

# Musical Metadata and Knowledge Management

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## INTRODUCTION

Is music a form of knowledge? Probably not, even if music is undoubtedly an important part of our cultural heritage. Music is not a type of knowledge, at least in first approximation, because music has no consensual, shared *meaning*. One of the main reasons why music has no meaning, as opposed to text or even pictures, is that music is not *referential*: music is made of elements (notes, chords, sounds) which do not refer to any objects or concepts outside the musical world (Meyer, 1956). Being without meaning, music is not a type of knowledge.

However, our heavily digitized society continuously produces and exploits an increasing amount of *knowledge about music*. This knowledge, also called *metadata*, has taken a growing importance in the music industry and deserves a special treatment in this encyclopedia because of the specificities of music. On one hand, music is ubiquitous and pervasive: there are about 10 million music titles produced by the major music labels in the Western world. Adding the music produced in the non-Western world probably doubles this figure. The music industry is one of the prevalent industries in the Western world today. On the other hand, music is elusive, in that it is difficult to define exactly what music is (for instance, distinguishing music from ambient sounds is not always trivial). To make all this music easily accessible to listeners, it is important to describe music in ways that machines can understand. Music knowledge management is precisely about this issue: (1) building meaningful *descriptions* of music that are easy to maintain, and (2) exploiting these descriptions to build efficient music access systems that help users find music in large music collections.

## BACKGROUND

The issue of building music description is the subject matter of the audio part of the Mpeg-7 standard (Nack & Lindsay, 1999). Mpeg-7 focuses only on the notion of metadata, as opposed to its predecessors (Mpeg-1, 2, and 4), and proposes schemes to represent arbitrary symbolic and numeric information about multimedia objects, such as music or movies. However, Mpeg-7 deals only with the syntax of these descriptions, and not with the way these descriptions are to be produced. Here is, for instance, an

extract of an Mpeg-7 description of the music title “Blowin’ in the Wind” by Bob Dylan. This extract declares the name of the artist, the name of the song, and its genre (here, “Folk,” according to a genre classification indicated in the extract itself).

The first step toward music knowledge management is probably music identification. Robust audio fingerprinting techniques have been developed recently to identify music titles from the analysis of possibly distorted sources, such as radio broadcasts, or direct recordings from cell phone microphones (Cano, Battle, Kalker, & Haitsma, 2002). Audio fingerprinting is not a knowledge management technique *per se*, but is a prerequisite to build music collections. This technique has received considerable attention in the last few years, and today very robust solutions have been designed and implemented in real-world systems, such as the MoodLogic Music Browser.

To give a concrete idea of typical music descriptions used in musical knowledge management systems, let us give here three examples and their related use.

Several companies produce and exploit so-called *editorial* musical metadata—for instance, AllMusicGuide (Datta, 2002) or MusicBrainz (<http://www.musicbrainz.org>). This information typically relates to songs and albums (e.g., track listings of albums), but also includes information on artists (biographies, periods of activities) and genres. A typical scenario of use is the display in a popular music player of an artist’s biography and genre when a title is played. When a title is played, an identification mechanism produces the identity of the title and artist, and a query is made to AllMusicGuide to retrieve more information, for example, the biography of the artist or the photograph of the album the title comes from.

Another popular application of musical metadata is *query-by-humming*. Query-by-humming consists of letting users sing or hum a melody, and retrieves the songs whose melodies match the input (Birmingham et al., 2002). Technically, query-by-humming is one instance of music information retrieval systems. In terms of knowledge management, this application makes use of the analysis of melodies from the audio signal and the sung inputs, so they fall in the category of acoustic descriptors as described below.

Finally a popular view on music knowledge management is *collaborative filtering*, as used in music portals such as Amazon. Collaborative filtering makes intensive

Figure 1. An Mpeg-7 extract for describing information about a music title

```

<?xml version="1.0" encoding="UTF-8"?>
<Mpeg7
  xmlns="urn:mpeg:mpeg7:schema:2001"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:mpeg7="urn:mpeg:mpeg7:schema:2001"
  xsi:schemaLocation="urn:mpeg:mpeg7:schema:2001 mpeg7-smp-2004.xsd">
  <Description xsi:type="CreationDescriptionType">
    <!-- ID3 Track number -->
    <CreationInformation id="track-01">
      <Creation>
        <!-- ID3 Song Title -->
        <Title type="songTitle">Blowin' in the wind</Title>
        <!-- ID3 Album Title -->
        <Title type="albumTitle">The Freewheelin'</Title>
        <!-- ID3 Artist -->
        <Creator>
          <Role href="urn:mpeg:mpeg7:RoleCS:2001:PERFORMER"/>
          <Agent xsi:type="PersonType">
            <Name>
              <FamilyName>Dylan</FamilyName>
              <GivenName>Bob</GivenName>
            </Name>
          </Agent>
        </Creator>
        <!-- ID3 Genre -->
        <Classification>
          <Genre href="urn:id3:cs:ID3genreCS:v1:80"><Name>Folk</Name></Genre>
        </Classification>
      </CreationInformation>
    </Description>
  </Mpeg7>

```

use of user profiles, and exploits similarity or patterns in large databases of profiles. Technically, collaborative filtering is one instance of so-called *cultural descriptors*, as we will see below.

The three examples are deliberately chosen to represent three types of information: editorial, cultural, and acoustic. These three types of information actually cover the whole range of techniques for music knowledge management. The next section reviews in more detail each of these types of information and highlights the main technical issues related to each of them.

### THREE TYPES OF MUSICAL METADATA

Although there is a virtually infinite number of musical metadata that can be thought of concerning the description of music, we propose here to classify all of them in only three categories: editorial, cultural, and acoustic. This classification is based on the nature of the process that leads to the elaboration of the metadata.

### Editorial Metadata

Editorial metadata refers to metadata obtained, literally, by the editor. Practically, this means that the information is provided manually, by authoritative experts. Examples of editorial metadata in music range from album information (e.g., the song “Yellow Submarine” by the Beatles appears on the Album “Revolver” issued in the UK) to administrative information such as the dates of recording, the composers or performers. Because editorial metadata covers a wide range of information, from *administrivia* to historical facts, it is difficult to define precisely its scope other than by stating how it was produced.

Editorial metadata is not necessarily objective. For instance, the AllMusicGuide editorial metadata portal (Datta, 2002) provides information about artist biographies, which may be biased by cultural factors. In particular, genre information—seen as editorial metadata (i.e., entered by human experts)—is known to be particularly subjective.

Technically, the tasks of organizing editorial metadata raises specific challenges, such as:

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