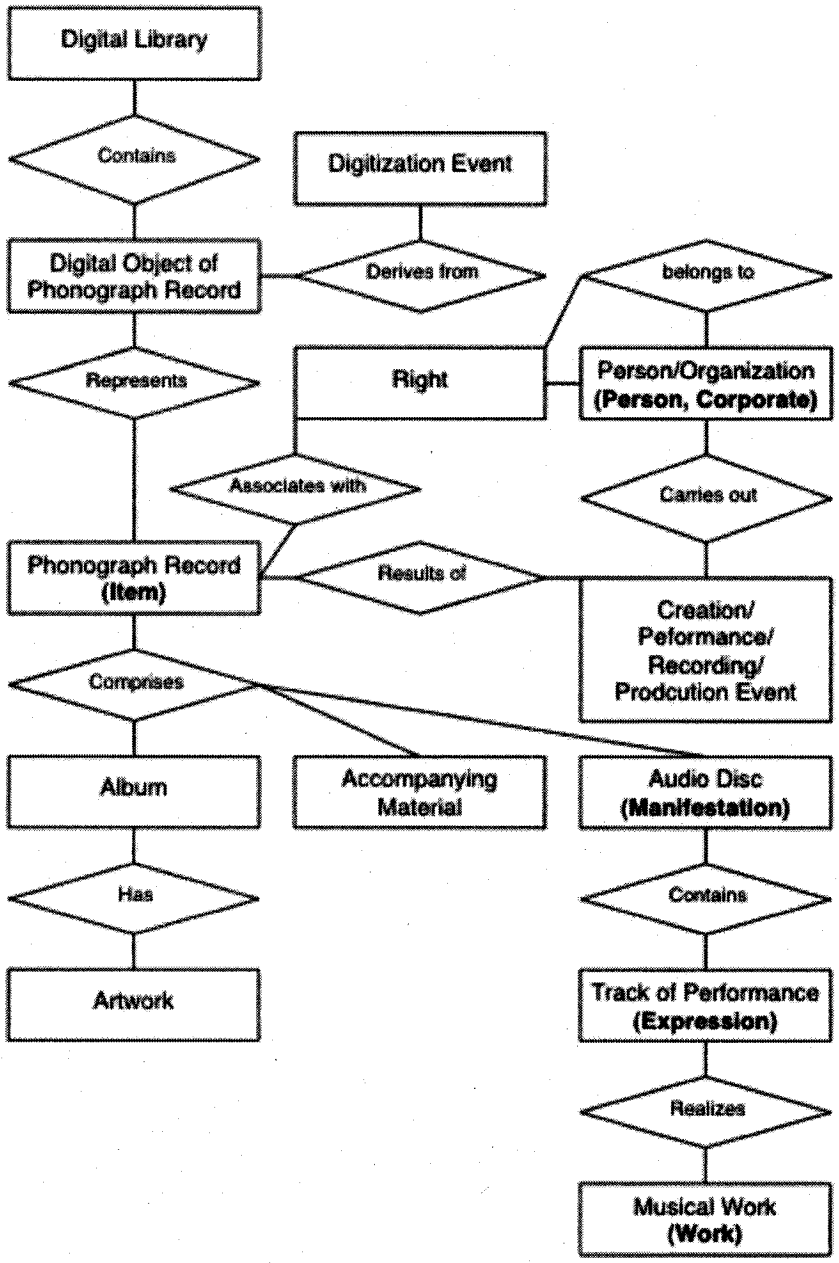
Appendix B–1

The Entity-Relationship Data Model of the Metadata:



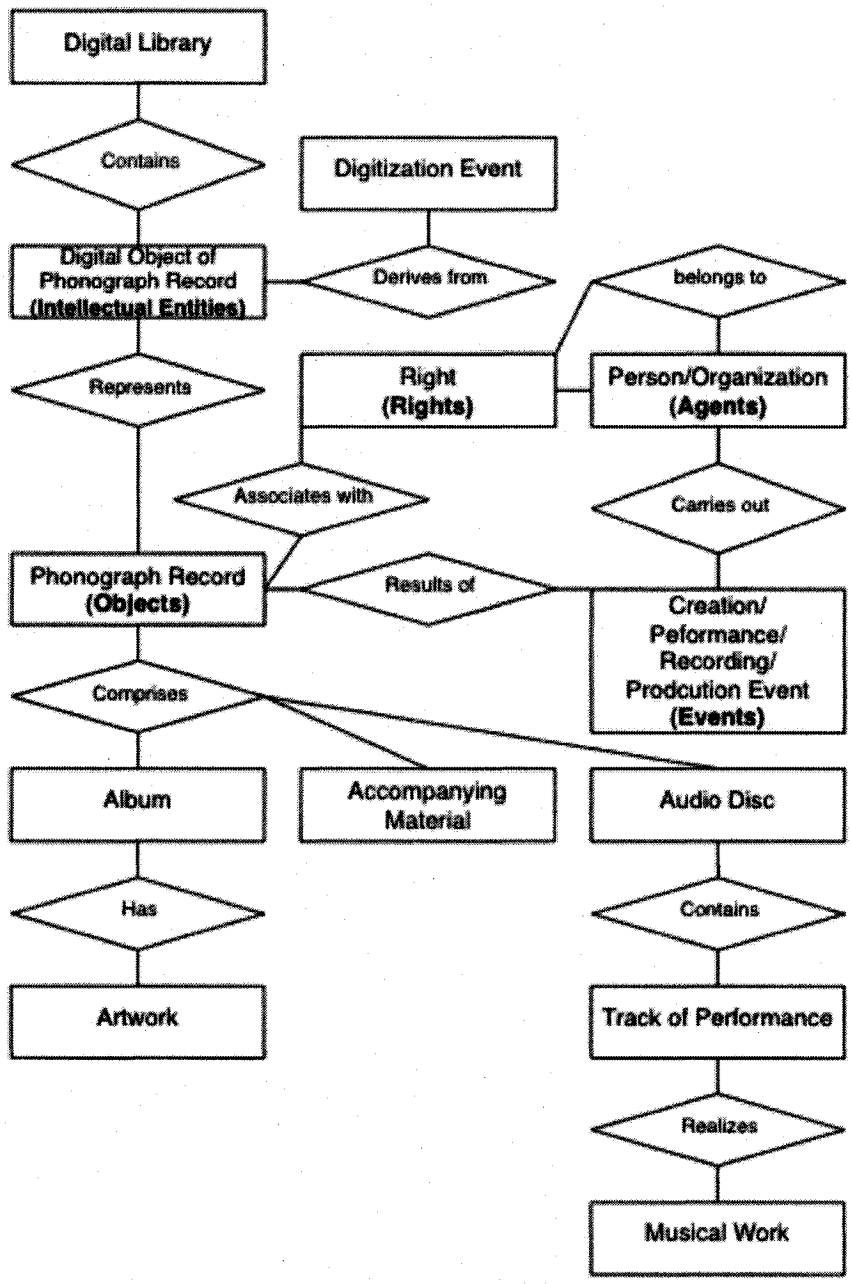
Appendix B–2

The Entity-Relationship Data Model of the Metadata with Highlight of the conceptual model of FRBR:



Appendix B–3

The Entity-Relationship Data Model of the Metadata with Highlight of the PREMIS data model:



Appendix C

Metadata Dictionary for Phonograph Records:

1. Field Reference

Field Name	The field name is a unique name of a metadata element within the Matadata Dictionary.
Definition	The definition field provides semantic meaning of metadata elements to make distinctions among metadata terms.
Multiplicity	The multiplicity field indicates the possible number of data entries for each metadata element. The value "0...many" indicates that the metadata is not required and may be repeated, the value "0...1" indicates that the metadata is not required and may not be repeated, and the value "1" indicates that the metadata is required and may not be repeated.
Data type	The data type field indicates the format in which the data is to be entered into the system and indicates any vocabulary controls (e.g., Library of Congress Subject Headings) enforced.
Label	The label field dictates the way that a metadata element is presented on a computer display interface, i.e., the display name.
Provenance	The provenance field pertains to the derivation history of a metadata element from its original source(s), including its unique identification, if available.
Examples or notes	The examples or notes field suggests encoding guidelines by providing examples of usage and describing the nature and properties of a metadata element. *Examples are in italics.*
Data constraints	The data constraint field indicates the scope of a metadata element.
Version tracking	The version-tracking field supports changes in data management, semantic evolution, and new technical requirements. The issued date, modified dates, replacement, or the deprecation of fields are provided when applicable.

2. Data Type

Data Type	Definition
Copyright/Restrictions	A Copyright/Restrictions Record comprises the following metadata: Copyright/Restrictions Statement Copyright/Restriction Expiration Date Copyright/Restriction Inception Date Licensing Statement Restriction Territory Registration Number Registration Type Copyright/Restrictions Note
Date	Based on the representations of ISO 8601: YYYY-MM-DD, or YYYY-MM, or YYYY
DateRange	Various forms of the Date–Date formats, e.g., YYYY-MM-DD–YYYY-MM-DD or YYYY–YYYY.
DateTime	The representations of ISO 8601: YYYY-MM-DD HH:MM:SS (with hours 0-24), YYYY-MM-DD, YYYY-MM, or YYYY.
Number	A positive integer.
Participation	A Participation Record comprises the following metadata: Event Date/Time Event Participation/Role Event Participation Detail
Person/Organization	A Person/Organization Record comprises the following metadata: Uniform Name

	Variant Names Transcribed Names Date Dates of Flourishing Variant Dates Place of Origin Address Email Phone Person/Organization Notes Related Resources
PositiveReal	A positive real number.
TypedDate	A TypedDate Record comprises the following metadata: Date (in the format of Date or DateRange) Type
Reference	A single pointer to another object.
Resource	A unique identification for a resource over the network such as a URL.
String	One or more alphanumeric characters.

3. Metadata Elements

3.1 Administration Metadata

3.1.1 Administration Metadata: General

Field Name	transcriberInformation
Definition	Provide information about a transcriber in charge of metadata and data entry.
Multiplicity	1
Data type	Person/Organization
Label	Transcriber Information
Provenance	Modified from *Variations2* data type "Contribution."
Version tracking	Issued on 2005-02-03

Field Name	transcriptionDateTime
Definition	Indicate the date/time that a metadata record was created by a transcriber.
Multiplicity	1
Data type	DateTime
Label	Transcription Date/Time
Provenance	Modified from *Variations2* metadata "Record Creation."
Version tracking	Issued on 2005-02-03

Field Name	provenanceData
Definition	Specify the source that the data is derived.
Multiplicity	0…1
Data type	String
Label	Provenance of Data
Examples or notes	*from album cover* *from container* *from accompanying typewritten notes* *from disc record label* *from* [URI to an existing record, such as a library bibliographic record] *from* [Standard reference to publications, such as a book, periodical, magazine, etc.] *from* [URL to a Website]
Version tracking	Issued on 2005-02-03 Modified on 2007-05-03

Field Name	typeProvenanceData
Definition	Specify the type of the source that the data is derived.
Multiplicity	0…1
Data type	String
Label	Type of Provenance of Data
Examples or notes	Suggested values: *bibliographic record* *described item* *publication* *website*
Version tracking	Issued on 2005-02-03

Field Name	provenanceDataNote
Definition	Provide notes about the provenance of data.
Multiplicity	0…many
Data type	String
Label	Provenance of Data Note
Version tracking	Issued on 2005-02-03

Field Name	lastRecordUpdate
Definition	Indicate the date/time of the most recent update of a metadata record.
Multiplicity	1
Data type	Date/Time
Label	Last Record Update
Provenance	Adopted from *Variations2* metadata "Last Record Update."
Version tracking	Issued on 2005-10-10

Field Name	recordStatus
Definition	Specify the status of the record using record status descriptors.
Multiplicity	0…1
Data type	String
Label	Record Status
Provenance	Adopted from *Variations2* "Record Status."
Examples or notes	Suggested values: *Available to the public* *Not available to the public*
Version tracking	Issued on 2005-10-10

3.1.2 Administration Metadata: Digital Library Entity

Field Name	digitizationProjectName
Definition	Provide the name of the digitization project.
Multiplicity	1
Data type	String
Label	Digitization Project Name
Examples or notes	*Digitization of the David Edelberg Handel LP Collection*
Data Constraints	Digital library only
Version tracking	Issued on 2004-07-13

Field Name	digitizationProjectNumber
Definition	Provide the assigned project number associated with a digitization project.
Multiplicity	0…1
Data type	String
Label	Digitization Project Number
Data Constraints	Digital library only

Version tracking	Issued on 2004-07-13

Field Name	digitizationFundingInformation
Definition	Provide information about the funding or other financial resources available in support of the digitization project.
Multiplicity	0…1
Data type	String
Label	Digitization Funding Information
Data constraints	Digital library only
Version tracking	Issued on 2004-07-13

Field Name	abstractCollection
Definition	Provide a brief summary of the materials being described, used primarily to encode bits of biographical or historical information about the creator and abridged statements about the scope, content, arrangement, or other descriptive details about the collection.
Multiplicity	0…1
Data type	String
Label	Abstract of Collection
Provenance	Adopted from EAD element <abstract>.
Examples or notes	*Montrealer David Edelberg was by profession the president of his own engineering firm and by nature one of Canada's most passionate Handelians. At the center of his tireless devotion to Handel's celebrated musical genius lay his efforts to assemble the world's most complete collection of Handel long-playing (LP) records David Edelberg started collecting in the mid-1970s. Over the subsequent fifteen years the collection grew rapidly, and by 1989 comprised nearly 3,000 sound recordings.*
Data constraints	Digital libraryonly
Version tracking	Issued on 2004-07-13

Field Name	extentCollection
Definition	Provide information about the quantity of the materials being digitized.
Multiplicity	0…1
Data type	String
Label	Extent of Collection
Provenance	Modified from EAD element <extent>.
Examples or notes	*112 LPs.*
Data constraints	Digital library only
Version tracking	Issued on 2004-07-13

Field Name	collectionAppraisalInformation
Definition	Provide information about the process of determining the archival value and thus the disposition of records based upon their current administrative, legal, and fiscal use; their evidential, intrinsic, and informational value; their arrangement and condition; and their relationship to other collections.
Multiplicity	0…many
Data type	String
Label	Appraisal Information of Collection
Provenance	Modified from EAD element <appraisal>.
Examples or notes	*This collection was re-appraised by library staff at the Marvin Duchow Music Library at McGill University in 2003. More than 150 LPs in the collection are now in the public domain. These unique recordings are in good condition and should be digitized for the ultimate benefit of scholarship and learning.*
Data constraints	Digital library only
Version tracking	Issued on 2004-07-13

Field Name	processingInformationCollection
Definition	Provide information about accessioning, arranging, describing, preserving, storing, or otherwise preparing the described materials for digitization.
Multiplicity	0…many
Data type	String
Label	Processing Information of Collection
Provenance	Modified from EAD element <processinfo>.
Examples or notes	*The LP portion of the collection was cataloged by Ichiro Fujinaga. The catalog was converted into a searchable sound recording database by Mohammed Ali Abbas.*
Data constraints	Digital library only
Version tracking	Issued on 2004-07-13

Field Name	restrictionsAccessCollection
Definition	Specify information about conditions that affect the availability of the collection being described. May indicate the nature of restrictions imposed by the donor, legal statute, repository, or other agency. May also indicate the lack of restrictions.
Multiplicity	0…1
Data type	String
Label	Restrictions on Access to Collection
Provenance	Modified from EAD element <accessrestrict>.
Examples or notes	*There are no access restrictions on this collection.* *The collection is available for consultation inside the Music Library only.*
Data constraints	Digital library only
Version tracking	Issued on 2004-07-13

Field Name	restrictionsUseCollection
Definition	Specify information about conditions that affect use of the collection after access has been granted. May indicate limitations, regulations, or special procedures imposed by a repository, donor, legal statute, or other agency regarding reproduction, publication, or quotation of the described materials. May also indicate the absence of restrictions, such as when copyright or literary rights have been dedicated to the public.
Multiplicity	0…many
Data type	String
Label	Restrictions on Use to Collection
Provenance	Modified from EAD element <userestrict>.
Examples or notes	*Until 2015 permission to digitize some performances from this collection has been limited at the request of the donor.*
Data constraints	Digital library only
Version tracking	Issued on 2004-07-13

3.1.3 Administration Metadata: Phonograph Record Entity

Field Name	physicalIdentification
Definition	Provide information identifying the place where the phonograph record is stored, such as the name or number of the building, room, stack, shelf, or other tangible area.
Multiplicity	0…1
Data type	String
Label	Physical Identification
Provenance	Modified from EAD element <physloc>.
Examples or notes	*Marvin Duchow Music Library Rare Books LP 1612*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	archivalReference
Definition	Provide a citation and/or an electronic link to separately described archival materials of special interest such as a general reference to the phonograph record with similar content.
Multiplicity	0…many
Data type	String
Label	Archival Reference
Provenance	Modified from EAD element <archref>.
Examples or notes	*McGill early music ensembles concert recordings. Consult Marvin Duchow Music Audio-Visual Reserves.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	bibliographicReference
Definition	Provide a citation and/or an electronic link for a sound recording.
Multiplicity	0…many
Data type	Resource
Label	Bibliographic Reference
Provenance	Modified from EAD element <bibref>.
Examples or notes	*http://catalogue.mcgill.ca/F0074t_number=0167&set_entry=000002&format=999*
Data constraints	Phonograph record only
Version tracking	Issued on 2005-05-03

Field Name	restrictionsAccessItem
Definition	Specify information about conditions that affect the availability of the item being described. May indicate the need for an appointment or the nature of restrictions imposed by the donor, legal statute, repository, or other agency. May also indicate the lack of restrictions.
Multiplicity	0…1
Data type	String
Label	Restrictions on Access to Item
Provenance	Modified from EAD element <accessrestrict>.
Examples or notes	*There are no access restrictions on this item.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	restrictionsUseItem
Definition	Specify information about conditions that affect use of the item after access has been granted. May indicate limitations, regulations, or special procedures imposed by a repository, donor, legal statute, or other agency regarding reproduction, publication, or quotation of the described materials. May also indicate the absence of restrictions, such as when copyright or literary rights have been dedicated to the public.
Multiplicity	0…1
Data type	String
Label	Restrictions on Use to Item
Provenance	Modified from EAD element <userestrict>.
Examples or notes	*Copyright to the item has been transferred to the Regents of McGill University.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	alternativeFormAvailable
Definition	Provide information about copies of the item being described, including the type of alternative form, significant control numbers, location, and source for ordering.

