Chapter XIV
Music Representation of Score, Sound, MIDI, Structure and Metadata All Integrated in a Single Multilayer Environment Based on XML

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ABSTRACT

In this chapter, we will analyze the heterogeneous contents involved in a comprehensive description of music, organizing them according to a multilayer structure. Each layer we can identify corresponds to a different degree of abstraction in music information. In particular, our approach arranges music contents in six layers: General, Music Logic, Structural, Notational, Performance, and Audio. In order to reflect such organization, we will introduce a new XML-based format, called MX, which is currently undergoing the IEEE standardization process (IEEE SA P1599). In an MX file, music symbols, printed scores, audio tracks, computer-driven performances, catalogue metadata, and graphic contents related to a single music piece can be linked and mutually synchronized within the same encoding. The aforementioned multilayer structure allows us to gather and organize heterogeneous contents, leaving them encoded in well-known and commonly used formats aimed at music description.
INTRODUCTION

Nowadays, music is considered an important matter in information and communication technology. Production, reproduction and representation of music by computer are different facets of the same problem: all these terms should be taken into account for a comprehensive description of music. In fact, if we want to provide an accurate and detailed description of a music piece, we cannot consider only its score. On the contrary, our approach requires a deep knowledge about the processes that bring to the final result, including compositional ideas, music structures and relationships, notated signs, sound generation, recording and reproduction.

Today it is possible to produce music and sound also by computer. In this context, the term production can mean generation, composition, but also transformation and manipulation of existent audio material. Computer based production is not only allowed, but even made easier and richer as regards expressive possibilities. We can cite the examples of computer aided composition, notation and editing software, digital instruments and effects, and so on.

Not only music production, but also music reproduction has gained benefit from digital knowledge and techniques. As regards digital music availability for its consumers, information technology has recently reached good results: let us cite portable and wearable audio devices or the phenomenon of online music sharing. In other words, music availability is now achieved both in space and in time, and music can be enjoyed both by remote and by future recipients.

About music reproduction on digital devices, a significant example is constituted by digital media supports and by file formats that make music available on computers. If we were able to include audio information coming from one or more media files as well as score symbolic representation, the overall description of the music piece would be more complete, opening a number of new scenarios that will be discussed later.

A directly related aspect is represented by music digitalization, in its most comprehensive meaning: not only performances, but also scores, graphic material, and related physical objects. We know that digital information is not intrinsically eternal (see Rothenberg, 1995 for a throughout discussion about the longevity of digital information), however—thanks to digitalization campaigns—documents can be preserved from the wearing out due to time and physical phenomena. After digitalization process, storage and networking technologies allow the preservation, the transmission, and the worldwide diffusion of music.

As regards information and communication technology, the state of the art of music production and reproduction by computer-based systems is noticeably advanced. But what about music description?

Before jumping into an in-depth discussion of the matter, let us claim the relevance of computer-based music description. In our opinion, the audience of potential recipients is very wide: music producers (publishers, editors, composers, major, and indie record labels, and multimedia entertainment industries), music consumers (both educated listeners and keens), and finally researchers (analysts, musicologists, etc.) Each of the aforementioned actors faces the problem of music description from a different point of view, and expects an answer to the actor’s requirements and demands.

Needless to say, the locution music description can embrace a number of different meanings, and understanding its exact sense is the first key problem. When we describe a music work, we usually list the metadata about its title, its author(s), its performers, its instrumental ensemble, and so on; but we could also want to catch the symbols that compose the piece, or give a description of physical objects related to music itself and to music performance; finally, also audio/video recordings