Towards a New Paradigm for the Representation of Musical Information

Stephen Hul
IMOS Limited
1000 Aztec West
Almondsbury
Bristol BS12 4SG
sjh@imos.co.uk

1 Introduction

Traditional computer music languages have been shaped more by traditional computer languages than by traditional musical languages. This is a reflection of the fact that CMLs began, not as a means of writing music which would incidentally be generated by computers, but as a means of programming computers to generate music – a means slightly more efficient than using a general-purpose computer language.

There is nothing wrong with this: in fact it has been both initially necessary and subsequently beneficial, for it has addressed the fact that both the constraints imposed and the freedoms provided by the usage of such a language are primarily those of the computer. Furthermore, the need is incorporated the restrictions of a medium into the work done in that medium is a very basic and powerful catalyst for creativity in all fields of endeavor. However, it is not the only catalyst available.

Hopefully, as the design of computers and their languages get increasingly sophisticated, to we can worry less about computing and more about music. in this paper I wish to look more closely at some aspects of the syntax and semantics of traditional Western musical language which are not represented in traditional CMLs.

2 Motivation and Disclaimer

There are two points about Western musical language which make it a worthwhile subject of study. The first is its age. It has been evolving for quite a few centuries and has had time to lose a lot of underlying characteristics and acquire a lot of good ones. The second is that it is familiar to the majority of Western musicians. Some of that familiarity has been transferred to CMLs before, as in the use of note names and time signatures. Perhaps more can be as well.

I should be stressed that I am making no criticism of existing approaches to CMLs and certainly not to other musical languages. I am not suggesting that traditional Western musical language is inherently superior to other languages. I do, however, feel that I should not be ignored just because it is familiar.

3 Syntax

By syntax I am referring, not just to common music notation, but to the very sophisticated interaction of notation and what, for lack of a better phrase, I shall call musical etiquette. it is important to remember that what is written down is only a part of the language.
3.1 Stack-like Operations

Consider a piece of music that begins Andante, then goes to slow and finally has the indication Primo Tempo. Note that the Largo did not replace the Andante; it temporarily overrode it. Primo Tempo is the restoration of the original tempo. Such changes from and returns to tempo, loudnesses, etc. are not well served by conditional brackets or if-then-else statements. It is instructive to note that they can be represented by the common data structure of a stack: when the Largo is encountered, we are in effect pushing it onto a "tempo" stack, covering up the Andante. The Primo Tempo is a pop operation wherein we lose the Largo indication permanently and restore the earlier tempo.

3.2 Explicit versus Implicit Language

The relationship between notation and musical etiquette can also be viewed as the relationship between what is explicit and what is implicit in the score. Take for instance the representation of loudness. We can classify three types of explicit loudness indication. First we have absolute loudness indications such as p, mf, etc. Between these absolute indications we may have bridging indications such as crescendo and diminuendo marks. Finally, we have transient indications such as accents and staccato. These transient indications are, by the way, another example of the stack-like operations mentioned above.

These indications can quite clearly map to loudness indications in CMLs. But loudness in Western musical language depends on much more than this: it is the intensification of a number of different influences. In addition to the explicit loudness indications, the loudness of a note will depend on such things as its position in the bar, its position in the phrase, the length of the piece of which it is a part, the instrument which is playing the note, the orchestration (i.e. what other music we are in the company of) and the size of the performance space.

Note that these are not arbitrary influences but definite and predictable ones for which there are conventional interpretations. Because there are conventional interpretations, they are part of the language, even though they are part of the language, even though not explicitly written down: they are implicit language.

If a CML were to have implicit parts, we might subdivide them into two categories. The first comprises these things which the composer does not want to deal with. Taking our example above, this might include such things as automatically scaling the loudness of a piece to the performance space, or specifying that a voice will stand out in front of the others in a piece, without necessarily knowing what those other voices will be. The other voices might eventually be specified in the CML, or they could come from elsewhere.