Multiplicity	0…many
Data type	String
Label	Alternative Form Available
Provenance	Modified from EAD element <altformavail>.
Examples or notes	*This item has been digitized and is available on CDs.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	condition
Definition	Specify the overall condition of the physical item, including any containers and/or labels.
Multiplicity	0…1
Data type	String
Label	Condition
Provenance	Modified from *Variations2* metadata "Condition" and the *IASA Cataloguing Rules* 7.B.15.
Examples or notes	Note: For a list of suggested terms to assist in the description of the physical condition of discs, consult Appendix C of the *IASA Cataloguing Rules.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	holdingStatusItem
Definition	Specify whether the physical item is circulating, non-circulating, or not retained.
Multiplicity	0…1
Data type	String
Label	Holding Status of Item
Provenance	Modified from *Variations2* metadata "Holding Status."
Examples or notes	Suggested values: *Circulating* *Non-circulating* *Not retained*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	sourceAcquisitionItem
Definition	Describe the circumstances under which the item was received. Includes donations, transfers, purchases, and deposits.
Multiplicity	0…1
Data type	String
Label	Source of Acquisition of Item
Provenance	Modified from EAD element <acqinfo>.
Examples or notes	*Item donated to the Music Library by Mr. David Edelberg in 1992. Donor number: 1992-03.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	custodialHistoryItem
Definition	Provide information about the chain of ownership of the item being described, before it reached the immediate source of acquisition. Both physical possession and intellectual ownership can be described, providing details of changes of ownership and/or custody that may be significant in terms of authority, integrity, and interpretation.
Multiplicity	0…1
Data type	String

Label	Custodial History of Item
Provenance	Modified from EAD element <custodhist>.
Examples or notes	*The David Edelberg Handel LPs were maintained by his wife from the time of Edelberg's death in 1980 until they were transferred, at his son's request, to the Marvin Duchow Music Library at McGill University in 1992.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	publicDomain
Definition	Indicates whether this work is known to be in the public domain, known NOT to be in the public domain, or is unknown.
Multiplicity	0…1
Data type	String Use controlled list: *unknown,* *known public domain,* *known not public domain*
Label	Public Domain
Provenance	Adopted from *Variations2* metadata "Public Domain."
Data constraints	Phonograph record only
Version tracking	Issued on 2005-10-10

3.1.4 Administration Metadata: Digitization Event Entity

Field Name	processingAgency
Definition	Identify the organization-level producer(s) of the processed digital object.
Multiplicity	1…many
Data type	String
Label	Processing Agency
Provenance	Adopted from NISO Z39.87 element 10.1.3 "processingAgency."
Examples or notes	*Marvin Duchow Music Library of McGill University*
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

Field Name	processingLocation
Definition	Provide the location of the organization-level producer(s) of the processed digital object.
Multiplicity	1…many
Data type	String
Label	Processing Location
Provenance	Modified from NISO Z39.87 element 10.1.3 "processingAgency."
Examples or notes	*Rare Books Collection Room, Marvin Duchow Music Library, McGill University*
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

Field Name	processingRationale
Definition	Provide rationale for editing decisions or describe trigger event for migration.
Multiplicity	0…many
Data type	String
Label	Processing Rationale
Provenance	Adopted from NISO Z39.87 element 10.1.4 "processingRationale."
Examples or notes	*Ogg Vorbis derivative files were created because the format is free, open, and unpatented. Ogg quality 5 is currently the official setting recommended for representing music of CD quality.*
Data constraints	Digitization event only

Version tracking	Issued on 2004-07-13

Field Name	processingSoftwareName
Definition	Provide the name of the processing software used to edit or transform digital objects.
Multiplicity	1
Data type	String
Label	Processing Software Name
Provenance	Adopted from NISO Z39.87 element 10.1.5.1 "processingSoftwareName."
Examples or notes	*Adobe Photoshop* *ImageMagic*
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

Field Name	processingSoftwareVersion
Definition	Specify the version of the processing software used to edit or transform digital objects.
Multiplicity	1
Data type	String
Label	Processing Software Version
Provenance	Adopted from NISO Z39.87 element 10.1.5.2 "processingSoftwareVersion."
Examples or notes	*6 (e.g., Adobe Photoshop 6)* *5.1.1 (e.g., ImageMagic 5.1.1)* for use with processingSoftwareName
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

Field Name	processingActions
Definition	Delineate an ordinal listing of the processing steps performed by way of a processing software.
Multiplicity	1…many
Data type	String
Label	Processing Actions
Provenance	Adopted from NISO Z39.87 element 10.1.6 "processingActions."
Examples or notes	*Using UNIX shell scripting, the color separation guide that was included in the original scan was cropped and different versions of derivatives were created. Three types of access files were automatically generated in JPEG: print file at 300dpi, web display files at 96dpi and 120dpi, and thumbnail files at 72dpi.*
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

Field Name	dateTimeProcessed
Definition	Indicate the date/time of digitization or post-processing.
Multiplicity	1
Data type	DateTime
Label	Processing Date/Time
Provenance	Modified from NISO Z39.87 element 10.1.1 "dateTimeProcessed."
Examples or notes	*2007-05-04 21:30*
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

Field Name	sourceType
Definition	Specify the medium of the analogue source item to be digitized.
Multiplicity	1
Data type	String

Label	Type of Source
Provenance	Adopted from NISO Z39.87 element 8.1.1 "sourceType."
Examples or notes	*cardoard jacket* *vinyl record*
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

Field Name	sourceIDType
Definition	Designate the system or domain in which the identifier is unique to be used in conjunction with sourceIDValue.
Multiplicity	0…1
Data type	String
Label	Type of Source ID
Provenance	Adopted from NISO Z39.87 element 8.1.2.1 "sourceIDType."
Examples or notes	[a local LP accession system] [a local system control number] [an OCLC record number]
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

Field Name	sourceIDValue
Definition	Give the value of the sourceID.
Multiplicity	0…1
Data type	String
Label	Source ID
Provenance	Adopted from NISO Z39.87 element 8.1.2.2 "sourceIDValue."
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

Field Name	conditionSource
Definition	Specify the physical condition of the source that is being digitized at the moment of digitization.
Multiplicity	0…1
Data type	String
Label	Condition of Source
Provenance	Modified from *Variations2* metadata "Condition."
Data constraints	Digitization event only
Version tracking	Issued on 2004-07-13

3.1.5 Administration Metadata: Digital Object of Phonograph Record

Field Name	objectIdentifierType
Definition	Designate the system or domain in which the identifier is unique to be used in conjunction with objectIdentifierValue.
Multiplicity	1
Data type	String
Label	Object Identifier Type
Provenance	Adopted from NISO Z39.87 element 6.1.1 "objectIdentifierType."
Examples or notes	[a local LP accession system] [a local system control number] [an OCLC record number]
Data constraints	Digital object only
Version tracking	Issued on 2004-07-13

Field Name	objectIdentifierValue
Definition	Designate the value of an objectIdentifier in objectIdentifierType.
Multiplicity	1
Data type	String
Label	Object Identifier Value
Provenance	Adopted from NISO Z39.87 element 6.1.2 "objectIdentifierValue."
Data constraints	Digital object only
Version tracking	Issued on 2004-07-13

Field Name	fileType
Definition	Specify the file's data format.
Multiplicity	1
Data type	String
Label	File Type
Provenance	Modified from CDL metadata "File Type."
Examples or notes	Suggested values: *image* *audio*
Data constraints	Digital object only
Version tracking	Issued on 2004-07-13

Field Name	fileSequence
Definition	Specify the relative position of a particular file within its encapsulating subset of objects.
Multiplicity	1
Data type	String
Label	File Sequence
Provenance	Modified from CDL metadata "File Sequence."
Examples or notes	*2nd of 5 page images*
Data constraints	Digital object only
Version tracking	Issued on 2004-07-13

Field Name	fileSize
Definition	Specify the size in bytes of a digital object.
Multiplicity	0…1
Data type	String
Label	File Size
Provenance	Adopted from NISO Z39.87 element 6.2 "fileSize."
Examples or notes	*618* *72839*
Data constraints	Digital object only
Version tracking	Issued on 2004-07-13

Field Name	formatName
Definition	Designate the format name or description of the file format.
Multiplicity	1
Data type	String
Label	Format Name
Provenance	Modified from NISO Z39.87 element 6.3.1 "formatName."
Examples or notes	*application/pdf* *application/ogg* *audio/x-aiff* *audio/x-wav* *image/gif*

	image/jpeg *image/png* *image/tiff*
Data constraints	Digital object only
Version tracking	Issued on 2004-07-13

Field Name	formatVersion
Definition	Designate the version of the formatName.
Multiplicity	1
Data type	String
Label	Format Version
Provenance	Adopted from NISO Z39.87 element 6.3.2 "formatVersion."
Examples or notes	*6.0* *2003*
Data constraints	Digital object only
Version tracking	Issued on 2005-02-03

Field Name	formatRegistryName
Definition	Designate the name of the referenced format registry.
Multiplicity	0…1
Data type	String
Label	Format Registry Name
Provenance	Adopted from NISO Z39.87 element 6.4.1 "formatRegistryName."
Data constraints	Digital object only
Version tracking	Issued on 2005-02-03

Field Name	formatRegistryKey
Definition	Specify the unique key used to reference an entry for the format in a format registry
Multiplicity	0…1
Data type	String
Label	Format Registry Key
Provenance	Adopted from NISO Z39.87 element 6.4.2 "formatRegistryKey."
Examples or notes	*TIFF/6.0*
Version tracking	Issued on 2005-02-03

Field Name	byteOrder
Definition	Designate the byte order in which multi-byte numbers are stored.
Multiplicity	0…1
Data type	String (restricted to list)
Label	Byte Order
Provenance	Adopted from NISO Z39.87 element 6.5 "byteOrder."
Examples or notes	Controlled values: *big_endian* *little_endian*
Data constraints	Digital object only
Version tracking	Issued on 2005-02-03

Field Name	fileName
Definition	Specify the name of the file.
Multiplicity	1
Data type	String
Label	File Name
Examples or notes	*jazz_78rpm_0050_blueace_204_d1_s1.png*

Field Name	fileUse
Definition	Describe the use of a digital object.
Multiplicity	1
Data type	String
Label	File Use
Provenance	Modified from CDL metadata "File Use."
Examples or notes	Recommended values: *archive* *online* *print* *thumbnail*
Data constraints	Digital object only
Version tracking	Issued on 2005-02-03

Field Name	fileLocator
Definition	Specify a unique identifier or locator which may be used by client software to retrieve the file in question.
Multiplicity	1
Data type	Resource
Label	File Locator
Provenance	Adopted from CDL metadata "File Locator."
Examples or notes	*http://coltrane.music.mcgill.ca/handel/multimedia/lp0051/audio/file1.aiff*
Data constraints	Digital object only
Version tracking	Issued on 2005-02-03

Field Name	displayEquipment
Definition	Specify the display equipment needed.
Multiplicity	1
Data type	Resource
Label	Display Equipment
Data constraints	Digital object only
Version tracking	Issued on 2005-02-03

Field Name	numberAccesses
Definition	Specify the number of times the file has been accessed.
Multiplicity	1
Data type	Number
Label	Number of Accesses
Provenance	Adopted from *Variations2* metadata "Number of Accesses."
Data constraints	Digital object only
Version tracking	Issued on 2005-02-03

Field Name	restrictionsAccessFile
Definition	Specify information about conditions that affect use or access to file. May indicate limitations, regulations, or special procedures imposed by a repository, donor, legal statute, or other agency regarding reproduction, publication, or quotation of the described materials. May also indicate the absence of restrictions, such as when copyright or literary rights have been dedicated to the public.
Multiplicity	0…1
Data type	String
Label	Restrictions on Access to File
Provenance	Modified from EAD element <accessrestrict>.

Examples or notes	*open to research use only*
Data constraints	Digital object only
Version tracking	Issued on 2005-02-03

3.1.6 Administration Metadata: Person/Organization Entity

Field Name	uniformName
Definition	Specify the full uniform name of a person or organization.
Multiplicity	1
Data type	String
Label	Uniform Name
Provenance	Adopted from *Variations2* metadata "Uniform Name."
Examples or notes	Note: The sources for this field in order of preference and/or availability are: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File Begin with the last name separated by a delimiter (comma) from the rest of the name. In the case of group names (e.g., "Haydn Quartet") or absence of a clear last name (e.g., "Anonymous II"), the whole name is entered before the delimiting comma.
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	variantName
Definition	Specifies the variant name(s) of a person organization, as indicated in the OCLC Authority File
Multiplicity	0…many
Data type	String
Label	Variant Name
Provenance	Adopted from *Variations2* metadata "Variant Name."
Examples or notes	Note: Begin with the last name separated by a delimiter (comma) from the rest of the name. In the case of group names (e.g., "Haydn Quartet") or absence of a clear last name (e.g., "Anonymous II"), the whole name is entered before the delimiting comma.
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	date
Definition	Specify the dates of birth and death of a person.
Multiplicity	1
Data type	TypedDate
Label	Date
Provenance	Modified from *Variations2* data type "TypedDate."
Examples or notes	Note: The sources for this field in order of preference and/or availability are: 1. The *New Grove Dictionary of Music and Musicians* 2. OCLC Authority File 3. OCLC Bibliographic File Specify the metadata "Type" in the TypedDate Record as "Date of birth" of "Dates of birth and death" accordingly.
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	flourishedDate
Definition	Specify the dates of flourishing of a person.
Multiplicity	0…1

Data type	TypedDate
Label	Dates of Flourishing
Provenance	Modified from *Variations2* data type "TypedDate."
Examples or notes	Note: The sources for this field in order of preference and/or availability are: 1. The *New Grove Dictionary of Music and Musicians* 2. OCLC Authority File 3. OCLC Bibliographic File Specify the metadata "Type" in the TypedDate Record as "Dates of flourishing."
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	variantDate
Definition	Specify appropriate dates associated with a person other than the dates of birth, death, and flourishing.
Multiplicity	0...many
Data type	TypedDate
Label	Variant Date
Provenance	Modified from *Variations2* data type "TypedDate."
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	placeOrigin
Definition	Specify the city and/or country of birth (for individual persons) or city and/or country of foundation (for orchestras, choirs, ensembles, etc.).
Multiplicity	0...1
Data type	String
Label	Place of Origin
Provenance	Adopted from *Variations2* metadata "Place of Origin."
Examples or notes	Note: The sources for this field in order of preference and/or availability are: 1. The *New Grove Dictionary of Music and Musicians* 2. OCLC Authority File 3. OCLC Bibliographic File
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	address
Definition	Specify the address of a person or organization.
Multiplicity	0...many
Data type	String
Label	Address
Provenance	Adopted from LC Audio-Visual Project's metadata "rights_holder_address."
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	email
Definition	Specify the e-mail of a person or organization.
Multiplicity	0...many
Data type	String
Label	E-mail
Provenance	Adopted from LC Audio-Visual Project's metadata "rights_holder_email."
Examples or notes	*abc@mail.mcgill.ca*
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	phone
Definition	Specify the phone number of a person or organization.
Multiplicity	0...many
Data type	String
Label	Phone
Provenance	Adopted from LC Audio-Visual Project's metadata "rights_holder_phone."
Examples or notes	*123-456-7890*
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	personOrganizationNote
Definition	Enter additional necessary information about a person or organization.
Multiplicity	0...many
Data type	String
Label	Person/Organization Note
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

Field Name	relatedResource
Definition	Include resources to external references related to the person or organization.
Multiplicity	0...many
Data type	Reference
Label	Related Resources
Version tracking	Issued on 2005-02-03
Provenance	Modified from *Variations2* data type "Related Resources."
Data constraints	Person or organization only
Version tracking	Issued on 2005-02-03

3.1.7 Administration Metadata: Creation/Performance/Recording/Production Event Entity

Field Name	eventDateTime
Definition	Provide the single date and time, or date and time range, at or during which the event occurred.
Multiplicity	1
Data type	String
Label	Event Date/Time
Provenance	Modified from PREMIS metadata "eventDateTime."
Version tracking	Issued on 2005-02-03

Field Name	eventParticipationRole
Definition	Describe the type of participation or role of a person in an event.
Multiplicity	1
Data type	String
Label	Event Participation/Role
Examples or notes	Note: Use this field to specify information about the instrument of an instrumentalist participating in a performance, for example: *composer* *conductor* *piano* *recording engineer*
Version tracking	Issued on 2005-02-03

Field Name	eventParticipationDetail
Definition	Provide additional information about an event.
Multiplicity	0…1
Data type	String
Label	Event Participation Detail
Examples or notes	*operated the mixing desk*
Provenance	Modified from PREMIS metadata "eventDetail."
Version tracking	Issued on 2005-02-03

3.2 Description Metadata

3.2.1 Description Metadata: Phonograph Record Entity

Field Name	albumSetTitle
Definition	Transcribe the title of an album as it appears on the immediate source.
Multiplicity	1
Data type	String
Label	Album Set Title
Provenance	Modified from the *Virtual Gramophone* metadata "Album Set Title."
Examples or notes	*Four organ concertos*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	albumSetAlternativeTitle
Definition	Transcribe the alternative as it appears on the immediate source.
Multiplicity	0…many
Data type	String
Label	Album Set Alternative Title
Provenance	Modified from *IASA Cataloguing Rules* 1.B.1.3.
Examples or notes	Note: An alternative title is the second part of a title proper that consists of two parts, each of which is a title. Either the parts are joined by the word or (or its equivalent in another language or script), or the alternative title is written within parentheses.
Examples or notes	*for piano and soprano*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	albumSetParallelTitle
Definition	Transcribe the parallel appeared on the immediate source.
Multiplicity	0…many
Data type	String
Label	Album Set Parallel Title
Provenance	Modified from *IASA Cataloguing Rules* 1.D.1.
Examples or notes	Note: A parallel title is the title presented as an equivalent of the title proper in another language and/or script or the title repeated with other title information in dialect, another language, and/or script.
Examples or notes	*Quatre concertos pour orgue* [= Four organ concertos in albumSetTitle]
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	albumSetVariationsTitle
Definition	Provide notes which give titles other than those chosen to appear in the title and statement of responsibility area.
Multiplicity	0…many
Data type	String

Label	Album Set Variations in Title
Provenance	Modified from *IASA Cataloguing Rules* 7.B.4.
Examples or notes	*Concertos for organ*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	otherTitleInformation
Definition	Transcribe all other title information appearing in conjunction with, and subordinate to the title or parallel titles.
Multiplicity	0...many
Data type	String
Label	Other Title Information
Provenance	Modified from *IASA Cataloguing Rules* 1.E.
Examples or notes	*a special compilation*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementResponsibility
Definition	Transcribe statements of responsibility relating to those persons or bodies credited in creating the intellectual content of the sound recording, including the performance, execution, or interpretation of a work.
Multiplicity	0...many
Data type	String
Label	Statement of Responsibility
Provenance	Modified from *IASA Cataloguing Rules* 1.F.
Examples or notes	*based on music by George Frideric Handel* *directed by Sir Charles Mackerras* *King Oliver's Jazz Band*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	largerTitle
Definition	Provide the title of a larger work when the item being transcribed is known to be one part of a larger work with a known title.
Multiplicity	0...1
Data type	String
Label	Title of Larger Work
Provenance	Adopted from Indiana University's IN Harmony metadata "Title of Larger Work."
Examples or notes	Note: Use the form of the title found in the Library of Congress Name Authority File (LCNAF), found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	seriesTitle
Definition	Transcribe the title of a series, which is a group of separated items related to one another by collective features.
Multiplicity	0...many
Data type	String
Label	Series Title
Provenance	Modified from *IASA Cataloguing Rules* 6.B.
Examples or notes	*Great voices of the century*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	parallelTitleSeries
Definition	Transcribe the parallel titles of a series.
Multiplicity	0...many.
Data type	String
Label	Parallel Title of Series
Provenance	Modified from *IASA Cataloguing Rules* 6.C.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	otherTitleInformationSeries
Definition	Give other title information of a series.
Multiplicity	0...many
Data type	String
Label	Other Title Information of Series
Provenance	Adopted from *IASA Cataloguing Rules* 6.C.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	numberingSeries
Definition	Give the numbering of the item within the series in the terms given on the immediate source.
Multiplicity	0...many
Data type	String
Label	Numbering within Series
Provenance	Adopted from *IASA Cataloguing Rules* 6.G.1.
Examples or notes	*vol. 1* *no. 8*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementResponsibilitySeries
Definition	Transcribe statements of responsibility appearing in conjunction with the series title.
Multiplicity	0...1
Data type	String
Label	Statement of Responsibility relating to Series
Provenance	Modified from *IASA Cataloguing Rules* 6.E.1.
Examples or notes	*The Columbia history of music by ear and eye by Percy Scholes.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	language
Definition	Indicate the language used in the associated locations/contexts of those languages such as in the program notes and lyrics.
Multiplicity	0...many
Data type	String
Label	Language
Provenance	Modified from *Variations2* metadata "Language."
Examples or notes	*sung in French* *program notes written in English and German*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	mediumPerformance
Definition	Specify the medium of performance.
Multiplicity	0…many
Data type	String
Label	Medium of Performance
Provenance	Adopted from Indiana University's IN Harmony metadata "Instrumentation."
Examples or notes	*piano and voice*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	alternateIssues
Definition	Record information pertaining to another release of the same issue.
Multiplicity	0…many
Data type	String
Label	Alternate Issues
Provenance	Adopted from the *Virtual Gramophone* metadata "Alternate Issues."
Examples or notes	*Reissue of Victor V-1125 (1952)* *Recorded in Vienna in 1961, previously released as Victor V-17035*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	internationalStandardRecordingCode
Definition	Give the International Standard Recording Code (ISRC) developed by the International Standards Office to a phonograph record, if it exists.
Multiplicity	0…1
Data type	String
Label	International Standard Recording Code (ISRC)
Provenance	Modified from IASA Cataloguing Rules 8.B.
Data constraints	Phonograph record only
Version tracking	Issued on 2005-10-10

Field Name	internationalStandardSerialNumber
Definition	Give the International Standard Serial Number (ISSN) developed by the International Serials Data System (ISDS), if it exists.
Multiplicity	0…1
Data type	String
Label	International Standard Serial Number (ISSN)
Provenance	Modified from IASA Cataloguing Rules 8.B.
Data constraints	Phonograph album only
Version tracking	Issued on 2005-10-10

Field Name	genericLabelPublisherName
Definition	Record the generic label/publisher name to bring all the variations of label names of a particular publishing company together.
Multiplicity	0…1
Data type	String
Label	Generic Label/Publisher Name
Provenance	Modified from the *Virtual Gramophone* metadata "Generic Label."
Examples or notes	The Generic Label "Berliner" groups together all the terms used on various Berliner records, such as "Concert", "Gramophone", "Imperial", "E. Berliner", etc. The generic label is usually the name of the company.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	transcribedLabelPublisherName
Definition	Transcribe the label/publisher name as appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Transcribed Label/Publisher Name
Provenance	Adopted from the *Virtual Gramophone* metadata "Transcribed Label."
Examples or notes	*Berliner Concert Grand* *E. Berliner's Gramophone* *His Master's Voice* *Starr*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	labelNumber
Definition	Identify the label name and label number as they appear on the immediate source. The label name is a unique identifier for the entire item and is usually printed on both sides of the label.
Multiplicity	1...many
Data type	String
Label	Label Number
Provenance	Adopted from *Variations2* metadata "Publisher/Plate Numbers."
Examples or notes	*V-38097* [V-38097-A on side A and V-38097-B on side B]
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	matrixNumber
Definition	Identify the matrix number, which is often handwritten or stamped on the run-out area of the disc. It is the number assigned to identify the source of a particular recording.
Multiplicity	0...many
Data type	String
Label	Matrix Number
Provenance	Adopted from the *Virtual Gramophone* metadata "Matrix Number."
Examples or notes	*148531*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	miscellaneousNumber
Definition	Occasionally, number in addition to the matrix numbers are imprinted on the run-out area of the disc. Indicate miscellaneous numbers including stamper numbers or other issues.
Multiplicity	0...many
Data type	String
Label	Miscellaneous Number
Provenance	Modified from the *Virtual Gramophone* metadata "Miscellaneous Number."
Examples or notes	*A-1744*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	edition
Definition	Identify the edition number of the album set.
Multiplicity	0...1
Data type	String
Label	Edition

