Chapter 4
Towards an Encoding of Musical Interaction

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ABSTRACT

While representing musical processes or musical scores through Markup Languages is now well established, the authors assume that there is still the need for a format to encode musical material with which a musician can interact. The lack of such a format is especially crucial for contemporary music that involves computing processes. They propose such a formal representation for composing musical scores in which some temporal properties can be interactively modified during their execution. This allows the creation of scores that can be interpreted by a performer in the same way a musician can interpret a score of instrumental music. The formal representation comes with an XML format for encoding the scores and also interfacing the representation with other types of Markup Language musical description.

INTRODUCTION

As contemporary music involves more and more signal processing during the compositional process and more and more interaction during the performance, the notions of interpretation and consequently of scores are in complete mutation. The musical material of such interactive musical pieces is often represented by samples, signal processing programs as well as temporal information often represented as cue-lists. Obviously, such material cannot be qualified as a score for several reasons. Firstly, a score is written by a composer for the musician to interpret. The score contains musical information as well as instructions for the musician. Secondly, a score is based on an abstract notation that does not describe the resulting music in detail. The only information presented to the musician is: instrument, pitches, volumes, dates and durations of the notes. A score never describes, as a signal processing program, how the sound is produced by the instrument. As a consequence, the notions of score and interpretation need to be formalized in this new context.
Let us imagine for a moment what a score for contemporary electro-acoustic music consists of. For instrumental scores, it should contain a description of the instrument. Because computer music instruments are often part of the creation of a musical piece, such a description cannot be limited to a label but it should provide information about sets of samples, sound synthesis, and processing functions. It should also contain a temporal organization of musical events. Some of those events are musician gestures controlling sound synthesis or triggering samples, and others are synthesized sound automatically played by the computer. Moreover, such scores should display the musician gestures in a readable way according to a convenient symbolic notation and following a left to right temporal ordering.

The question that is raised concerns the nature of the link that should bind this kind of score and the usual musical material, which lies in the core of the computer during performance. By contrast with a paper score, a numeric score has the property to be an executable document. Moreover, by contrast with a paper score, which is physically separated from the instrument, a numeric score lies in the computer as well as the musical material composing the piece. As a consequence, this document should ideally be used on the one hand by the musician to execute the gestures that are provided by the score, and on the other hand by the computer to acquire the gestures information according to the temporal organization of the score and execute the corresponding signal processing programs during performance.

To complete this introduction, let us imagine how interpretation of contemporary music should be defined and formalized. Taking interpretation of instrumental pieces as an example, a performer would be able to control dates and durations of the musical events as well as sound and musical parameters in some limits given by the composer. As a consequence, the execution of a score, instead of being read in a deterministic way, should provide the musician with all the interpretation choices specified by the composer. Thus, a musical piece can be seen as a set of interpretations defined by a composer and among which the musician makes his choice.

To reach this objective, we introduce the notion of Interactive Scores. Objectives are written by the composer and they can also be performed and executed by the musicians. These interactive scores are based on a temporal formalism allowing the performers to control the dates and the durations of the musical events as in a traditional score, according to the freedom that the composer has given to them. We aim at creating a system, including an environment of assisted composition that allows the composers to create interactive scores, and an execution machine used by the performers in order to interpret the scores. We have already developed part of such a system that we called Iscore (Allombert, et al., 2007).

The Iscore system needs a backup format to encode the scores that are created with it. We address this issue with a transcription of the formalism into an XML format. More than a simple backup copy system, the Iscore-XML format can be applied to the more general representation of pieces of music allowing interaction. This is the point of view that we take here.

First, we present the abstract formalism of interactive scores. Then we explain why a specific format to encode them is needed, while one can find similarities with existing formats for multimedia documents. Finally, we show some applications of this format that we have developed, and imagine some perspectives of research and use.

**BACKGROUND**

As stated, our model of interactive scores was introduced to answer the question of the interpretation in electro-acoustic music context. Indeed, this question remains widely open (Dahan, et al., 2008) since the pieces of this type of music are supportive, and the possibilities to interact