The second category of implicit notation contains those things that the composer is aware of and intentionally uses. A simple example would be the modification of loudness by means of phrasing, but the possibilities are many. In this category we can see the distinction between the language and the instrument being blurred somewhat. Some of what we may term an implicit part of the language might also be termed the characteristics of the instruments being composed for.

3.3 Scaling of Influences

This same loudness example reveals another aspect ofWestern musical language: the multiplicity of influences governing any dimension of the performance at any time. Rather than setting the loudness and being done with it, the specification of loudness is the combination of very many parts, as outlined above. This is also a result of the semantics of Western musical language, as will be discussed below.

The loudness example given in the discussion of syntax above is an example of various contributions having to be combined to determine a value. Certain of these may be weighted more heavily than others; certain may be ignored. For example, in the above example the absolute, bridging and transient indications may have the most influence on the loudness. The next most significant influences may be the instrument, orchestration and size of performance space. The length of the piece may also have a smaller influence, then the phrasing and finally the position in the bar.

This scaling of influences can be specified in two ways. First, the various influences can carry with them an indication of how significant their effect on that aspect of the musical element should be. Second, a piece of music or a musical element could declare to what degree it will be affected by the various influences acting upon it. Both methods would provide powerful capabilities in a CML.
4 Semantics

By the term semantics, I mean the intentions of the composer. This encompasses not only the way these intentions are carried out in the performance of the music, but how the performer actually composes the music.

4.1 Indirect Effects

Tying in with, though not identical to, the idea of implicit language discussed above is an aspect of composition which I will term indirect effects. This concerns those parts of a composition which the composer specifies only partially or indirectly. A phrase such as "loud" serves as a good example. A composer may write a line and say "louder" and proceed from there. The loudness is not so much the substance of the composer's activity, but rather a result of those activities. The composer neither knows nor cares what the precise loudness will be. The composer sets out guidelines and leaves it to the combination of the various influences and the performer's understanding of the implicit parts of the musical language for the loudness to be determined appropriately.

4.2 Aspects of Musical Elements

Each use of Western musical language centres around the creation of musical elements which are then used in different ways, both by themselves and in combination with other elements. By a musical element I mean a complete articulation of some musical material. This includes not just the sequence of pitches, but a timbre, expression, possibly harmonies and anything else which could affect what is heard.

Using this definition, it is clear that the complete element is rarely used. Rather, certain aspects of it are used. The most common aspect which occurs is the sequence of pitches. The rhythm of the element is also frequently employed. Another aspect which could be used is the pattern of rise and fall within the sequence of pitches taken, stripped of the actual intervals the pattern is composed of.

I will refer to computer languages only to note that an object-oriented model lends itself nicely to this idea. A musical element can be represented by an object. Requests could then be made of this object for whichever aspects are desired.

4.3 Perturbation

While a musical element may exist in a "pure" form in the composer's mind, its occurrences in a piece of music may all be different. The relationship between the absolute characteristics of an element and the individual differences of its instances is central to Western music, yet it is not generally well-represented in CMLs. A case in point is grammar-based CMLs. Many such languages have been developed which allow the replication and rearrangement of musical elements, some with a great deal of sophistication. The problem with such languages is that, in the vast majority of cases, such precise replication and rearrangement is not what composers want to do. Rather, it is a crude approximation of what composers want to do. Composers irreg-

ularity quote, whimsically modify, irrationally alter and serendipitously misplace musical elements. However, since irregularity, whimsey, irrationality and serendipity are difficult to represent in binary form, they have for the most part been ignored.

Perhaps every time a musical element occurs in a piece it could be accompanied by a list of perturbations, that is, ways in which this instance differs from the generic element. Conventional manipulations of musical material which might be represented as perturbations include augmentation, diminution, inversion, retrograde and the use of only a fragment of the element. Perturbations might also represent such things as the changing of individual notes or the addition of ornamentation.

5 Conclusions

I have briefly looked at the syntax and semantics traditional Western musical language. In doing so, I have identified several parts of this language which are not commonly incorporated into CMLs, but which seem to have potential to enrich such languages in the same way that they have enriched their own.