Provenance	Adopted from *Variations2* metadata "Edition."
Examples or notes	*3e* Students' ed.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	editionStatement
Definition	Transcribe a statement relating to an edition of an album that contains differences from other editions of that album, or to a named reissue of an album. Omit reissues where they differ from the original in terms of publisher or label name and catalog number or matrix number, as these are different publications. Use standard abbreviations and numerals in place of words. Do not give an edition statement for first edition, issue, etc.
Multiplicity	0...many
Data type	String
Label	Edition Statement
Provenance	Adopted from *IASA Cataloguing Rules* 2.B.
Examples or notes	*Limited ed.* *Restored version*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	editionIssueHistoryNotes
Definition	Make notes relating to the edition or issue being described, to the edition or issue of the work being performed, or to the history of the recording.
Multiplicity	0...many
Data type	String
Label	Edition, Issue, and History Notes
Provenance	Adopted from *IASA Cataloguing Rules* 7.B.9.
Examples or notes	*Short version of work originally released in 1967*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	parallelEditionStatement
Definition	If an edition statement appears in more than one language or script, transcribe the statement that is not in the same language or script of the title proper as parallel edition statement.
Multiplicity	0...many
Data type	String
Label	Parallel Edition Statement
Provenance	Modified from *IASA Cataloguing Rules* 2.C.
Examples or notes	*Éd. pour les étudiants* [= Students' ed.]
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	additionalEditionStatement
Definition	Give an additional edition statement if an album is a revision of an edition (a named reissue of a particular edition containing changes from that edition), or belongs to an edition equivalent to the first named edition.
Multiplicity	0...many
Data type	String
Label	Additional Edition Statement
Provenance	Modified from *IASA Cataloguing Rules* 2.E.1.
Examples or notes	*2nd ed., rev. issue*

Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	localSubject
Definition	Record a subject term meaningful to the holding institution.
Multiplicity	0...many
Data type	String
Label	Local Subject
Provenance	Adopted from Indiana University's IN Harmony metadata "Local Subject."
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	placeNameSubject
Definition	Record named countries, states, provinces, counties, and cities associated with the music and lyrics (rather than publication information) of the album being transcribed.
Multiplicity	0...many
Data type	String
Label	Place Name Subject
Provenance	Adopted from Indiana University's IN Harmony metadata "Place Name Subject."
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	otherGeographicSubject
Definition	Record named geographic places associated with the music and lyrics (rather than publication information) of the item being transcribed that are not countries, states, provinces, counties, or cities.
Multiplicity	0...many
Data type	String
Label	Other Geographic Subject
Provenance	Adopted from Indiana University's IN Harmony metadata "Other Geographic Subject."
Examples or notes	Note: Terms may be chosen from the Library of Congress subject headings and Library of Congress Name Authority File, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	temporalSubject
Definition	Record a named time period relevant to the album being transcribed. Named time periods can include centuries, eras, stylistic periods, and seasons.
Multiplicity	0...many
Data type	String
Label	Temporal Subject
Provenance	Adopted from Indiana University's IN Harmony metadata "Temporal Subject."
Examples or notes	Note: Terms may be chosen from the Library of Congress subject headings and Library of Congress Name Authority File, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	form/Genre
Definition	Record the form or genre of the musical work on the album being transcribed.
Multiplicity	0...many

Data type	String
Label	Form/Genre
Provenance	Adopted from Indiana University's IN Harmony metadata "Form/Genre."
Examples or notes	Note: Terms may be chosen from the Library of Congress subject headings and Library of Congress Name Authority File, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	topicalSubject
Definition	Record the topical content of a song with lyrics in the album being transcribed.
Multiplicity	0…many
Data type	String
Label	Topical Subject
Provenance	Modified from Indiana University's IN Harmony metadata "Topical Subject."
Examples or notes	Note: Terms may be chosen from the Library of Congress subject headings and Library of Congress Name Authority File, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	nameSubject
Definition	Record a personal or corporate name that is the subject of a song in the album being transcribed.
Multiplicity	0…many
Data type	String
Label	Name as Subject
Provenance	Modified from Indiana University's IN Harmony metadata "Name as Subject."
Examples or notes	Note: Use name forms from the Library of Congress Name Authority File (LCNAF) when possible, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	numberAudioDisc
Definition	Specify the number of physical units of audio discs in the album set.
Multiplicity	1
Data type	Number
Label	Number of Audio Disc
Examples or notes	*2*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	numberAccompanyingMaterial
Definition	Specify the number of physical units of accompanying material, not including discs, in the album set.
Multiplicity	1
Data type	Number
Label	Number of Accompanying Material
Examples or notes	*2*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	extent
Definition	Describe the number of physical units specific types of material designator in the album set.
Multiplicity	1
Data type	String
Label	Extent
Provenance	Adopted from *IASA Cataloguing Rules* 5.B.1.
Version tracking	Issued on 2004-07-13
Data constraints	Phonograph Record Entity
Examples or notes	*2 sound discs*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	priceInformation
Definition	Record any information about the price of the album set.
Multiplicity	0...many
Data type	String
Label	Price Information
Examples or notes	$7.99
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	programNote
Definition	Record any program notes as appear on the phonograph record.
Multiplicity	0...many
Data type	String
Label	Program Note
Examples or notes	Note: This field is for text conversion of musical work notes.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	musicalWorkNote
Definition	Record any notes or statements about musical work as appear on the phonograph record.
Multiplicity	0...many
Data type	String
Label	Musical Work Note
Examples or notes	Note: This field is for text conversion of musical work notes.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	artistNote
Definition	Record any notes or statements, such as bibliographical sketch, about artists as appear on the phonograph record.
Multiplicity	0...many
Data type	String
Label	Artist Note
Examples or notes	Note: This field is for text conversion of artist notes.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	lyricNote
Definition	Record any lyrics or notes or statement about lyrics as appear on the phonograph record.

Multiplicity	0...many
Data type	String
Label	Lyric Note
Examples or notes	Note: This field is for text conversion of lyric notes.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	librettoNote
Definition	Record any libretto or notes or statements about librettos as appear on the phonograph record.
Multiplicity	0...many
Data type	String
Label	Libretto Note
Examples or notes	Note: This field is for text conversion of libretto notes.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	composerInformation
Definition	Record information about a composer responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Person/Organization
Label	Composer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	composerParticipationInformation
Definition	Record participation information of a composer responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Participation
Label	Composer Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	performerInformation
Definition	Record information about a performer responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Person/Organization
Label	Performer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only

Version tracking	Issued on 2004-07-13

Field Name	performerParticipationInformation
Definition	Record participation information of a performer responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Participation
Label	Performer Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	conductorInformation
Definition	Record information about a conductor responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Person/Organization
Label	Conductor Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	conductorParticipationInformation
Definition	Record participation information of a conductor responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Participation
Label	Conductor Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	instrumentGroupInformation
Definition	Record information about an instrument group responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Person/Organization
Label	Instrument Group Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	instrumentGroupParticipationInformation
Definition	Record participation information of an instrument group responsible for the intellectual/artistic content of the album.
Multiplicity	0...many

Data type	Participation
Label	Instrument Group Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	chorusInformation
Definition	Record information about a chorus group responsible for the intellectual/artistic content of the album.
Multiplicity	0…many
Data type	Person/Organization
Label	Chorus Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	chorusParticipationInformation
Definition	Record participation information of a chorus group responsible for the intellectual/artistic content of the album.
Multiplicity	0…many
Data type	Participation
Label	Chorus Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	recordingEngineerInformation
Definition	Record information about a recording engineer responsible for the intellectual/artistic content of the album.
Multiplicity	0…many
Data type	Person/Organization
Label	Recording Engineer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	recordingEngineerParticipationInformation
Definition	Record participation information of a recording engineer responsible for the intellectual/artistic content of the album.
Multiplicity	0…many
Data type	Participation
Label	Recording Engineer Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	librettistInformation
Definition	Record information about a librettist responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Person/Organization
Label	Librettist Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	librettistParticipationInformation
Definition	Record participation information of a librettist responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Participation
Label	Librettist Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	lyricistInformation
Definition	Record information about a lyricist responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Person/Organization
Label	Lyricist Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	lyricistParticipationInformation
Definition	Record participation information of a lyricist responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Participation
Label	Lyricist Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	arrangerInformation
Definition	Record information about an arranger responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Person/Organization
Label	Arranger Information

Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	arrangerParticipationInformation
Definition	Record participation information of an arranger responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Participation
Label	Arranger Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	accompanyingMaterialWriterInformation
Definition	Record information about an accompanying material writer responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Person/Organization
Label	Accompanying Material Writer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	accompanyingMaterialWriterParticipationInformation
Definition	Record participation information of an accompanying material writer responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Participation
Label	Accompanying Material Writer Participation Information
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	generalMaterialDesignation
Definition	Specify the general material category of the primary component of the immediate source belongs.
Multiplicity	1
Data type	String (controlled vocabulary)
Label	General Material Designation
Provenance	Adopted from *IASA Cataloguing Rules* 1.C.1.
Examples or notes	*sound recording*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	specificMaterialDesignation
Definition	Record the specific material category of the primary component of the immediate source belongs.
Multiplicity	1
Data type	String (controlled vocabulary)
Label	Specific Material Designation
Provenance	Adopted from *IASA Cataloguing Rules* 5.E.1.
Examples or notes	*sound disc*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementSpeed
Definition	Transcribe statements about the playback speed as it appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Statement of Speed
Provenance	Modified from *IASA Cataloguing Rules* 5.C.2.
Examples or notes	*Long 33 1/3 play*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementConfigurationPlaybackChannel
Definition	Transcribe statements about the configuration of playback channels as it appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Statement of Configuration of Playback Channels
Examples or notes	*Stereophonic*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementGrooveWidth
Definition	Transcribe statements about the groove width for discs as it appears on the immediate source.
Multiplicity	0...many
Data type	String
Examples or notes	*Microgroove*
Label	Statement of Groove Width
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementDimension
Definition	Transcribe statements about the diameter of a disc as it appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Statement of Dimension of Disc
Examples or notes	*10 in.* *12 in.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementKindMaterial
Definition	Transcribe statements about the kind of material used in the manufacture of the phonograph record.
Multiplicity	0…many
Data type	String
Label	Statement of Kind of Material
Examples or notes	Notes: Some of the kinds of material used include shellac and vinyl.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementCutting
Definition	Transcribe statements about the kind of cutting of the grooves used on a disc.
Multiplicity	0…many
Data type	String
Label	Statement of Kind of Cutting
Examples or notes	Notes: Some cuttings include hill-and-dale cutting, lateral cutting, or combined cutting.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementSpecialPlaybackCharacteristics
Definition	Transcribe statements about the playback characteristics used for special equipment or equalization necessary for proper playback.
Multiplicity	0…many
Data type	String
Label	Statement of Special Playback Characteristics
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementCaptureStorageTechnique
Definition	Transcribe statements about the technique by which the sound was originally captured and stored.
Multiplicity	0…many
Data type	String
Label	Statement of Capture and Storage Technique
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	datePublication
Definition	Identify the date of publication of the phonograph album.
Multiplicity	0…1
Data type	Date
Label	Date of Publication
Provenance	Adopted from *Variations2* metadata "Date of Publication."
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	dateRecording
Definition	Identify the date of recording of a phonograph record.
Multiplicity	0…1
Data type	DateRange
Label	Date of Recording
Provenance	Modified from *Variations2* metadata "Date of Publication."
Examples or notes	*1961*

Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	dateCopyright
Definition	Identify the copyright date of a phonograph album.
Multiplicity	0…1
Data type	Date
Label	Date of Copyright
Provenance	Adopted from *Variations2* metadata "Date of Copyright."
Examples or notes	*c1971* *p1979*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	dateCreation
Definition	Identify the creation date if a phonograph record has never been published.
Multiplicity	0…1
Data type	Date
Label	Date of Creation
Provenance	Modified from *IASA Cataloguing Rules* 8.B.
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	publicationPlace
Definition	Specify the location of publication.
Multiplicity	0…1
Data type	String
Label	Publication Place
Provenance	Adopted from *Variations2* metadata "Place of Publication."
Examples or notes	*New York*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	distributor
Definition	Identify the name of the company that distributed the phonograph album.
Multiplicity	0…1
Data type	String
Label	Distributor
Provenance	Modified from the *Virtual Gramophone* metadata "Distributor."
Examples or notes	*Middle Earth Co.* *Virgin Records*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	city
Definition	Specify the city where the distributor was based.
Multiplicity	0…many
Data type	String
Label	City
Provenance	Modified from the *Virtual Gramophone* metadata "City."
Examples or notes	*London*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	manufactureName
Definition	Identify the name of the manufacturer.
Multiplicity	0…1
Data type	String
Label	Manufacture Name
Provenance	Modified from *IASA Cataloguing Rules* 3.G.
Examples or notes	*High Fidelity Sound Studios*
Examples or notes	*Parlophone*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	manufacturePlace
Definition	Identify the place of the manufacture.
Multiplicity	0…many
Data type	String
Label	Manufacture Place
Provenance	Modified from *IASA Cataloguing Rules* 3.G.
Examples or notes	*London*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	manufactureDate
Definition	Identify the date of manufacture.
Multiplicity	0…many
Data type	Date
Label	Manufacture Date
Provenance	Modified from *IASA Cataloguing Rules* 3.H.
Examples or notes	*1970*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	recordingLocation
Definition	Identify the location where original recording took place, including city, province or state, and country.
Multiplicity	0…1
Data type	String
Label	Recording Location
Provenance	Modified from the *Virtual Gramophone* metadata "Recording Location."
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	recordingCompany
Definition	Identify the name of the company that originally recorded the disc.
Multiplicity	0…1
Data type	String
Label	Recording Company
Provenance	Modified from the *Virtual Gramophone* metadata "Recording Company."
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	circumstanceRecording
Definition	Provide information about the circumstance of recording.
Multiplicity	0…many
Data type	String

Label	Circumstance of Recording
Provenance	Modified from *IASA Cataloguing Rules* 7.B.11.
Examples or notes	*Live recording during world premiere performance* *Live recording at Carnegie Hall*
Data constraints	Phonograph record only
Version tracking	Issued on 2005-10-10

Field Name	copyrightRestrictionsInformation
Definition	Identify various copyright and restrictions information of a phonograph record.
Multiplicity	1
Data type	Copyright/Restrictions
Label	Copyright/Restrictions Information
Examples or notes	*Public broadcast is prohibited*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementAdvertisement
Definition	Transcribe the statement of advertisement as appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Statement of Advertisement
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementWarning
Definition	Transcribe the statement of warning as appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Statement of Warning
Examples or notes	*Not licensed for radio broadcast* *Unauthorized public performance, broadcasting and copying of this record prohibited*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementHandlingInstruction
Definition	Transcribe the statement regarding handling instruction as appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Statement of Handling Instruction
Examples or notes	*For best results use Victor Needles*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementReviews
Definition	Transcribe the statement regarding reviews of performed music as appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Statement of Reviews
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	statementDisclaimer
Definition	Transcribe the statement of disclaimer as appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Statement of Disclaimer
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	attributionConjectures
Definition	Make notes on persons or organizations to whom the recording being described has been attributed.
Multiplicity	0...many
Data type	String
Label	Statement of Attribution and Conjectures
Provenance	Modified from *IASA Cataloguing Rules* 7.B.8.
Examples or notes	*Performance dedicated to Jim Black*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	albumDuration
Definition	Give the playing time of the recording if the playing time is stated on the item.
Multiplicity	0...1
Data type	String
Label	Duration
Provenance	Modified from *IASA Cataloguing Rules* 5.B.4.
Examples or notes	*21 min., 5 sec.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	phonographRecordNote
Definition	Make additional necessary notes about the phonograph album.
Multiplicity	0...many
Data type	String
Label	Phonograph Record Note
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

Field Name	phonographRecordPeculiarityNote
Definition	Make notes of any peculiarities associated with the phonograph album.
Multiplicity	0...many
Data type	String
Label	Phonograph Record Peculiarity Note
Examples or notes	*Misprint of the track number on the back of the album cover. Two tracks are numbered as track number 3.*
Data constraints	Phonograph record only
Version tracking	Issued on 2004-07-13

3.2.2 Description Metadata: Album Entity

Field Name	classification
Definition	Assign a classification term to place the album as a work of art in a useful organizational scheme.
Multiplicity	0...many
Data type	String (controlled vocabulary)

Label	Classification
Provenance	Adopted from the CDWA: Classification.
Examples or notes	Note: Sources of terminology recommended include the AAT or LC Descriptive Terms for Graphic Materials.
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	albumDesignerInformation
Definition	Record information about a designer responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Person/Organization
Label	Album Designer Information
Provenance	Modified from *Variations2* data type "Contribution."
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	albumDesignerParticipationInformation
Definition	Record participation information of a designer responsible for the intellectual/artistic content of the album.
Multiplicity	0...many
Data type	Participation
Label	Album Designer Participation Information
Data constraints	Album only
Version tracking	Issued on 2005-02-03

Field Name	placeCreation
Definition	Indicate the location where the creation, design, or production of the work or its components took place.
Multiplicity	0...many
Data type	String
Label	Place of Creation
Provenance	Adopted from the CDWA: Creation- Place /Original Location.
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	creationCulture
Definition	Assign a term to the name of the culture, people, or nationality from which the work originated.
Multiplicity	0...many
Data type	String (controlled vocabulary)
Label	Creation Culture
Provenance	Adopted from the CDWA: Creation- Culture.
Examples or notes	Note: Sources of terminology recommended include the Styles and Periods facet of the AAT.
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	styles/Periods/Groups/MovementsDescription
Definition	Give a prose description of the salient characteristics in relation to a particular style, historical period, group, school, or movement.
Multiplicity	0...many
Data type	String
Label	Styles/Periods/Groups/Movements Description

Provenance	Adopted from the CDWA: Styles/Periods/Groups/Movements- Description.
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	styles/Periods/Groups/MovementsDescriptionIndexTerm
Definition	Assign a term which identifies the style, historical period, school, or art movement whose characteristics are represented by the work.
Multiplicity	0...many
Data type	String (controlled vocabulary)
Label	Styles/Periods/Groups/Movements Description Term
Provenance	Adopted from the CDWA: Styles/Periods/Groups/Movements- Term.
Examples or notes	Sources of controlled terminology recommended include the AAT (especially Styles and Periods hierarchy).
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	measurements/DimensionDescription
Definition	Provide information about the dimensions, size, or scale of the work.
Multiplicity	0...1
Data type	String
Label	Measurements/Dimension Description
Provenance	Adopted from the CDWA: Measurements- Dimensions Description
Examples or notes	Note: For regular dimensions, use simple height by width by depth. *12 x 12 inches*
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	materialTechniquesDescription
Definition	Record the matter, materials, or substances used to create a work, and the processes, techniques, and implements used to apply or form the materials, as appropriate. When necessary, clarify the relationship between the materials and the techniques used to apply them.
Multiplicity	0...many
Data type	String
Label	Material and Techniques Description
Provenance	Adopted from the CDWA: Material and Techniques- Description.
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	subjectMatterDisplay
Definition	Provide a description of the subject depicted in, on, or by the work.
Multiplicity	0...many
Data type	String
Label	Subject Matter Display
Provenance	Adopted from the CDWA: Subject Matter- Display.
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	subjectMatterIndexingTerm
Definition	Record one or more terms that characterize the persons, groups of persons, things, places, activities, abstract shapes, decorations, stories, events from literature, mythology, religion, or history, and philosophical, theoretical, symbolic, or allegorical themes depicted in the work.
Multiplicity	0...many

Data type	String (controlled vocabulary)
Label	Subject Matter Indexing Term
Provenance	Adopted from the CDWA: Subject Matter Indexing- Term.
Examples or notes	Note: Sources of terminology recommended include the AAT, LCSH, LC Name Authorities, and Canadiana Authorities.
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	subjectMatterInterpretiveHistory
Definition	Record the interpretive history or iconology of this work in its place in the history of the meaning of this subject.
Multiplicity	0…many
Data type	String
Label	Subject Matter Interpretive History
Provenance	Adopted from the CDWA: Subject Matter- Interpretive History.
Data constraints	Album only
Version tracking	Issued on 2005-10-10

Field Name	albumNote
Definition	Provide additional necessary note about the album.
Multiplicity	0…many
Data type	String
Label	Album Note
Data constraints	Album only
Version tracking	Issued on 2005-10-10

3.2.3 Description Metadata: Artwork Entity

Field Name	artworkType
Definition	Identify the specific type of work or image being described.
Multiplicity	0…many
Data type	String (controlled vocabulary)
Label	Artwork Type
Provenance	Adopted from VRA Core 4.0 metadata "Type."
Examples or notes	Note: Sources of controlled terminology recommended include the AAT.
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	artworkMeasurements
Definition	Indicate the size, shape, or dimensions of the work or image.
Multiplicity	0…many
Data type	String
Label	Artwork Measurements
Provenance	Adopted from VRA Core 4.0 metadata "Measurements."
Examples or notes	*3 cm x 6 cm* [height x width]
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	artworkTechnique
Definition	Indicate the production or manufacturing processes, techniques, and methods incorporated in the fabrication or alteration of the work or image.
Multiplicity	0…many
Data type	String (controlled vocabulary)
Label	Artwork Technique

