Chapter II
MPEG Symbolic Music Representation: A Solution for Multimedia Music Applications

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ABSTRACT

The evolution of digital communication devices and formats has recently produced fundamental changes in the practical approach to music representation and notation, transforming them from a simple visual coding model for sheet music into a composite tool for modelling music in computer and multimedia applications in general. As a consequence, a multilayer model of music representation is needed for several purposes in addition to sheet music production or visual display, such as audio rendering, entertainment, music analysis, database query, music performance coding, music distance learning, and so forth. Symbolic music representation is a standard for modelling music notations, proposed inside the MPEG multimedia framework. Symbolic music representation generalizes the main music notation concepts to model the visual aspects of a music score, along with audio information or annotations related to the music piece, allowing integration with other audiovisual elements by multimedia references. The symbolic music representation standard overcomes the limitations of a widely accepted format like MIDI, which is in line with its main purpose to model music events whereas it reveals important limitations in producing audio and visual representations with satisfactory results.
INTRODUCTION

Music is mainly accessed through its audible representation, while music notations have been developed to visually represent the information needed by performers to play, through specific instruments, the musical work and reproduce music as intended by the author. The visual representation of music has reached the present format by means of many years of evolution. Thus, the edition of music scores for professional publishing and visualization is one of the earliest applications of music notation on computers, and it is mainly focussed on visual arrangement and rendering of music symbols (Blostein & Haken, 1991; CANTATE, 1994; Selfridge-Field, 1997), (many commercial applications exist: Sibelius (http://www.sibelius.com), Finale of Coda (http://www.finalemusic.com/), Capella (Capella, 2005)). Sheet music publishing requires the production of high-quality music scores, in terms of visual rendering.

The evolution of information technology has recently produced changes in the usage of music representation in practice, transforming music notation from a simple visual coding model for music score to a tool for modelling music in computer programs and electronic tools in general. In the last few years, several XML-compliant mark-up languages for music modelling have been presented (and a review is also reported in this book), among them: MNML (musical notation markup language), MusicML, MML (music markup language), MusicXML (Good, 2001), WEDELMUSIC (http://www.wedelmusic.org) (Bellini, Della Santa, & Nesi, 2001; Bellini & Nesi, 2001), CAPXML (Capella, 2005), and so forth. Most of them are mainly focused on modelling the music elements to preserve and interchange them among other applications. Past efforts for standardizing music notation were attempted in the past with SMDL (SMDL, 1995) and NIFF (NIFF Consortium, 2005). Only a few of the mentioned formats can cope with part of the needs of the innovative and emerging applications in interactive multimedia music, as highlighted in the MPEG requirements on symbolic music representation (ISO document ISO/IEC SC29WG11, W6689). The most relevant among these requirements are briefly reported and commented on in this chapter. Some of the innovative applications integrate 3-D virtual reality, complex animations, and synchronizations, and they are already spreading in everyday life, together with many emerging prototypes and tools from research and development projects that explore new areas and possibilities. These new applications can be categorised briefly as:

- Multimedia music systems for music tuition, for example: VOYETRA, SMARTSCORE, PLAYPRO, PIANOTUTOR, IMUTUS (self-tuition system for recorder in which the pupil has the possibility of receiving suggestions and observing the correct posture of the hands provided by a 3-D scene reconstruction) (http://www.exodus.gr/imutus/), MUSICALIS (self-tuition system for several instruments in which the user may receive suggestions and other information) (http://www.musicalis.fr/), Freehands (allowing the visualization and the annotation of music scores, http://www.freehandsystems.com/), Yamaha tools for music education (http://www.digitalmusicnotebook.com/home/), and so forth.
- Multimedia music tools for edutainment and infotainment in archives such as WEDELMUSIC (integrating music notation and multimedia for building and distributing multimedia music cultural content with digital rights management) (http://www.wedelmusic.org) (Bellini, Barthelemy, Bruno, Nesi, & Spinu, 2003), or for producing multimedia content to document and assist the user in theatres such as in OPENDRAMA (http://www.iua.upf.es/mtg/opendrama/).