Provenance	Adopted from VRA Core 4.0 metadata "Technique."
Examples or notes	Note: Sources of controlled terminology recommended include AAT.
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	caption
Definition	Transcribe the caption of a work or image as it appears.
Multiplicity	0…many
Data type	String
Label	Caption
Examples or notes	*Photo taken by John Smith*
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	artistInformation
Definition	Record information about an artist responsible for the intellectual/artistic content of the work or image.
Multiplicity	0…many
Data type	Person/Organization
Label	Artist Information
Provenance	Modified from *Variations2* data type "Contribution."
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	artistParticipationInformation
Definition	Record participation information of an artist responsible for the intellectual/artistic content of the album.
Multiplicity	0…many
Data type	Participation
Label	Artist Participation Information
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	style/Period
Definition	Define the style, historical period, group, school, dynasty, movement, etc. whose characteristics are represented in the work or image.
Multiplicity	0…many
Data type	String (controlled vocabulary)
Label	Style/Period
Provenance	Adopted from VRA Core 4.0 metadata "Style/Period."
Examples or notes	Note: Sources of controlled terminology recommended include the AAT (especially Styles and Periods hierarchy).
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	culture
Definition	Give the name of the culture, people, or adjectival form of a country name from which a work or image originates or with which the work or image has been associated.
Multiplicity	0…many
Data type	String
Label	Culture
Provenance	Adopted from VRA Core 4.0 metadata "Culture."
Examples or notes	Note: Sources of controlled terminology recommended include the AAT (especially

	Styles and Periods hierarchy) and LCSH.
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	subject
Definition	Provide terms or phrases that describe, identify, or interpret the work or image and what it depicts or expresses. These may include proper names (e.g., people or events), geographic designations (places), generic terms describing the material world, or topics (e.g., iconography, concepts, themes, or issues).
Multiplicity	0...many
Data type	String
Label	Subject
Provenance	Adopted from VRA Core 4.0 metadata "Subject."
Examples or notes	Note: Sources of terminology recommend include the AAT, TGM, ICONCLASS, Sears Subject Headings.
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	relation
Definition	Give terms or phrases describing the identity of the related work and the relationship between the work or image and the related work.
Multiplicity	0...many
Data type	String
Label	Relation
Provenance	Adopted from VRA Core 4.0 metadata "Relation."
Examples or notes	*part of*
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	descriptionArtwork
Definition	Describe the work or image, including comments, description, or interpretation.
Multiplicity	0...many
Data type	String
Label	Description of Artwork
Provenance	Adopted from VRA Core 4.0 metadata "Description."
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	artworkNote
Definition	Provide additional necessary note about the artwork.
Multiplicity	0...many
Data type	String
Label	Artwork Note
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

Field Name	artworkPeculiarityNote
Definition	Make notes of any peculiarities associated with the work or image.
Multiplicity	0...many
Data type	String
Label	Artwork Peculiarity Note
Data constraints	Artwork only
Version tracking	Issued on 2005-10-10

3.2.4 Description Metadata: Accompanying Material Entity

Field Name	accompanyingMaterialType
Definition	Specify the existence and type of accompanying material.
Multiplicity	0…1
Data type	String
Label	Accompanying Material Type
Provenance	Modified from *IASA Cataloguing Rules* 7.B.18.
Examples or notes	*booklet* *linear note*
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	accompanyingMaterialContent
Definition	Specify the content in the accompanying material.
Multiplicity	0…many
Data type	String
Label	Accompanying Material Content
Provenance	Modified from *IASA Cataloguing Rules* 7.B.18.
Examples or notes	*Lyrics in booklet*
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	languageUsage
Definition	Specify the language usage in an accompanying material.
Multiplicity	0…many
Data type	String
Label	Language Usage
Provenance	Modified from *IASA Cataloguing Rules* 7.B.18.
Examples or notes	*Lyrics and notes in English, French and Swedish in booklet.*
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	physicalDimensionAccompanyingMaterial
Definition	Provide information about the physical dimensions and characteristics of the accompanying material.
Multiplicity	0…1
Data type	String
Label	Physical Dimension of Accompanying Material
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	accompanyingMaterialStatementResponsibility
Definition	Transcribe the statement of responsibility as it appears on the accompanying material.
Multiplicity	0…many
Data type	String
Label	Statement of Responsibility of the Accompanying Material
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	librettistInformation
Definition	Record information about a librettist responsible for the intellectual/artistic content of the accompanying material.

Multiplicity	0...many
Data type	Person/Organization
Label	Librettist Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	librettistParticipationInformation
Definition	Record participation information of a librettist responsible for the intellectual/artistic content of the accompanying material.
Multiplicity	0...many
Data type	Participation
Label	Librettist Participation Information
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	lyricistInformation
Definition	Record information about a lyricist responsible for the intellectual/artistic content of the accompanying material.
Multiplicity	0...many
Data type	Person/Organization
Label	Lyricist Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Accompanying material only
Version tracking	Issued on 2004-07-13

Field Name	lyricistParticipationInformation
Definition	Record participation information of a lyricist responsible for the intellectual/artistic content of the accompanying material.
Multiplicity	0...many
Data type	Participation
Label	Lyricist Participation Information
Data constraints	Accompanying material only
Version tracking	Issued on 2004-07-13

Field Name	accompanyingMaterialWriterInformation
Definition	Record information about an accompanying material writer responsible for the intellectual/artistic content of the accompanying material.
Multiplicity	0...many
Data type	Person/Organization
Label	Accompanying Material Writer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from:

	1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Accompanying material only
Version tracking	Issued on 2004-07-13

Field Name	accompanyingMaterialWriterParticipationInformation
Definition	Record participation information of an accompanying material writer responsible for the intellectual/artistic content of the accompanying material.
Multiplicity	0...many
Data type	Participation
Label	Accompanying Material Writer Participation Information
Data constraints	Accompanying material only
Version tracking	Issued on 2004-07-13

Field Name	designerInformation
Definition	Record information about a designer responsible for the intellectual/artistic content of the accompanying material.
Multiplicity	0...many
Data type	Person/Organization
Label	Designer Information
Provenance	Modified from *Variations2* data type "Contribution."
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	designerParticipationInformation
Definition	Record participation information of a designer responsible for the intellectual/artistic content of the accompanying material.
Multiplicity	0...many
Data type	Participation
Label	Designer Participation Information
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	illustratorInformation
Definition	Record information about an illustrator responsible for the intellectual/artistic content of the accompanying material.
Multiplicity	0...many
Data type	Person/Organization
Label	Illustrator Information
Provenance	Modified from *Variations2* data type "Contribution."
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	illustratorParticipationInformation
Definition	Record participation information of an illustrator responsible for the intellectual/artistic content of the accompanying material.
Multiplicity	0...many
Data type	Participation
Label	Illustrator Participation Information
Data constraints	Accompanying material only
Version tracking	Issued on 2005-02-03

Field Name	accompanyingMaterialNote
Definition	Provide additional necessary note about the accompanying material.
Multiplicity	0...many
Data type	String
Label	Accompanying Material Note
Data constraints	Accompanying material only
Version tracking	Issued on 2004-07-13

Field Name	accompanyingMaterialPeculiarityNote
Definition	Make notes of any peculiarities associated with the accompanying material.
Multiplicity	0...many
Data type	String
Label	Accompanying Material Peculiarity Note
Data constraints	Accompanying material only
Version tracking	Issued on 2004-07-13

3.2.5 Description Metadata: Audio Disc Entity

Field Name	discNumber
Definition	Identify the disc of the audio disc being transcribed, if there are more than one.
Multiplicity	1
Data type	Number
Label	Disc Number
Examples or notes	*2*
Data constraints	Disc
Version tracking	Issued on 2004-07-13

Field Name	discSide
Definition	Identify the side of the audio disc being transcribed.
Multiplicity	1
Data type	String
Label	Side
Examples or notes	*1* *A*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	numberTracks
Definition	Specify the number of tracks of performances on the audio disc being transcribed.
Multiplicity	1
Data type	Number
Label	Number of Tracks
Examples or notes	*6*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	discMatrixNumber
Definition	Identify the matrix number, which is often handwritten or stamped on the run-out area of the disc. It is the number assigned to identify the source of a particular recording.
Multiplicity	0...many
Data type	String
Label	Matrix Number
Provenance	Adopted from the *Virtual Gramophone* metadata "Matrix Number."

Examples or notes	*W86074*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	discMiscellaneousNumber
Definition	Indicate miscellaneous numbers including stamper numbers or other issues as appeared on the audio disc.
Multiplicity	0...many
Data type	String
Label	Miscellaneous Number
Provenance	Modified from the *Virtual Gramophone* metadata "Miscellaneous Number."
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	type
Definition	Specify the type of materials used in the manufacture of the audio disc.
Multiplicity	1
Data type	String
Label	Type
Provenance	Modified from MARC 007 Physical Description Fixed Field
Examples or notes	*shellac* *vinyl*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	dimension
Definition	Give the diameter of the audio disc being transcribed.
Multiplicity	1
Data type	String
Label	Dimension
Provenance	Modified from *IASA Cataloguing Rules* 5.D.2.
Examples or notes	*10 in.* *12 in.*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	grooveCharacteristic
Definition	Give the groove characteristic of the audio disc being transcribed.
Multiplicity	1
Data type	String
Label	Groove Characteristic
Provenance	Modified from *IASA Cataloguing Rules* 5.C.3.
Examples or notes	*coarse groove* *microgroove*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	playbackSpeed
Definition	Give the playback speed in rpm.
Multiplicity	1
Data type	String
Label	Playback Speed
Provenance	Modified from *IASA Cataloguing Rules* 5.C.2.
Examples or notes	Note: some common playback speeds for analogue discs include:

	33 1/3 rpm 45 rpm 78 rpm
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	playbackMode
Definition	Give the playback mode if the information is readily available, using one or more of the following terms as appropriate.
Multiplicity	0...1
Data type	String (restricted list)
Label	Playback Mode
Provenance	Adopted from *IASA Cataloguing Rules* 5.C.5.
Examples or notes	Controlled values: *mono* *stereo* *binaural stereo* *joint stereo* *quadraphonic* *surround sound*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	audioStatementResponsibility
Definition	Transcribe statements of responsibility as appears on the audio disc being transcribed.
Multiplicity	0...many
Data type	String
Label	Statement of Responsibility
Provenance	Modified from *IASA Cataloguing Rules* 1.F.
Examples or notes	*Buster Bailey and his Rhythm Busters* *Vocal Chorus by Louis Armstrong*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	statementProductionInformation
Definition	Transcribe the statement of production, including the place, company name, and date, as appears on the audio disc being transcribed.
Multiplicity	0...many
Data type	String
Label	Statement of Production Information
Provenance	Modified from *IASA Cataloguing Rules* 3.C.
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	statementPublicationInformation
Definition	Transcribe the statement of publication, including the place, company name, and date, as appears on the audio disc being transcribed.
Multiplicity	0...many
Data type	String
Label	Statement of Publication Information
Provenance	Modified from *IASA Cataloguing Rules* 3.C.
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	statementDistributorInformation
Definition	Transcribe the statement of distribution, including the place, company name, and date, as appears on the audio disc being transcribed.
Multiplicity	0...many
Data type	String
Label	Statement of Distribution Information
Provenance	Modified from *IASA Cataloguing Rules* 3.C.
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	statementManufactureInformation
Definition	Transcribe the statement of manufacture, including the place, company name, and date, as appears on the audio disc being transcribed.
Multiplicity	0...many
Data type	String
Label	Statement of Manufacture Information
Provenance	Modified from *IASA Cataloguing Rules* 3.G.
Examples or notes	Note: Manufacture information can usually be found on record labels or the back of an album cover. *RCA Victor Company Limited Montreal, Canada.* *Mfrd. by Decca Records, Inc., New York, U.S.A.*
Data constraints	Disc
Version tracking	Issued on 2004-07-13

Field Name	discDateRecording
Definition	Identify the date of recording of the audio disc being transcribed.
Multiplicity	0...1
Data type	DateRange
Label	Date of Recording
Provenance	Modified from *Variations2* metadata "Date of Publication."
Examples or notes	Note: Recording date may be identified by label and matrix numbers using discographies.
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	discRecordingLocation
Definition	Identify the location where original recording took place, including city, province or state, and country, of the audio disc being transcribed.
Multiplicity	0...1
Data type	String
Label	Recording Location
Provenance	Modified from the *Virtual Gramophone* metadata "Recording Location."
Examples or notes	Note: Recording Location can be identified by label and matrix numbers using discographies.
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	discRecordingCompany
Definition	Identify the name of the company that recorded the audio disc being transcribed.
Multiplicity	0...1
Data type	String
Label	Recording Company
Provenance	Modified from the *Virtual Gramophone* metadata "Recording Company."

Data constraints	Disc only
Examples or notes	*Diamond Record Corporation N.Y.*
Version tracking	Issued on 2004-07-13

Field Name	discCircumstanceRecording
Definition	Provide information about the circumstance of recording pertaining to the audio disc being transcribed.
Multiplicity	0...many
Data type	String
Label	Circumstance of Recording
Provenance	Modified from *IASA Cataloguing Rules* 7.B.11.
Examples or notes	*Electrically recorded phonograph records*
Data constraints	Disc only
Version tracking	Issued on 2005-10-10

Field Name	discRecordingEngineerInformation
Definition	Record information about a recording engineer responsible for the intellectual/artistic content of the audio disc being transcribed.
Multiplicity	0...many
Data type	Person/Organization
Label	Recording Engineer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	discRecordingEngineerParticipationInformation
Definition	Record participation information of a recording engineer responsible for the intellectual/artistic content of the audio disc being transcribed.
Multiplicity	0...many
Data type	Participation
Label	Recording Engineer Participation Information
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	discPerformerInformation
Definition	Record information about a performer responsible for the intellectual/artistic content of the side of the audio disc being transcribed.
Multiplicity	0...many
Data type	Person/Organization
Label	Performer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	discPerformerParticipationInformation
Definition	Record participation information of a performer responsible for the intellectual/artistic content of the side of the audio disc being transcribed.
Multiplicity	0...many
Data type	Participation
Label	Performer Participation Information
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	discDuration
Definition	Give the playing time of the recording if the playing time is stated on the audio disc record label.
Multiplicity	0...1
Data type	String
Label	Duration
Examples or notes	Note: If only the individual track durations are available, add the playing times for a total duration of the disc. *2:36*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	statementCopyrightRestrictionsInformation
Definition	Transcribe various copyright and restrictions information as appears on the audio disc record label.
Multiplicity	0...many
Data type	CopyrightRestriction
Label	Statement of Copyright Restrictions on Audio Disc Label.
Examples or notes	*All rights of the manufacturer and of the owner of the recorded work reserved*
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	audioDiscNote
Definition	Provide additional necessary note about an audio disc.
Multiplicity	0...many
Data type	String
Label	Audio Disc Note
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

Field Name	audioDiscPeculiarityNote
Definition	Make notes of any peculiarities associated with the audio disc.
Multiplicity	0...many
Data type	String
Label	Audio Disc Peculiarity Note
Data constraints	Disc only
Version tracking	Issued on 2004-07-13

3.2.6 Description Metadata: Track of Performance Entity

Field Name	trackTitle
Definition	Transcribe the title of the track of performed music as appears on the audio disc record label.
Multiplicity	1
Data type	String
Label	Track Title

Provenance	Modified from the *Virtual Gramophone* metadata "Album Set Title."
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackNumber
Definition	Identify the track number.
Multiplicity	1
Data type	Number
Label	Track Number
Examples or notes	*2*
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackDateRecording
Definition	Identify the date of recording of the track of performed music being transcribed.
Multiplicity	0…1
Data type	DateRange
Label	Date of Recording
Provenance	Modified from *Variations2* metadata "Date of Publication."
Examples or notes	Note: Date of recording can be identified by the record label and matrix numbers using discographies.
Data constraints	Track only
Version tracking	Issued on 2005-02-03

Field Name	trackRecordingLocation
Definition	Identify the location where original recording took place, including city, province or state, and country, of the track of performed music being transcribed.
Multiplicity	0…1
Data type	String
Label	Recording Location
Provenance	Modified from the *Virtual Gramophone* metadata "Recording Location."
Data constraints	Track only
Version tracking	Issued on 2005-02-03

Field Name	trackRecordingCompany
Definition	Identify the name of the company that recorded the track of performed music being transcribed.
Multiplicity	0…1
Data type	String
Label	Recording Company
Provenance	Modified from the *Virtual Gramophone* metadata "Recording Company."
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackCircumstanceRecording
Definition	Provide information about the circumstance of recording pertaining to the track of performed music being transcribed.
Multiplicity	0…many
Data type	String
Label	Circumstance of Recording
Provenance	Modified from *IASA Cataloguing Rules* 7.B.11.
Data constraints	Track only
Version tracking	Issued on 2005-10-10

Field Name	trackPerformerInformation
Definition	Record information about a performer responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0...many
Data type	Person/Organization
Label	Performer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackPerformerParticipationInformation
Definition	Record participation information of a performer responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0...many
Data type	Participation
Label	Performer Participation Information
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackConductorInformation
Definition	Record information about a conductor responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0...many
Data type	Person/Organization
Label	Conductor Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackConductorParticipationInformation
Definition	Record participation information of a conductor responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0...many
Data type	Participation
Label	Conductor Participation Information
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackInstrumentGroupInformation
Definition	Record information about an instrument group responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0...many
Data type	Person/Organization
Label	InstrumentGroup Information

Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackInstrumentGroupParticipationInformation
Definition	Record participation information of an instrument group responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0...many
Data type	Participation
Label	Instrument Group Participation Information
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackRecordingEngineerInformation
Definition	Record information about a recording engineer responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0...many
Data type	Person/Organization
Label	Recording Engineer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackRecordingEngineerParticipationInformation
Definition	Record participation information of a recording engineer responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0...many
Data type	Participation
Label	Recording Engineer Participation Information
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackArrangerInformation
Definition	Record information about an arranger responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0...many
Data type	Person/Organization
Label	Arranger Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File

Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackArrangerParticipationInformation
Definition	Record participation information of an arranger responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0…many
Data type	Participation
Label	Arranger Participation Information
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackOtherContributorInformation
Definition	Record information about a contributor (other than composer, performer, conductor, recording engineer, or an instrument group) responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0…many
Data type	Person/Organization
Label	Other Contributor Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackOtherContributorParticipationInformation
Definition	Record participation information of a contributor (other than composer, performer, conductor, recording engineer, or an instrument group) responsible for the intellectual/artistic content of the track of performed music being transcribed.
Multiplicity	0…many
Data type	Participation
Label	Other Contributor Participation Information
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackDuration
Definition	Give the playing time of a track of performed music.
Multiplicity	0…1
Data type	String
Label	Track Duration
Examples or notes	*2:31*
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackNote
Definition	Provide additional necessary note about a track of performance.
Multiplicity	0…many
Data type	String
Label	Track Note
Data constraints	Track only
Version tracking	Issued on 2004-07-13

Field Name	trackPeculiarityNote
Definition	Make notes of any peculiarities associated with a track of performance.
Multiplicity	0…many
Data type	String
Label	Track Peculiarity Note
Data constraints	Track only
Version tracking	Issued on 2004-07-13

3.2.7 Description Metadata: Musical Work Entity

Field Name	workType
Definition	Specifies whether the musical work is a single or collective work.
Multiplicity	0…1
Data type	String (restricted list)
Label	Type
Provenance	Adopted from *Variations2* metadata "Type."
Examples or notes	Controlled values: *single* *collective*
Data constraints	Musical work only
Version tracking	Issued on 2005-10-10

Field Name	workUniformTitle
Definition	Specify the uniform title of the musical work.
Multiplicity	1
Data type	String
Label	Uniform Title
Provenance	Adopted from *Variations2* metadata "Uniform Title."
Examples or notes	Note: The sources for this field recommended in order of preference and/or availability are: 1. OCLC Authority File 2. OCLC Bibliographic File 3. *The New Grove Dictionary of Music and Musicians*
Data constraints	Musical work only
Version tracking	Issued on 2004-07-13

Field Name	workVariantTitle
Definition	Specify the work's variant title, as indicated in the OCLC authority file.
Multiplicity	0…many
Data type	String
Label	Variant Title
Provenance	Adopted from *Variations2* metadata "Variant Title."
Data constraints	Musical work only
Version tracking	Issued on 2004-07-13

Field Name	workComposerInformation
Definition	Record information about a composer responsible for the musical work.
Multiplicity	0…many
Data type	Person/Organization
Label	Composer Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File

	2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Musical work only
Version tracking	Issued on 2004-07-13

Field Name	workComposerParticipationInformation
Definition	Record participation information of a composer responsible for the intellectual/artistic content of the musical work.
Multiplicity	0...many
Data type	Participation
Label	Composer Participation Information
Data constraints	Musical work only
Version tracking	Issued on 2004-07-13

Field Name	workLibrettistInformation
Definition	Record information about a librettist responsible for the intellectual/artistic content of the musical work.
Multiplicity	0...many
Data type	Person/Organization
Label	Librettist Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Musical work only
Version tracking	Issued on 2004-07-13

Field Name	librettistParticipationInformation
Definition	Record participation information of a librettist responsible for the intellectual/artistic content of the musical work.
Multiplicity	0...many
Data type	Participation
Label	Librettist Participation Information
Data constraints	Musical work only
Version tracking	Issued on 2004-07-13

Field Name	workLyricistInformation
Definition	Record information about a lyricist responsible for the intellectual/artistic content of the musical work.
Multiplicity	0...many
Data type	Person/Organization
Label	Lyricist Information
Provenance	Modified from *Variations2* data type "Contribution."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. OCLC Authority File 2. *The New Grove Dictionary of Music and Musicians* 3. OCLC Bibliographic File
Data constraints	Musical work only
Version tracking	Issued on 2004-07-13

Field Name	workLyricistParticipationInformation
Definition	Record participation information of a lyricist responsible for the intellectual/artistic content of the musical work.
Multiplicity	0...many
Data type	Participation
Label	Lyricist Participation Information
Data constraints	Musical work only
Version tracking	Issued on 2004-07-13

Field Name	dateComposition
Definition	Specify the date of composition.
Multiplicity	0...1
Data type	Date
Label	Date of Composition
Provenance	Adopted from *Variations2* metadata "Date of Composition."
Examples or notes	Note: Sources for this person/organization record can be taken in order of preference and/or availability from: 1. *The New Grove Dictionary of Music and Musicians* 2. OCLC Authority File 3. OCLC Bibliographic File
Data constraints	Musical work only
Version tracking	Issued on 2005-10-10

Field Name	placeComposition
Definition	Identify the location of composition (city and country, if available).
Multiplicity	0...many
Data type	String
Label	Place of Composition
Provenance	Adopted from *Variations2* metadata "Place of Composition."
Examples or notes	Note: A Source recommended for this person/organization record is *The New Grove Dictionary of Music and Musicians*.
Data constraints	Musical work only
Version tracking	Issued on 2005-10-10

Field Name	internationalStandardWorkCode
Definition	Give the International Standard Work Code (ISWC) developed by the International Confederation of Authors' and Composers' societies (CISAC) to identify a musical work. ISWC is a unique identifier for musical work similar to ISBN in books.
Multiplicity	0...1
Data type	String
Label	International Standard Work Code (ISWC)
Provenance	Modified from IASA Cataloguing Rules 8.B.
Data constraints	Musical work only
Version tracking	Issued on 2005-10-10

Field Name	performingRightsSocietyWorkNumber
Definition	Identify the performing rights society work number; this is a unique ID for a work in the corresponding performing rights society's database.
Multiplicity	0...1
Data type	String
Label	Performing Rights Society Work Number
Provenance	Adopted from *Variations2* metadata "Performing Rights Society Work Number."
Data constraints	Musical work only
Version tracking	Issued on 2005-10-10

Field Name	dateFirstPerformance
Definition	Specify the date of first performance.
Multiplicity	0...many
Data type	Date
Label	Date of First Performance
Provenance	Adopted from *Variations2* metadata "Date of First Performance."
Examples or notes	Note: A recommended source for this field is *The New Grove Dictionary of Music and Musicians*.
Version tracking	Issued on 2005-02-03

Field Name	dateFirstPublication
Definition	Specify the date of first publication.
Multiplicity	0...1
Data type	String
Label	Date of First Publication
Provenance	Adopted from *Variations2* metadata "Date of First Publication."
Examples or notes	1868-12-03
Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	workLanguage
Definition	Indicate the language used in the work.
Multiplicity	0...many
Data type	String
Label	Language
Provenance	Adopted from *Variations2* metadata "Language."
Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	subjectHeading
Definition	Specify the Library of Congress Subject Heading appropriate for the given work.
Multiplicity	0...many
Data type	String
Label	Subject Heading
Provenance	Adopted from *Variations2* metadata "Subject Heading."
Examples or notes	*Oratorios -- Excerpts -- Scores*
Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	workInstrumentation
Definition	Identify the instrumentation of a work.
Multiplicity	0...many
Data type	String
Label	Instrumentation
Provenance	Adopted from Indiana University's IN Harmony metadata "Instrumentation."
Examples or notes	*Piano and Voice*
Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	form/Genre/Style
Definition	Record the form or genre of the musical work on the musical work being transcribed.
Multiplicity	0...many

Data type	String
Label	Form/Genre/Style
Provenance	Adopted from *Variations2* metadata "Form/Genre/Style."
Examples or notes	Note: Terms may be chosen from the Library of Congress subject headings and Library of Congress Name Authority File, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Version tracking	Issued on 2005-02-03

Field Name	key
Definition	Specify the key of the overall work in which the music is written.
Multiplicity	0...1
Data type	String
Label	Key
Provenance	Adopted from *Variations2* metadata "Key."
Examples or notes	*D major*
Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	workTopicalSubject
Definition	Record the topical content of a musical work with lyrics.
Multiplicity	0...many
Data type	String
Label	Topical Subject
Provenance	Modified from Indiana University's IN Harmony metadata "Topical Subject."
Examples or notes	Note: Terms may be chosen from the Library of Congress subject headings and Library of Congress Name Authority File, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	workNameSubject
Definition	Record a personal or corporate name that is the subject of a musical work.
Multiplicity	0...many
Data type	String
Label	Name as Subject
Provenance	Modified from Indiana University's IN Harmony metadata "Name as Subject."
Examples or notes	Note: Use name forms from the Library of Congress Name Authority File (LCNAF) when possible, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	workPlaceNameSubject
Definition	Record named countries, states, provinces, counties, and cities associated with the music and lyrics (rather than publication information) of the musical work being transcribed. It consists of three sub-elements: country, state/province/county, and city.
Multiplicity	0...many
Data type	String
Label	Place Name Subject
Provenance	Adopted from Indiana University's IN Harmony metadata "Place Name Subject."
Examples or notes	Note: Terms may be chosen from the Library of Congress subject headings and Library of Congress Name Authority File, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.

Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	workOtherGeographicSubject
Definition	Record named geographic places associated with the music and lyrics (rather than publication information) of the musical work being transcribed that are not countries, states, provinces, counties, or cities.
Multiplicity	0...many
Data type	String
Label	Other Geographic Subject
Provenance	Adopted from Indiana University's IN Harmony metadata "Other Geographic Subject."
Examples or notes	Note: Terms may be chosen from the Library of Congress subject headings and Library of Congress Name Authority File, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	workTemporalSubject
Definition	Record a named time period relevant to the musical work being transcribed. Named time periods can include centuries, eras, stylistic periods, and seasons.
Multiplicity	0...many
Data type	String
Label	Temporal Subject
Provenance	Adopted from Indiana University's IN Harmony metadata "Temporal Subject."
Examples or notes	Note: Terms may be chosen from the Library of Congress subject headings and Library of Congress Name Authority File, found through the OCLC authority file, or, if your institution does not have OCLC access, from <http://authorities.loc.gov/>.
Data constraints	Musical work only
Version tracking	Issued on 2005-02-03

Field Name	musicalWorkNote
Definition	Provide additional necessary note about a musical work.
Multiplicity	0...many
Data type	String
Label	Musical Work Note
Data constraints	Musical work only
Version tracking	Issued on 2004-07-13

3.3 Legal Right Metadata

3.3.1 Legal Right Metadata: Right Entity

Field Name	copyrightRestrictionStatement
Definition	Transcribe the statement of copyright declaration as appears.
Multiplicity	0...many
Data type	String
Label	Copyright/Restrictions Statement
Provenance	Modified from *Variations2* data type "Copyright Declaration."
Examples or notes	Note: Copyright/restrictions statements are usually found on the record label or the back of an album cover. *Copyright patented record. Not to be publicly performed without license or sold below price fixed by Patentees.*
Version tracking	Issued on 2004-07-13

Field Name	licensingStatement
Definition	Transcribe the statement regarding the licensing.
Multiplicity	0...many
Data type	String
Label	Licensing Statement
Provenance	Modified from LC Audio-Visual Project's metadata "licensing."
Examples or notes	Note: Licensing information are usually found on the record label or the back of an album cover. *Licensed by mfr. (under U.S. pats pending) only for non-commercial use on phonographs in homes. Mfr. and original purchasers have agreed this record shall not be resold or used for any other purpose.* *Licensed under Canada Patent No. 160997*
Version tracking	Issued on 2004-07-13

Field Name	registrationNoticesStatement
Definition	Transcribe the statement regarding registration notices as appears on the immediate source.
Multiplicity	0...many
Data type	String
Label	Registration Notices Statement
Provenance	Modified from *IASA Cataloguing Rules* 4.C.
Version tracking	Issued on 2004-07-13

Field Name	copyrightRestrictionInceptionDate
Definition	Indicate the date upon which the copyright/restrictions begins.
Multiplicity	0...1
Data type	Date
Label	Copyright/Restrictions Inception Date
Provenance	Modified from LC Audio-Visual Project's metadata "restriction_inception_date."
Version tracking	Issued on 2004-07-13

Field Name	copyrightRestrictionExpirationDate
Definition	Indicate the date upon which the copyright/restrictions ends.
Multiplicity	0...1
Data type	Date
Label	Copyright/Restrictions Expiration Date
Provenance	Modified from LC Audio-Visual Project's metadata "restriction_expiration_date."
Version tracking	Issued on 2004-07-13

Field Name	restrictedTerritory
Definition	Indicate the territory in which the restriction applies.
Multiplicity	0...many
Data type	String
Label	Restricted Territory
Provenance	Modified from LC Audio-Visual Project's metadata "restriction_territory."
Examples or notes	*United States* *Canada*
Version tracking	Issued on 2005-02-03

Field Name	registrationNumber
Definition	Indicate the registration number, if any, such as a copyright registration number.
Multiplicity	0...many
Data type	String
Label	Registration Number

Provenance	Modified from LC Audio-Visual Project's metadata "registration_number."
Examples or notes	*U.S. Patents 1625705*
Version tracking	Issued on 2005-10-10

Field Name	registrationType
Definition	Indicate the type of registration associated.
Multiplicity	0…many
Data type	String
Label	Registration Type
Provenance	Modified from LC Audio-Visual Project's metadata "registration_type."
Examples or notes	*patent (US)* *copyright (US)* *copyright (France)*
Version tracking	Issued on 2005-10-10

Field Name	copyrightRestricitonNote
Definition	Provide additional necessary note to copyright/restrictions
Multiplicity	0…many
Data type	String
Label	Copyright/Restrictions Note
Version tracking	Issued on 2004-07-13

3.4 Structure Metadata

3.4.1 Structure Metadata: General

Field Name	font
Definition	Identify the font.
Multiplicity	0…many
Data type	String
Label	Font
Examples or notes	Note: The metadata is to be used for OCR. *Arial* *Courier*
Version tracking	Issued on 2004-07-13

Field Name	fontStyle
Definition	Identify the style of the font.
Multiplicity	0…many
Data type	String (restricted list)
Label	Font Style
Examples or notes	Note: The metadata is to be used for OCR. Controlled values: *Regular* *bold* *italic* *bold italic*
Version tracking	Issued on 2004-07-13

Field Name	fontSize
Definition	Specify the height of the tallest character in a continuous stream of text, in cm.
Multiplicity	0…many
Data type	PositiveReal
Label	Font Size (height)
Examples or notes	Note: The metadata is to be used for OCR.

Version tracking	Issued on 2004-07-13

Field Name	widthUnitData
Definition	Record the numeric value, in cm, for the structural dimension of the width of a unit/section/block/ of data (e.g., a line of title, a block of program note, a photo) for annotating the position of the appearance of a unit of data on the item being transcribed.
Multiplicity	0…1
Data type	PositiveReal
Label	Width of the Structural Dimension of a Unite/Block/Section of Data
Examples or notes	Note: The metadata is to be used for OCR.
Version tracking	Issued on 2004-07-13

Field Name	heightUnitData
Definition	Record the numeric value, in cm, for the structural dimension of the height of a unit/section/block/ of data (e.g., a line of title, a block of program note, a photo) for annotating the position of the appearance of a unit of data on the item being transcribed.
Multiplicity	0…1
Data type	PositiveReal
Label	Height of the Structural Dimension of a Unite/Block/Section of Data
Examples or notes	Note: The metadata is to be used for OCR.
Version tracking	Issued on 2004-07-13

Field Name	xCoordinateTopLeft
Definition	Record the numeric value for the x coordinate of the top left corner of the structural dimension of a unit/section/block/ of data (e.g., a line of title, a block of program note) for annotating the position of the appearance of a unit of data on the item being transcribed.
Multiplicity	0…1
Data type	PositiveReal
Label	X Coordinate of the Top Left Corner of the Unit of Data
Examples or notes	Note: The metadata is to be used for OCR. *10*
Version tracking	Issued on 2004-07-13

Field Name	yCoordinateTopLeft
Definition	Record the numeric value for the y coordinate of the top left corner of a structural dimension of a unit/section/block/ of data (e.g., a line of title, a block of program note) for annotating the position of the appearance of a unit of data on the item being transcribed.
Multiplicity	0…1
Data type	PositiveReal
Label	X Coordinate of the Top Left Corner of the Unit of Data
Examples or notes	Note: The metadata is to be used for OCR. *3.5*
Version tracking	Issued on 2004-07-13

3.4.2 Structure Metadata: Digital Object of Phonograph Record Entity

Field Name	ID
Definition	A unique identifier internal to the digital object for reference.
Multiplicity	1
Data type	String
Label	ID

Provenance	Modified from CDL metadata "File ID."
Version tracking	Issued on 2004-07-13

Field Name	sequenceID
Definition	An identifier used to indicate the relative position of a particular digital object within its encapsulating subset of digital objects.
Multiplicity	0…1
Data type	String
Label	Sequence ID
Provenance	Modified from CDL metadata "File Sequence."
Version tracking	Issued on 2005-02-03

Field Name	ownerID
Definition	An identifier uniquely identifying this digital object as belonging to the owner.
Multiplicity	0…many
Data type	String
Label	Owner ID
Provenance	Modified from CDL metadata "File Owner ID."
Version tracking	Issued on 2005-02-03

Field Name	equivalentID
Definition	An identifier that indicates two separate digital objects may be considered equivalent in some sense.
Multiplicity	0…many
Data type	String
Label	Equivalents ID
Provenance	Modified from CDL metadata "File Equivalents."
Version tracking	Issued on 2005-02-03

3.5 Technical Information Metadata

3.5.1 Technical Information Metadata: Digital Object of Phonograph Record Entity-General

Field Name	conservationPreservationTreament
Definition	Describe the process and details about any conservation/preservation treatment such as repairing or cleaning prior to digitization.
Multiplicity	0…many
Data type	String
Label	Conservation/Preservation Treatment
Version tracking	Issued on 2005-10-10

Field Name	conservationPreservationTreamentNote
Definition	Provide additional necessary note about the conservation/preservation process.
Multiplicity	0…many
Data type	String
Label	Conservation/Preservation Treatment Note
Version tracking	Issued on 2005-02-03

Field Name	postProcessing
Definition	Describe in detail any editing or enhancement processes involved in post-processing.
Multiplicity	0…many
Data type	String
Label	Post Processing
Data Constraints	Digital object only

Version tracking	Issued on 2005-02-03

Field Name	postProcessingNote
Definition	Make additional necessary note about post-processing.
Multiplicity	0…many
Data type	String
Label	Post Processing Note
Data Constraints	Digital object only
Version tracking	Issued on 2005-02-03

Field Name	changeHistory
Definition	Summarize any changes made and detail the processes involved.
Multiplicity	0…many
Data type	String
Label	Change History
Data Constraints	Digital object only
Version tracking	Issued on 2004-07-13

Field Name	displayEquipment
Definition	Specify any software or hardware equipment required in the reproduction of the digital object.
Multiplicity	0…many
Data type	String
Label	Display Equipment
Data Constraints	Digital object only
Version tracking	Issued on 2004-07-13

3.5.2 Technical Metadata: Digital Object of Phonograph Record Entity- Audio

Field Name	audioBitDepth
Definition	Specify the number of bits per audio sample.
Multiplicity	1
Data type	String
Label	Audio Bit Depth
Provenance	Adopted from LC Audio-Visual Project metadata "bit_per_sample."
Data constraints	Digital audio only
Version tracking	Issued on 2004-07-13

Field Name	samplingFrequency
Definition	Specify the rate at which the audio was sampled, expressed in kHz.
Multiplicity	1
Data type	String
Label	Sampling Frequency
Provenance	Adopted from LC Audio-Visual Project metadata "sampling_frequency."
Examples or notes	*22* *44.1* *48* *96*
Data constraints	Digital audio only
Version tracking	Issued on 2004-07-13

Field Name	duration
Definition	Specify the lapsed time of the entire file.
Multiplicity	0…1

Data type	String
Label	Duration
Provenance	Adopted from LC Audio-Visual Project metadata "duration."
Examples or notes	Note: Use MM:SS of the DateTime format for this field
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	compressionScheme
Definition	Designate the compression scheme used to store the audio data.
Multiplicity	0...many
Data type	String
Label	Compression Scheme
Data constraints	Digital audio only
Version tracking	Issued on 2004-07-13

Field Name	audioCaptureDevice
Definition	Describe the equipment used for digitizing audio, including all local access electronic resources in detail.
Multiplicity	1
Data type	String
Label	Audio Capture Device
Provenance	Modified from *IASA Cataloguing Rule* 7.B.0.
Examples or notes	Note: Description should include detail such as the name, model and/or number of the computer(s), the amount of free memory, the name and version of the operating system, the software requirements, peripherals hardware (internal) modifications.
Data constraints	Digital audio only
Version tracking	Issued on 2004-07-13

Field Name	stylusDimension
Definition	Give the radius of the tip of the stylus.
Multiplicity	1
Data type	String
Label	Stylus Dimension
Examples or notes	Note: Choosing the appropriate stylus is essential because proper contact between stylus and groove walls helps in obtaining optimum sound quality during reproduction. For example, using a smaller stylus causes tracking lower into the groove, which can compensate for a record with upper-groove damage. *2.5 mil*
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	stylusShape
Definition	Give the shape of the stylus.
Multiplicity	1
Data type	String
Label	Stylus Shape
Examples or notes	*conical* *elliptical* *spherical*
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	stylusTipMass
Definition	Specify the tip mass of the stylus.

Multiplicity	0...many
Data type	String
Label	Stylus Tip Mass
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	trackingForce
Definition	Give the total force holding the stylus in place in the record groove.
Multiplicity	0...1
Data type	String
Label	Tracking Force
Examples or notes	Note: Tracking force is the downward pressure on the stylus, which causes wear on both the disc and stylus. *1.5 g*
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	tonearmCartridgeAlignment
Definition	Describe the process and techniques used to adjust pickup arm and cartridge orientation.
Multiplicity	0...many
Data type	String
Label	Tonearm and Cartridge Alignment
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	antiSkate
Definition	Make note of any anti-skating mechanisms employed.
Multiplicity	0...many
Data type	String
Label	Anti-skate
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	bassTurnover
Definition	Give the equalizer settings used to accomplish the playback adjustment for bass turnover.
Multiplicity	0...1
Data type	String
Label	Bass Turnover
Examples or notes	Note: Due to mechanical reasons, manufacturers of phonograph records reduced the frequencies below 500 Hz (of recorded bass) in electrically recorded discs so that the vibrations of the record grooves would not overcut one another. Unless a correct turnover is applied in playback, bass and treble balance of performed music will sound unbalanced. *500 Hz* *RIAA*
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	trebleRolloff
Definition	Give the equalizer settings used to accomplish the playback adjustment for treble rolloff.
Multiplicity	0...1

Data type	String
Label	Treble Rolloff
Examples or notes	Note: Rolloff is the rate of treble attenuation in dB at 10 kHz during record playback and is used to match a corresponding rate of treble pre-emphasis used in the recording process, which improves high frequency response and reduce surface noise such as hiss, clicks, and pops. Unless a correct rolloff is applied in playback, high-midrange and treble balance will sound too bright or too dull.
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	playbackSpeed
Definition	Give nominal speed of the source recording, including indication of the unit of measure.
Multiplicity	1
Data type	String
Label	Playback Speed
Provenance	Adopted from LC Audio-Visual Project metadata "speed."
Examples or notes	*78 rpm*
Data constraints	Digital audio only
Version tracking	Issued on 2004-07-13

Field Name	speedAdjustment
Definition	Give a note to state actual speed used for digitization as a number (73 rpm) or to state a deviation.
Multiplicity	1
Data type	String
Label	Speed Adjustment
Provenance	Modified from LC Audio-Visual Project metadata "speed_adjustment."
Examples or notes	Note: Although recordings such as 78s are referred to as 78-rpms, the speed was not standardized until the mid-1930s. Slight deviation from the actual speed recorded during reproduction will change the recording pitch and timber. Proper selection and adjustment to speed during playback is thus essential. *73 rpm* *Corrected to C sharp pitch*
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	numberAudioChannel
Definition	Specify the number of audio channels.
Multiplicity	1
Data type	String
Label	Number of Audio Channel
Provenance	Adopted from LC Audio-Visual Project metadata "num_channels."
Data constraints	Digital audio only
Version tracking	Issued on 2004-07-13

Field Name	digitalNoiseReduction
Definition	Give any details of noise reduction, emphasis, and bit rate reduction.
Multiplicity	0...many
Data type	String
Label	Digital Noise Reduction
Provenance	Modified from *IASA Cataloguing Rules* 5.C.9.
Data constraints	Digital audio only
Version tracking	Issued on 2005-02-03

Field Name	audioSoftwareName
Definition	Identify the name of the capture software used to create the audio.
Multiplicity	1
Data type	String
Label	Audio Editing Software Name
Provenance	Modified from NISO metadata "audioSoftwareName."
Data constraints	Digital audio only
Version tracking	Issued on 2004-07-13

Field Name	audioSoftwareVeresionNumber
Definition	Specify the version number of the capture software used to create the audio.
Multiplicity	1
Data type	String
Label	Audio Editing Software Version Number
Provenance	Adopted from NISO metadata "audioSoftwareVersionNo."
Examples or notes	*4.0*
Data constraints	Digital audio only
Version tracking	Issued on 2004-07-13

Field Name	digitalAudioNote
Definition	Provide additional necessary note about the digitization process of audio.
Multiplicity	0...many
Data type	String
Label	Digital Audio Note
Data constraints	Digital audio only
Version tracking	Issued on 2004-07-13

3.5.3 Technical Metadata: Digital Object of Phonograph Record Entity- Image

Field Name	imageBitDepth
Definition	Specify the number of bits per component for each pixel.
Multiplicity	1
Data type	String
Label	Image Bit Depth
Provenance	Modified from NISO metadata "bitsPerSample."
Examples or notes	*24 bit*
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	resolution
Definition	Specify the resolution settings on the scanner.
Multiplicity	1
Data type	String
Label	Resolution
Provenance	Modified from CDL metadata "Resolution."
Examples or notes	*600 dpi*
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	compressionScheme
Definition	Designate the compression scheme used to store the image data.
Multiplicity	1
Data type	String

Label	Compression Scheme
Provenance	Adopted from NISO metadata "compressionScheme."
Examples or notes	*LZW* *JPEG2000 Lossy*
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	width
Definition	Specify the width of the digital image, i.e., horizontal or X dimension, in pixel.
Multiplicity	0…1
Data type	Number
Label	Width of the Digital Image
Provenance	Adopted from NISO metadata "imageWidth."
Data constraints	Digital image only
Version tracking	Issued on 2005-02-03

Field Name	height
Definition	Specify the height of the digital image, i.e., vertical or Y dimension, in pixel.
Multiplicity	0…1
Data type	Number
Label	Height of the Digital Image
Provenance	Adopted from NISO metadata "imageHeight."
Data constraints	Digital image only
Version tracking	Issued on 2005-02-03

Field Name	displayOrientation
Definition	Designate the orientation of the image.
Multiplicity	0…1
Data type	String
Label	Display Orientation
Provenance	Adopted from NISO metadata "orientation."
Examples or notes	*normal* *flipped* *rotated 180°* *flipped, rotated 180°*
Data constraints	Digital image only
Version tracking	Issued on 2005-02-03

Field Name	colorSpace
Definition	Designate the color model of the decompressed image data.
Multiplicity	1
Data type	String
Label	Color Space
Provenance	Adopted from NISO metadata "colorSpace."
Examples or notes	*CMYK* *RGB*
Data constraints	*Digital image only*
Version tracking	Issued on 2005-02-03

Field Name	ICCProfileName
Definition	Designate the well-defined name of the ICC profile used.
Multiplicity	0…1
Data type	String
Label	ICC Profile Name

Provenance	Adopted from NISO metadata "iccProfileName."
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	ICCProfileVersion
Definition	Designate the version of the ICC Profile used.
Multiplicity	0…1
Data type	String
Label	ICC Profile Version
Provenance	Adopted from NISO metadata "iccProfileVersion."
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	ICCProfileURL
Definition	Designate the URL/URN where the ICC profile is located.
Multiplicity	0…1
Data type	Resource
Label	ICC Profile URL
Provenance	Modified from NISO metadata "iccProfileURL."
Data constraints	Digital image only
Version tracking	Issued on 2005-10-10

Field Name	localProfileURL
Definition	Designates the URL/URN where the local color profile is located.
Multiplicity	0…1
Data type	Resource
Label	Local Profile URL
Provenance	Modified from NISO metadata "localProfileURL."
Data constraints	Digital image only
Version tracking	Issued on 2005-10-10

Field Name	localProfileName
Definition	Designate the name of the local color profile used.
Multiplicity	0…1
Data type	String
Label	Local Profile Name
Provenance	Modified from NISO metadata "localProfileName."
Data constraints	Digital image only
Version tracking	Issued on 2005-10-10

Field Name	physicalDimensionSource
Definition	Specify the physical dimension of source.
Multiplicity	0…1
Data type	String
Label	Physical Dimensions of Source
Provenance	Adopted from CDL metadata "Physical Dimensions of Source."
Examples or notes	Note: The metadata is needed for appropriate facsimile output. *10.2cm x 18.4cm*
Data constraints	Digital image only
Version tracking	Issued on 2005-02-03

Field Name	physicalDimensionsAreaScanned
Definition	Specify the dimensions of area actually scanned.
Multiplicity	0…1

Data type	String
Label	Physical Dimensions of Area Scanned
Provenance	Adopted from CDL metadata "Physical Dimensions of Area Scanned."
Examples or notes	*8.3cm x 11.2cm*
Data constraints	Digital image only
Version tracking	Issued on 2005-02-03

Field Name	lightSource
Definition	Specify the settings for the scan; may be necessary in later evaluation
Multiplicity	0...1
Data type	String
Label	Physical Dimensions of Area Scanned
Provenance	Adopted from CDL metadata "Light Source."
Examples or notes	*3400K Tungsten, infrared, OSram Dlux L fluorescent*
Data constraints	Digital image only
Version tracking	Issued on 2005-02-03

Field Name	imageCaptureDevice
Definition	Classification of device used to create the image data.
Multiplicity	1
Data type	String
Label	Image Capture Device
Provenance	Adopted from NISO metadata "captureDevice."
Examples or notes	*transmission scanner* *flatbed scanner*
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	scannerManufacturer
Definition	Specify the manufacturer of the scanner used to create the image.
Multiplicity	1
Data type	String
Label	Scanner Manufacturer
Provenance	Adopted from NISO metadata "scannerCapture."
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	scannerModel
Definition	Specify the model name of the scanner used to create the image,
Multiplicity	1
Data type	String
Label	Scanner Model
Provenance	Adopted from NISO metadata "scannerModel."
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	scannerModelNumber
Definition	Specify the model number of the scanner used to create the image.
Multiplicity	1
Data type	String
Label	Scanner Model Number
Provenance	Adopted from NISO metadata "scannerNumber."
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	scannerModelSeriesNumber
Definition	Specify the serial number of the scanner used to create the image.
Multiplicity	0…1
Data type	String
Label	Scanner Model Series Number
Provenance	Adopted from NISO metadata "scannerModelSerialNo."
Data constraints	Digital image only
Version tracking	2005-10-10

Field Name	maximumOpticalResolution
Definition	Designate the actual number of photo elements in the scanning sensor.
Multiplicity	0…1
Data type	String
Label	Maxmium Optical Resolution
Provenance	Adopted from NISO metadata "maximumOpticalResolution."
Examples or notes	*400 dpi* *3072 x 2048*
Data constraints	Digital image only
Version tracking	Issued on 2005-10-10

Field Name	scanningSoftwareName
Definition	Identify the name of the capture software used to create the image.
Multiplicity	1
Data type	String
Label	Scanning Software Name
Provenance	Adopted from NISO metadata "scanningSoftwareName."
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	scanningSoftwareVeresionNumber
Definition	Specify the version number of the capture software used to create the image.
Multiplicity	1
Data type	String
Label	Scanning Software Version Number
Provenance	Adopted from NISO metadata "scanningSoftwareVersionNo."
Examples or notes	*4.0*
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	targetType
Definition	Identify the targets as either internal or external.
Multiplicity	1…many
Data type	String (restricted list)
Label	Target Type
Provenance	Adopted from NISO metadata "targetType."
Examples or notes	Controlled values: *External* *Internal*
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	targetManufacturer
Definition	Identify the manufacturer or organization that created the target.

Multiplicity	1
Data type	String
Label	Target Manufacturer
Provenance	Adopted from NISO metadata "targetManufacturer."
Examples or notes	*Eastman Kodak* *Applied Image Inc*
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	targetName
Definition	Identify the name of the target.
Multiplicity	1
Data type	String
Label	Target Name
Provenance	Adopted from NISO metadata "targetName."
Examples or notes	*Q60* *ISO 16067*
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	targetNumber
Definition	Identify the version or number of the target.
Multiplicity	1
Data type	String
Label	Target Number
Provenance	Adopted from NISO metadata "targetNumber."
Examples or notes	*Version 2*
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Field Name	digitalImageNote
Definition	Provide additional necessary note about the digitization process of scanning image.
Multiplicity	0…many
Data type	String
Label	Digital Image Note
Data constraints	Digital image only
Version tracking	Issued on 2004-07-13

Appendix D

Production Workflow for the Digitization of Handel LP Collection:

2007-05-03 Modified Version

Digitization for Preservation of the David Edelberg Handel LP Collection

Summary

This document describes the process of digitizing long-playing phonographs (LPs). The workflow management system consists of largely three parts:

Part 1 explains how to digitize LPs with particular emphasis on the special requirements for digital re-mastering.

Part 2 explains how to scan images from album covers, audio discs, and any accompanying materials. The goal is to create high-quality digital preservation master copies of enduring value.

Part 3 describes how to use a web data entry form to enter metadata about LPs into a MySQL database.

The result of the process will include preservation copies of audio files, preservation copies of the scanned images of album covers, audio discs, and other accompanying materials, and a database that stores metadata about the digital phonograph recordings.

Part 1. Playing LPs for Digital Re-Mastering

Equipment and Software

- VPI HW-17F Professional Record Cleaning Machine
- VPI Aries 2 Black Knight Turntable
- JMW-9 Tonearm with cartridge and stylus
- VPI Synchronous Drive System
- Jazz Club Vinyl and 78 Restoration Phono Pre-amplifier
- Apogee Rosetta 200 2-channel, 24bit/192kHz AD/DA converter with X-Firewire
- Peak LE 4 (audio editor)
- Sennheiser HD 600 (headphone)

VPI HW-17F Professional Record Cleaning Machine

The VPI HW-17F is a professional fully automatic record vacuum cleaning machine. Since an LP must be as clean as possible to achieve optimum audio quality, it is highly recommended that an LP be cleaned before each play. The VPI HW-17F can clean an LP in both clockwise and counterclockwise directions. Use it to remove dirt and surface dust, which would otherwise accumulate on the stylus and impair the sound.

VPI Synchronous Drive System (SDS)
The VPI SDS provides frequency-stable clean power to the turntable motor. Adjustment of both the voltage and frequency fed to the turntable motor can be made from the front panel. To make corrections in the pitch of music recordings, use a strobe disk to set the exact speed. Otherwise, push the center of the button labeled 33-45 to set the speed at 33 RPM.

Jazz Club Vinyl and 78 Restoration Phono Pre-amplifer
To permit greater playback times and to improve sound quality, manufacturers of phonograph records reduced the frequencies below 500 Hz and strengthened the frequencies above 2 kHz when cutting their master records. The attenuation or boost of a frequency range in audio processing is known as the equalization and can be compensated for accurate reproduction during playback.

By adjusting the pair of selector switches in the front panel of the Jazz Club, the pre-amplifier stage restores the original tonal balance. Select the equalization characteristics according to the date of recording and the manufacturer of the record. Refer to Appendix 1 for the equalization settings for Pre-1955 records. If the setting recommended is not available, use the closest setting.

Apogee Rosetta 200 2-channel 24 bit, 192 kHz, AD/DA Converter
The Rosetta is an audio interface that converts analogue audio signals to digital. It connects to Mac with FireWire cable.

Setup and Instruction: Recording an LP into Peak

Record Cleaning

1. Lift the cover of the VPI HW-17 and make sure that the applicator head (left rear) and the vacuum pickup tube (right rear) are in their rest positions.
    a. The applicator head's rest position is back and parallel to the rear surface of the VPI HW-17.
    b. The vacuum pickup tube's rest position is with the velvet-surfaced tube pointing toward the back of the VPI HW-17.
2. Make sure the VPI HW-17 is level. Unscrew the record clamp and place a record on the turntable.
3. Place the clamp and tighten it enough to hold the record firmly. Loosen it if the outer rim of the record bows up.
4. Move the 'TABLE' switch up. The turntable should revolve in a clockwise or forward direction. Gear noise should be heard and is NORMAL.
5. Lift the applicator head (it lifts up only slightly) and swing it over the record.
6. Press the 'PUMP' switch briefly. Do not hold it in for more than a moment; otherwise too much fluid may be dispensed. The correct amount of fluid will completely cover the record's grooved area without spilling over the edge or onto the record label.

7. After the correct amount of fluid has been dispensed, allow the turntable to revolve three times in the forward (clockwise direction).
8. Then move the 'TABLE' switch down two clicks and run the turntable for three revolutions in the reverse (counterclockwise direction).
    c. Cleaning a record in the reverse direction is normally done only the first time it is cleaned. Thereafter, only the forward direction is used, unless, of course, the record should somehow get very dirty.
9. Lift the applicator head slightly and return it to its rest position.
10. Move the 'TABLE' switch two clicks back to its up position to start the turntable revolving forward again.
11. Swing the vacuum pickup tube anticlockwise over the record so that it is pointing at the turntable spindle.
12. Move the 'VACUUM' switch to its up position (the sound will be very much like a home vacuum cleaner). The vacuum pickup tube will lower and lock in position automatically, pointing toward the spindle.
13. Let the record revolve twice and return the 'VACUUM' switch to its down position again. The vacuum pickup tube will lift off the record and can be returned to its rest position.
    d. Two revolutions will normally remove all the cleaning fluid and leave a record completely dry. This does, of course, depend on how much fluid was dispensed on the record. If necessary, the record may be vacuumed for two additional revolutions.
    e. Do NOT think that more revolutions of drying is better. Excessive vacuuming can cause a buildup of static electricity that will attract the same kind of dirt that was just removed.
14. Move the 'TABLE' switch down one click to its center (OFF) position.
    f. To prevent damage to records, *always* turn off the vacuum before turning off the turntable.
15. Unscrew the record clamp, turn over the record, and repeat step 3-14 on the other side.
16. Clean any fluid dripped off the record being cleaned or the applicator head to prevent fluid from getting in the motors.

Playing an LP for Digital Re-Mastering

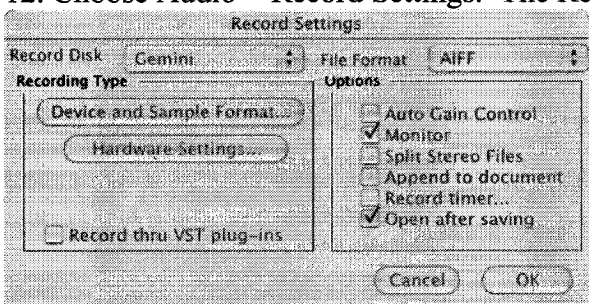
1. Make sure the VPI SDS is turned on.
2. Switch the setting to 33 RPM by pressing the button on the front panel if it is not already at 33.
3. Make sure the Jazz Club is turned on.
4. Refer to Appendix 1 and select in the front panel the appropriate switch positions for equalization settings.
5. Remove the record clamp and leave the rubber washer on the acrylic platter.
6. Place the disc on the turntable (i.e., the platter) with the playing side up; the rubber washer should be *below* the record.
7. Take the knurled clamp to tighten the LP down to the acrylic platter with moderate pressure. The LP should not spin freely.

8. Turn on the turntable by pressing the black button located on the left side of the turntable.
9. Remove the clear protecting case from the cartridge.
10. Dismount the tonearm from the armrest; move it to near the rim of the disc.

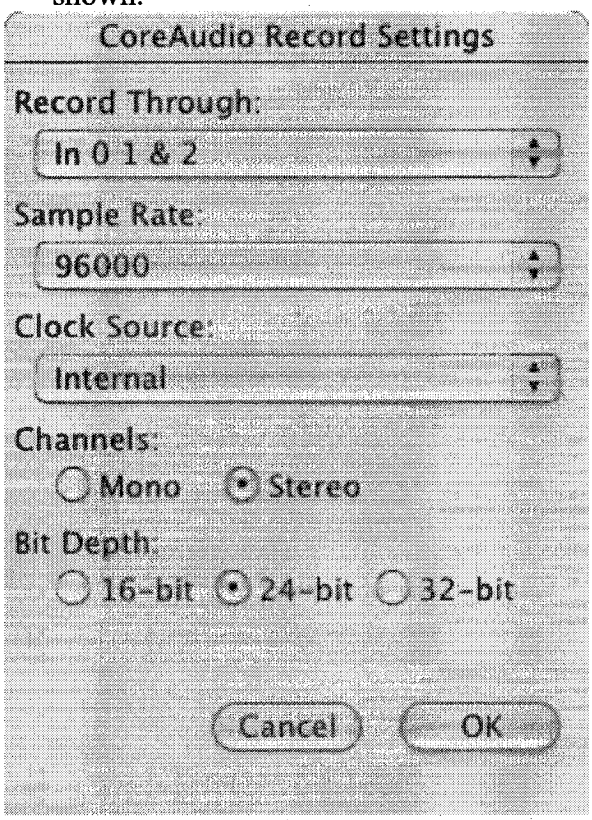
Configuring Peak for Recording

11. Locate the Peak icon on the dock and launch Peak (third from the right).

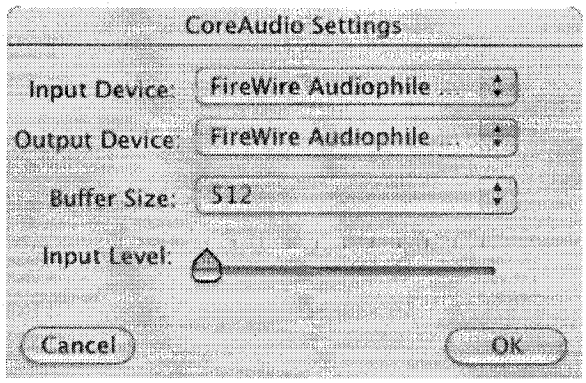
12. Choose Audio > Record Settings. The Record Settings dialog is shown.



13. Click Device and Sample Format. The CoreAudio Record Settings dialog is shown.

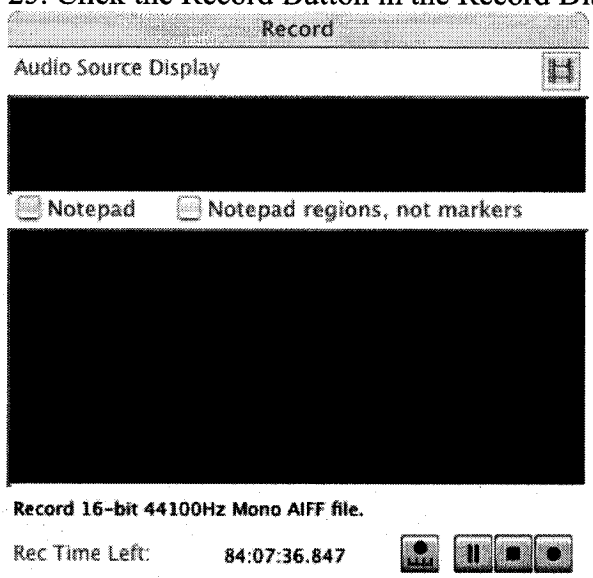


14. Configure the settings to match the ones pictured above and click the OK button.
15. In the Record Settings dialog (step 12), choose Hardware Settings.



16. Configure the settings to match the ones picture above and click the OK button.
17. Click the OK button close the Record Setting dialog box as shown in step 12.
18. Choose Windows>Transport.
19. Choose Windows>Toolbar.
20. Choose Audio>Record, or press Command-R. The Record window opens- not recording yet.
21. Wear the headphone to monitor the recording.
22. On the Transport, press Record and/or lower the needle to the LP by lowering the lever attached to the tonearm.

23. If connections are correct, Peak's VU (level) meters should be active on with green lights.
24. On the Transport, press Stop and/or raise the needle from the LP.
25. Click the Record Button in the Record Dialog (the button far right).



26. Start playback of the LP from the beginning of the record.
27. When finished recording, click the Stop button in the Record Dialog (the button from second right).
28. When the Save dialog appears, in the exiting folder GEMINI/USERS/Digitalmachine/Documents/handel_lp/audio, create a new

folder named lpXXXX (e.g. lp0050) where XXXX is the Handel LP Collection number.

29. Name the audio file as lpXXXXdiscZsideS-YYYY-MM-DD.aiff (e.g. lp0050disc2side1-2006-05-10.aiff) where
    a. XXXX is the Handel LP Collection number
    b. Z is the disc number
    c. S is the side number
    d. YYYY-MM-DD is the date
30. Click the Save button to save the file in the new directory just created.

Part 2. Scanning Images

Equipment and Software

- Epson Expression 1640XL Graphic Arts
- EPSON Scan
- Adobe Photoshop 7.0
- Kodak Color Separation Guide (Small) Q 13, catalog number 152 7654
- Glass

Epson Expression 1640XL Graphics Arts
Getting the best scan possible depends on several factors, including the quality of the original source and the scanning resolution. Since scanning is very labor-intensive, it is preferable to scan at a much higher quality than it can practically be delivered today. These large scanned images can be used to derive smaller images to mount online today.

EPSON Scan
EPSON Scan directly controls all of the features of the EPSON scanner. This scanning software can be accessed directly or from Adobe Photoshop 7.0.1.

Adobe Photoshop 7.0.1
Since Photoshop is used for image manipulation, images are scanned directly into Photoshop using EPSON Scan.

Kodak Color Separation Guide
Color values can be measured with Adobe Photoshop software to ensure consistency. Against each image, therefore, a Kodak Color Separation Guide should be placed to the side of the scanning image.

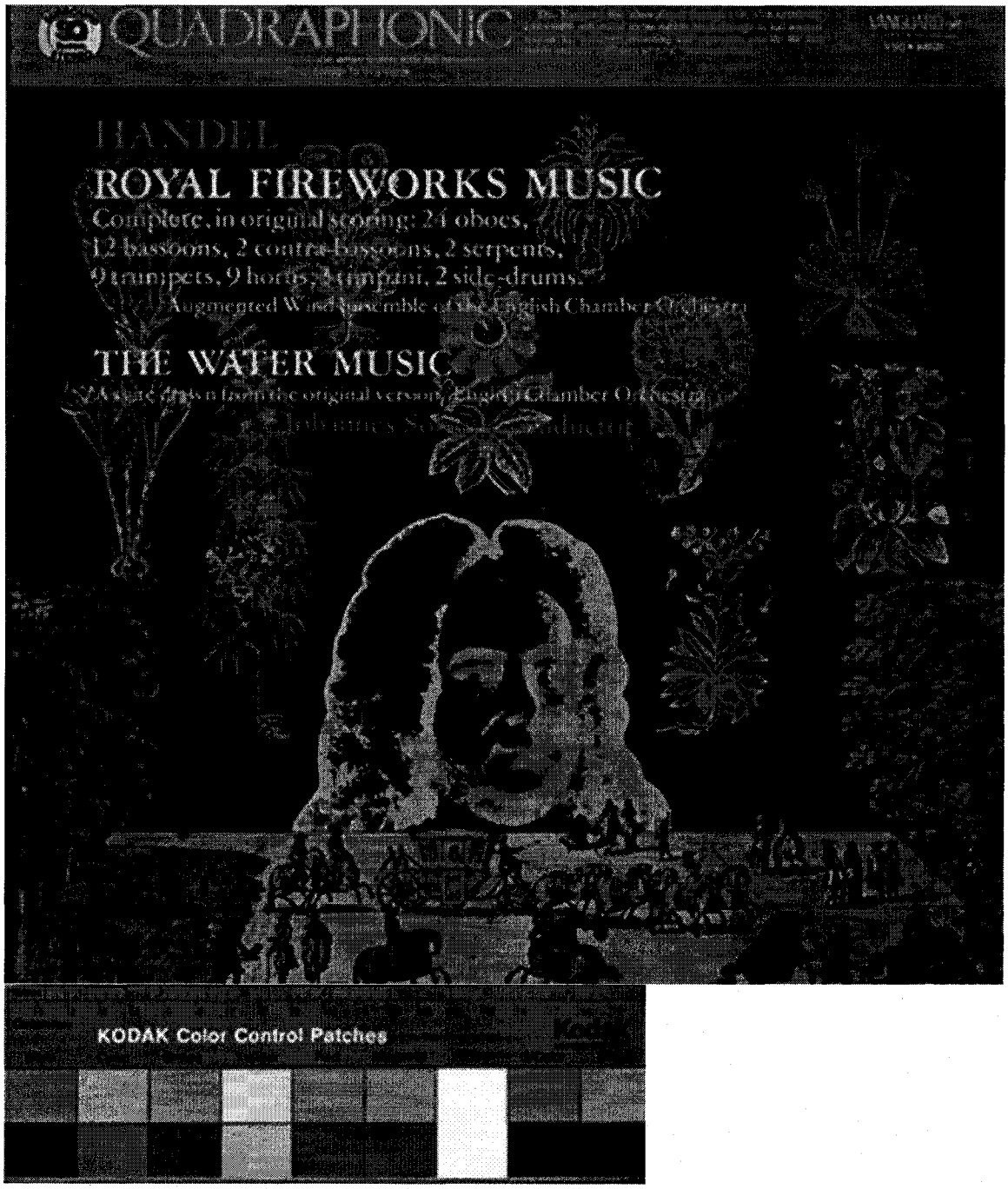
Glass
A piece of glass is place on top of the scanner bed. It protects the document table so that the discs will not scratch the surface of the scanner.

Calibration and Instruction: Image Capture Procedures

1. Light conditions can have a substantial effect on the ability of the operator to assess tones and colors accurately both in the originals and on screen. Modify

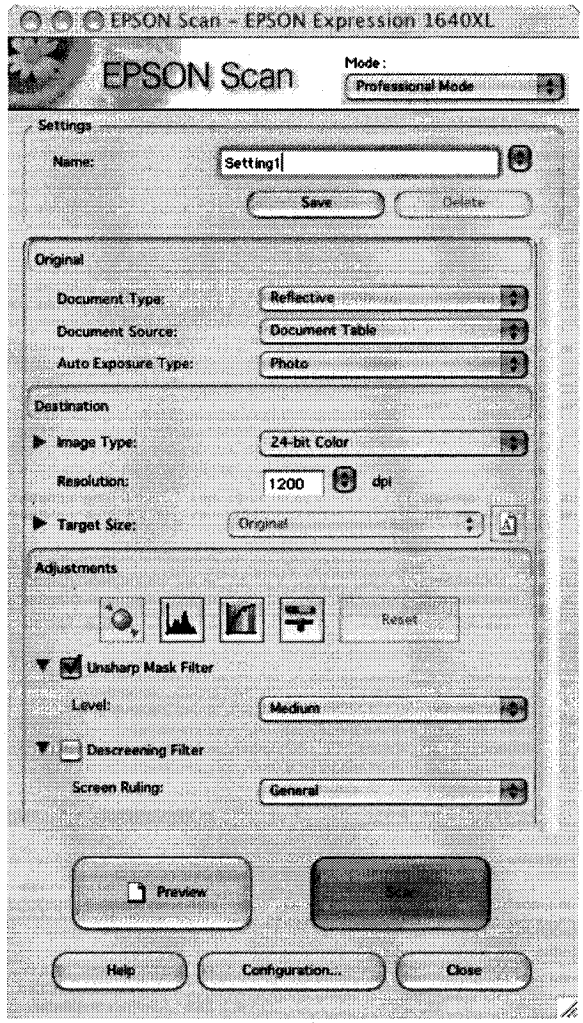
conditions (e.g., close the blind) to suit the prevailing light conditions. Reflections and high light conditions should be avoided as they affect the fidelity of on-screen images.

2. Raise the scanner cover and place a piece of glass on top of the document to protect the surface of the glass *when scanning a disc.*
3. Place the original document (e.g. album cover, booklet, disc) face down on the document table. Orient the document so that the entire object will be scanned.
4. Place the document so the horizontal and vertical edges are carefully aligned with the scales along the sides of the document table.
5. Include Kodak Color Separation Guide to the bottom of the scanning document. Make sure the strips aren't touching the image. See the example below.

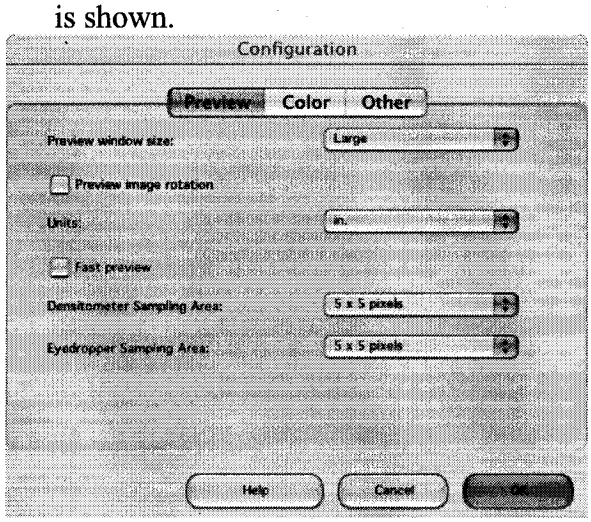


6. Close the document cover slowly. Be careful not to move the document.
7. Locate the Photoshop icon on the dock and launch Adobe Photoshop 7.0 (fourth from the right).

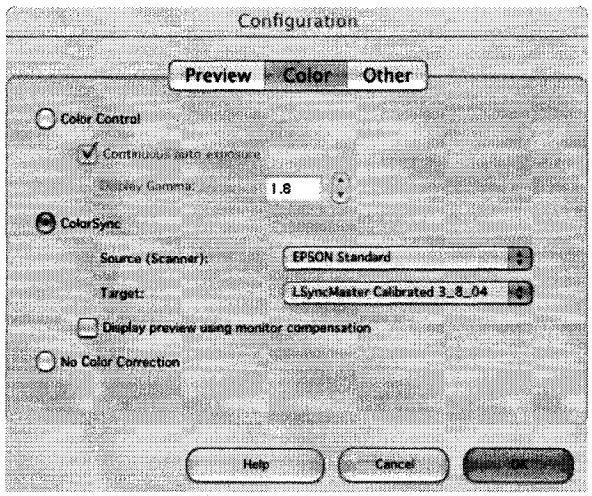
8. Choose File > Import > EPSON Expression 1640 XL. The EPSON scan dialog is shown.



9. Configure the settings to match the ones pictured above.
10. In the Epson scan dialog (step 8), choose Configuration. The Configuration dialog is shown.



11. Configure the settings to match the ones in the picture above.
12. In the same window choose the tab Color. The Color dialog is shown.



13. Configure the settings to match the settings in the picture above.
14. In the EPSON scan dialog (step 8) press the button Preview to do a pre-scan.
15. Compare to the original to make sure you have the right exposure. Also make sure the strips are not touching the scanned image so cropping the image will not remove any content information from the original.
16. Press the Auto Exposure button to obtain the best setting for the scan. When have finished making adjustments, click the Scan button in the EPSON scan dialog.
17. In Photoshop choose File>Save As
18. In the exiting folder GEMINI/USERS/Digitalmachine/Documents/handel_lp/images, create a new folder named lpXXXX (e.g. lp0050) where XXXX is the Handel LP Collection number.
19. When the Save dialog appears, name the recording lpXXXX_YY_ZZ) where
    a. XXXX is the Handel LP Collection number.
    b. YY is the abbreviation for album unit, specifically,

Unit	Abbreviation
Sleeve Case/Jacket	sc
Inner Sleeve	is
Liner Notes/ Insert	ln
Container	ct
Disc 1 *	d1

    c. ZZ is the abbreviation for pagination, for example, 01, 02.
20. Choose format PNG; check Embed Color Profile; and choose the new directory created above to save it in.
21. Click the Save button.

Part 3. Form-to-Database Online Data Entry

Equipment and Software

- Safari Web Browser

Setup and Instruction: Entering Metadata

1. Open a web browser (e.g. Safari) and go to the web data entry form located at http://coltrane.muscic.mcgill.ca/handel/handel-data-entry/material.php
2. Enter information (i.e., data and metadata) pertinent to or appears on the album jacket, sleeves, booklet, or inserts in the Album/Accompanying Material page.
3. Enter information pertinent to or appears on the discs in the Discs page.
4. Click on data entry field label to find help and examples. Pay special attention to text fields for Works, Program Notes, and Artists Biographies in the Program Information section. The content for these are to be typed inside a word document for text conversion. For keyboard shortcuts to special symbols and characters, refer to Appendix 2. Only the names of the files are to be supplied in theses text fields. Click on the entry field labels for specific examples.

Appendix 1: Equalization Chart for Pre-1955 LP Records

Manufacturer	Turnover (Hz)	Rolloff (dB)
Audio Fidelity	500	-16
Capitol	400	-12
Capitol-Cetra	400	-12
Columbia	500	-16
Decca	400	-12
Decca (until 11/55)	500	-16
Decca FFRR (1951)	300	-14
Decca FFRR (1953)	450	-11
Ducretet-Thomson	500	-11
EMS	375	-12
Epic (until 1954)	500	-16
Esoteric	400	-12
Folkways	500	-16
HMV	500	-16
London (up to LL-846)	450	-11
London International	450	-11
Mercury (until 10/54)	400	-12
MGM	500	-12
RCA Victor (until 8/52)	500	-12
Vox (until 1954)	500	-16
Westminster (before 1956)	500	-16
Or	400	-12

The information above is taken from the following reference:

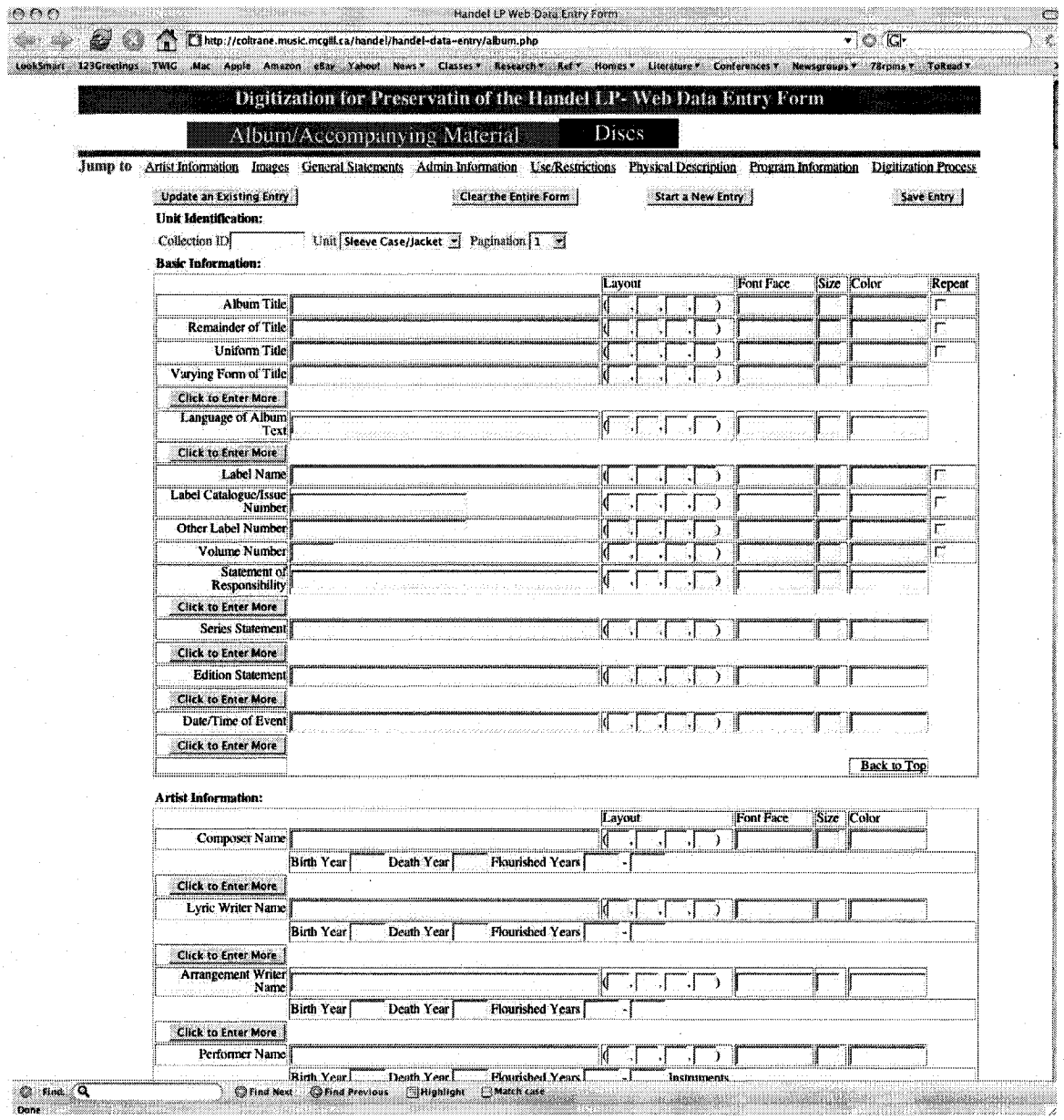
IASA and Miliano. 1999. *The IASA cataloguing rules: A manual for the description of sound recordings and related audiovisual media.* Stockholm: International Association of Sound and Audiovisual Archives.

Appendix 2: Keyboard Shortcut to Special Symbols and Characters

Letter	Keystroke
Ä	Option + U, Shift + A
Ö	Option + U, Shift + O
Ü	Option + U, Shift + U
ä	Option + U, A
ë	Option + U, E
ö	Option + U, O
ü	Option + U, U
®	Option + R
©	Option + G
™	Option + 2

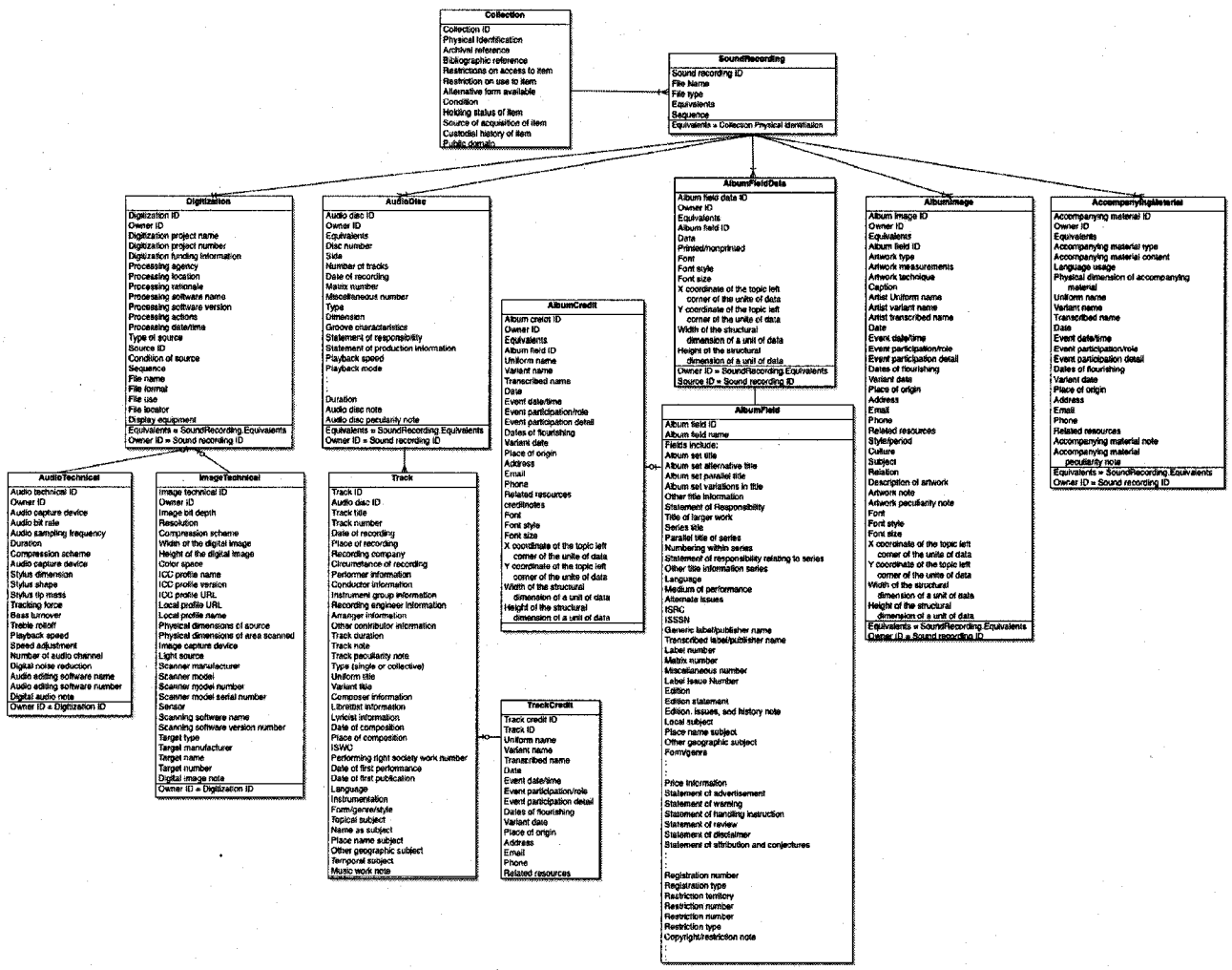
Appendix E

A screenshot of the web data entry form for the digitization of Handel LP Collection. The data-entry form was implemented in PHP 4.4.1, under OS X.



Appendix F

UML Diagram of the Handel LP Database, which features the specialization hierarchy:



Appendix G

Production workflow of the Digitization of Jazz 78-rpm Collection:

2007-05-03 Modified Version

Digitization for Preservation of the Jazz 78-rpm Collection

Summary

This document describes the process of digitizing 78-rpm recordings (78s). The workflow management system consists of largely three parts:

Part 1 explains how to digitize 78s with particular emphasis on the special requirements for digital re-mastering.

Part 2 explains how to scan images including the album covers, discs, and any accompanying materials. The goal is to create high-quality digital preservation master copies of enduring value.

Part 3 describes how to use a web data entry form to enter metadata about 78s into a MySQL database.

The result of the process will include preservation copies of audio files, preservation copies of the scanned images of album covers, audio discs, and other accompanying materials, and a database that stores metadata about the digital phonograph recordings.

Part 1. Playing 78-rpm recordings for Digital Re-Mastering

Equipment and Software

- VPI HW-17F Professional Record Cleaning Machine
- VPI Aries 2 Black Knight Turntable
- JMW-9 Tonearm with cartridge and stylus
- VPI SDS- Synchronous Drive System
- Jazz Club Vinyl and 78 Restoration Phono Pre-amplifier
- Apogee Rosetta 200 2-channel, 24bit/192kHz AD/DA converter with X-Firewire
- Peak LE 4 (audio editor)
- Sennheiser HD 600 (headphone)

VPI HW-17F Professional Record Cleaning Machine

The VPI HW-17F is a professional fully automatic record vacuum cleaning machine. Since an LP must be as clean as possible to achieve optimum audio quality, it is highly recommended that an LP be cleaned before each play. The VPI HW-17F can clean an LP in both clockwise and counterclockwise directions. Use it to remove dirt and surface dust which would otherwise accumulate on the stylus and impair the sound.

VPI Synchronous Drive System (SDS) and KAB SpeedStrobe
The VPI SDS provides frequency-stable clean power to the turntable motor. Adjustment of both the voltage and frequency fed to the turntable motor can be made from the front panel. To set accurate frequency for playing 78s, play the SpeedStrobe disk with incremental markings and adjust the frequency by pressing the ^ and v buttons on the SDS. Point the battery-operated strobe light on the 78 markings on the rotating disc. When the rate of the flashing light matches the 78 markings on the disc, the motion of the disc will appear stationary.

Jazz Club Vinyl and 78 Restoration Phono Pre-amplifer
To permit greater playback times and to improve sound quality, manufacturers of phonograph records reduced the frequencies below 500 Hz and strengthened the frequencies above 2 kHz when cutting their master records. The attenuation or boost of a frequency range in audio processing is known as the equalization and can be compensated for accurate reproduction upon playback.

By adjusting the pair of selector switches in the front panel of the Jazz Club, the pre-amplifier stage restores the original tonal balance. Select the equalization characteristics according to the date of recording and the manufacturer of the record. Refer to Appendix 1 for the equalization settings for Pre-1955 records. If the setting recommended is not available, use the closest setting.

Apogee Rosetta 200 2-channel 24 bit, 192 kHz, AD/DA Converter
The Rosetta is an audio interface that converts analogue audio signals to digital. It connects to Mac with FireWire cable.

Setup and Instruction: Recording a 78 into Peak

Record Cleaning

1. Lift the cover of the VPI HW-17 and make sure that the applicator head (left rear) and the vacuum pickup tube (right rear) are in their rest positions.
    g. The applicator head's rest position is back and parallel to the rear surface of the VPI HW-17.
    h. The vacuum pickup tube's rest position is with the velvet-surfaced tube pointing toward the back of the VPI HW-17.
2. Make sure the VPI HW-17 is level. Unscrew the record clamp and place a record on the turntable.
3. Place the clamp and tighten it enough to hold the record firmly. Loosen it if the outer rim of the record bows up.
4. Move the 'TABLE' switch up. The turntable should revolve in a clockwise or forward direction. Gear noise should be heard and is NORMAL.
5. Lift the applicator head (it lifts up only slightly) and swing it over the record.
6. Press the 'PUMP' switch briefly. Do not hold it in for more than a moment; otherwise too much fluid may be dispensed. The correct amount of fluid will completely cover the record's grooved area without spilling over the edge or onto the record label.

7. After the correct amount of fluid has been dispensed, allow the turntable to revolve three times in the forward (clockwise direction).
8. Then move the 'TABLE' switch down two clicks and run the turntable for three revolutions in the reverse (counterclockwise direction).
    i. Cleaning a record in the reverse direction is normally done only the first time it is cleaned. Thereafter, only the forward direction is used, unless, of course, the record should somehow get very dirty.
9. Lift the applicator head slightly and return it to its rest position.
10. Move the 'TABLE' switch two clicks back to its up position to start the turntable revolving forward again.
11. Swing the vacuum pickup tube anticlockwise over the record so that it is pointing at the turntable spindle.
12. Move the 'VACUUM' switch to its up position (the sound will be very much like a home vacuum cleaner). The vacuum pickup tube will lower and lock in position automatically, pointing toward the spindle.
13. Let the record revolve twice and return the 'VACUUM' switch to its down position again. The vacuum pickup tube will lift off the record and can be returned to its rest position.
    j. Two revolutions will normally remove all the cleaning fluid and leave a record completely dry. This does, of course, depend on how much fluid was dispensed on the record. If necessary, the record may be vacuumed for two additional revolutions.
    k. Do NOT think that more revolutions of drying is better. Excessive vacuuming can cause a buildup of static electricity that will attract the same kind of dirt that was just removed.
14. Move the 'TABLE' switch down one click to its center (OFF) position.
    l. To prevent damage to records, *always* turn off the vacuum before turning off the turntable.
15. Unscrew the record clamp, turn over the record, and repeat step 3-14 on the other side.
16. Clean any fluid dripped off the record being cleaned or the applicator head to prevent fluid from getting in the motors.

Playing a 78rpm for Digital Re-Mastering

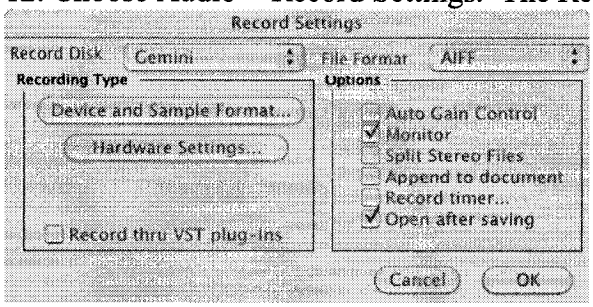
1. Make sure the SDS is turned on.
2. Switch the setting to 78 RPM by pressing the button on the front panel if it is not currently at 78.
3. Make sure the Jazz Club is turned on.
4. Refer to Appendix 1 and select the appropriate switch positions for equalization settings in the front panel.
5. Remove the record clamp and leave the rubber washer on the acrylic platter.
6. Place the disc on the turntable (the platter) with the playing side up; the rubber washer should be *below* the record.
7. Take the knurled clamp to tighten the 78rpm down to the acrylic platter with moderate pressure (the 78rpm should not spin freely).

8. Turn on the turntable by pressing the black button located on the left side of the turntable.
9. Remove the clear protecting case from the cartridge.
10. Dismount the tonearm from the armrest; move it to near the rim of the disc.

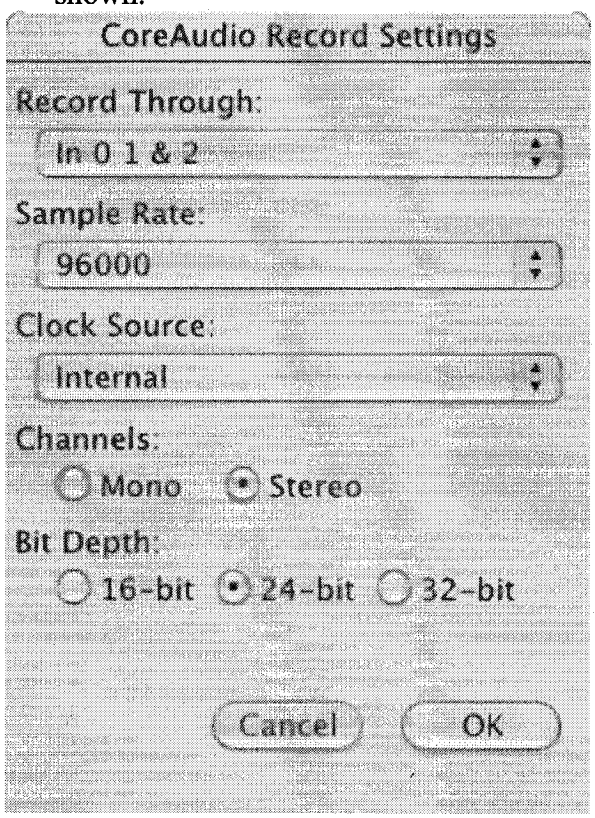
Configuring Peak for Recording

11. Locate the Peak icon on the dock and launch Peak (third from the right).

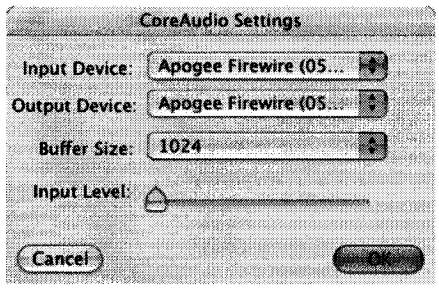
12. Choose Audio > Record Settings. The Record Settings dialog is shown.



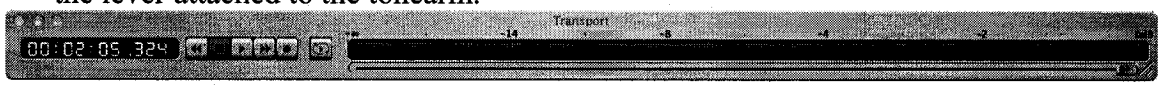
13. Click Device and Sample Format. The CoreAudio Record Settings dialog is shown.



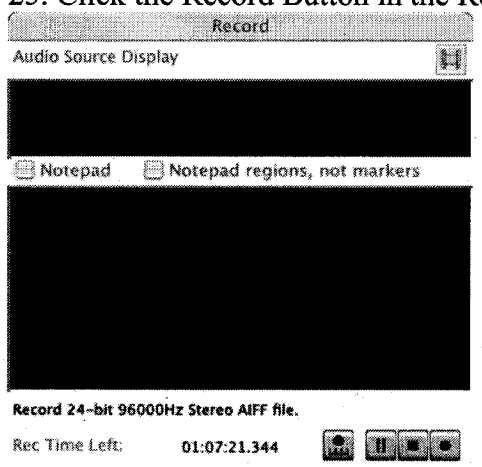
14. Configure the settings to match the ones pictured above and click the OK button.
15. In the Record Settings dialog (step 12), choose Hardware Settings.



16. Configure the settings to match the ones picture above and click the OK button.
17. Click the OK button close the Record Setting dialog box as shown in step 12.
18. Choose Windows>Transport.
19. Choose Windows>Toolbar.
20. Choose Audio>Record, or press Command-R. The Record window opens- not recording yet.
21. Wear the headphone to monitor the recording.
22. On the Transport, press Record and/or lower the needle to the record by lowering the lever attached to the tonearm.



23. If connections are correct, Peak's VU (level) meters should be active on with green lights.
24. On the Transport, press Stop and/or raise the needle from the record.
25. Click the Record Button in the Record Dialog (the button far right).



26. Start to play from the beginning of the record.
27. When finished recording, click the Stop button in the Record Dialog (the button from second right).
28. When the Save dialog appears, in the exiting folder GEMINI/USERS/Digitalmachine/Documents/jazz_78rpm/audio, create a new folder named.
29. Name the audio file as 78rpm_jazz_XXXX_Y_sideZ.aiff where
    a. XXXX is the collection number; if currently not cataloged, use 'uns'
    b. Y is the smaller matrix number of the two sides on the disc (consisted of alphanumeric characters)
    c. Z is 1 or 2 for side 1 or side 2, respectively

30. Click the Save button to save the file in the new directory just created.

Part 2. Scanning Images

Equipment and Software

- Epson Expression 1640XL Graphic Arts
- Epson Scan
- Adobe Photoshop 7.0
- Kodak Color Separation Guide (Small) Q 13, catalog number 152 7654
- Glass

Epson Expression 1640XL Graphics Arts
Getting the best scan possible depends on several factors, including the quality of the original source and the scanning resolution. Since scanning is very labor-intensive, it is preferable to scan at a much higher quality than it can practically be delivered today. These large scanned images can be used to derive smaller images to mount online today.

EPSON Scan
EPSON Scan directly controls all of the features of the EPSON scanner. This scanning software can be accessed directly or from Adobe Photoshop 7.0.1.

Adobe Photoshop 7.0.1
Since Photoshop is used for image manipulation, images are scanned directly into Photoshop using EPSON Scan.

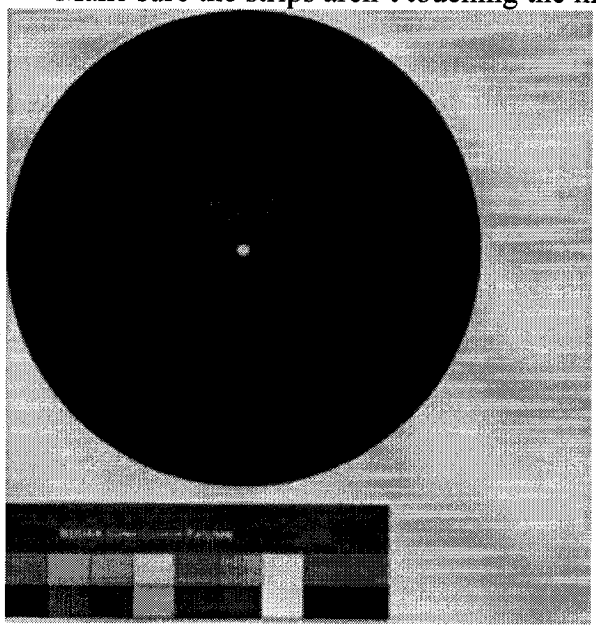
Kodak Color Separation Guide
Color values can be measured with Adobe Photoshop software to ensure consistency. Against each image, therefore, a Kodak Color Separation Guide should be placed to the side of the scanning image.

Glass
A piece of glass is place on top of the scanner bed. It protects the document table so that the discs will not scratch the surface of the scanner.

Calibration and Instruction: Image Capture Procedures

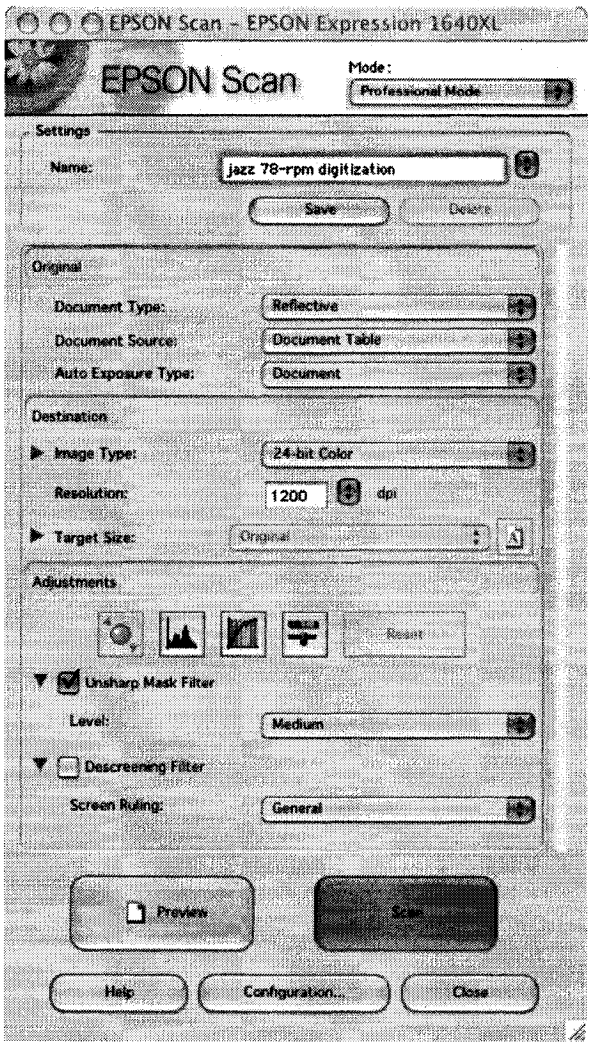
1. Light conditions can have a substantial effect on the ability of the operator to assess tones and colors accurately both in the originals and on screen. Modify conditions so there is sufficient lighting.
2. Raise the scanner cover and place the extra piece of glass on top of the document to protect the surface of the glass *when scanning a disc.*
3. Place the original document (e.g. album cover, booklet, disc) face down on the document table. Orient the document so that the entire object will be scanned.
4. Place the document so the horizontal and vertical edges are carefully aligned with the scales along the sides of the document table.

5. Include Kodak Color Separation Guide to the side of the scanning document. Make sure the strips aren't touching the image. See the example below.

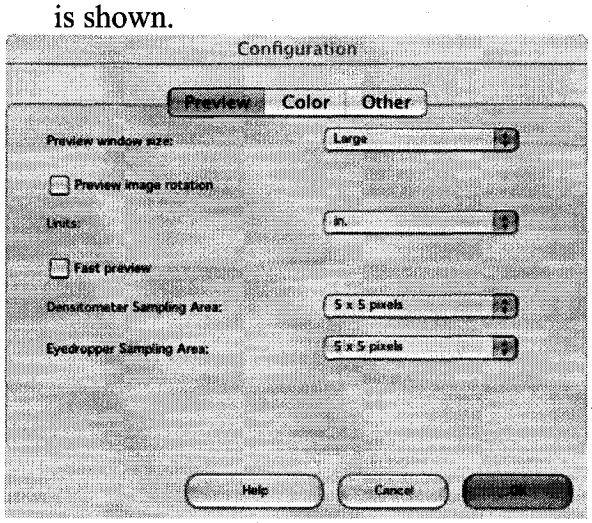


6. Close the document cover slowly. Be careful not to move the document.
7. Locate the Photoshop icon on the dock and launch Adobe Photoshop 7.0 (fourth from the right).

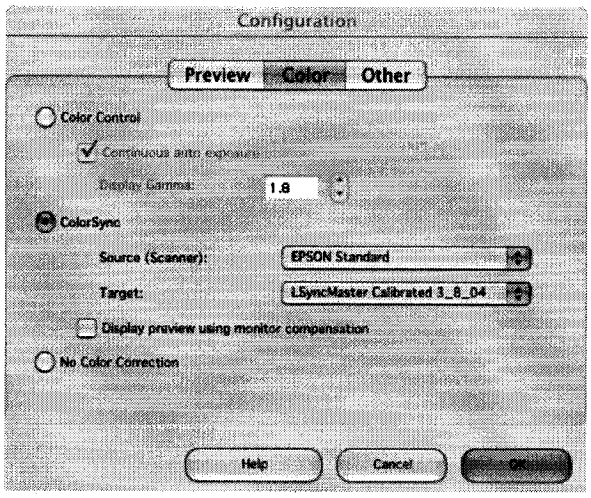
8. Choose File > Import > EPSON Expression 1640 XL. The EPSON scan dialog is shown.



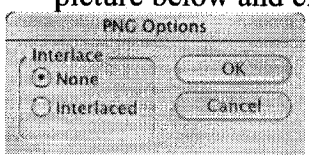
9. Configure the settings to match the ones pictured above.
10. In the Epson scan dialog (step 8), choose Configuration. The Configuration dialog is shown.



11. Configure the settings to match the ones pictures above.
12. In the same window choose the tab Color. The Color dialog is shown.



13. Configure the settings to match the ones pictures above.
14. In the Epson scan dialog (step 8) press the button Preview to do a pre-scan.
15. Compare to the original to make sure you have the right exposure. Also make sure the strips are not touching the scanned image so cropping the image will not remove any content information from the original.
16. Press the Auto Exposure button to obtain the best setting for the scan. When have finished making adjustments, click the Scan button in the Epson scan dialog.
17. In Photoshop choose File>Save As
18. In the exiting folder GEMINI/USERS/Digitalmachine/Documents/Jazz-78rpm/images, create a new folder named jazz_X_Y_Z where X is the four digit collection number (e.g. 0001), Y is the label name (e.g. decca), and Z is the issue number or the matrix number on side 1 of the disc label.
19. When the Save dialog appears, name the file jazz_X_Y_Z_d#_s#, for example, jazz_0001_decca_2803_d1_s1, for disc 1, side 1.
20. Choose format PNG; check Embed Color Profile; and choose the new directory created above to save it in.
21. Click the Save button.
22. When the PNG Options dialog appears, configure to match the ones like the picture below and click the button OK.



Part 3. Form-to-Database Online Data Entry

Equipment and Software

- Safari Web Browser

Setup and Instruction: Recording Metadata

1. Open a web browser (e.g. Safari) and go to the web data entry page located at http://coltrane.music.mcgill.ca/jazz78rpm/jazz78-data-entry/album.php

2. Enter information (i.e. data and metadata) pertinent to or appears on the album jacket, sleeves, booklet, or inserts in the relevant section in the Album/Accompanying Material page.
3. Enter information pertinent to or appears on the discs in the Discs page.
4. Click on data entry field label to find help and examples.

Appendix I: Equalization Chart for 78-rpm Records

Switch Positions	Manufacturer
0/0	Acoustics
500/0	Brunswick, Parlophone, US mid 30s
400/12	Capitol (1942); Decca (1934); Mercury
200/8.5	Columbia (1925–1937)
300/16	Columbia (1938–)
250/0	Columbia (Eng.), EMI (1931), HMV (1931), HMV/Blumlein
150/6	Decca (early 30s)
357/12	Decca (1934)
150/9	Decca 78
250/5	Decca FFRR (1949); London FFRR (1949)
500/12	MGM, Victor (1947–52)
200/0	EMI 1931
375/5	Victor (1925)
500/7	Victor (1938–47)
500/13.7	RIAA/CCIR

Table 1

Information in Table 1 is compiled from the reference sources below:

Powell, J. 1992. *The audiophile's guide to 78 rpm transcription, and microgroove recordings.* Portage, MI: Gramophone Adventures.

Powell, J., and R. Stehle. 1993. *Playback equalizer settings for 78 rpm recordings.* Portage, MI: Gramophone Adventures.

Appendix H

UML Diagram of the Jazz 78s Database: