The GUIDO Notation Format

A Novel Approach for Adequately Representing Score-Level Music

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Abstract. GUIDO Music Notation is a novel approach for adequately representing score-level music. Based on a simple, yet powerful and easily extensible formalism, GUIDO is realised as a plain-text, human-readable and platform independent format. The key feature of our design is *representational adequacy*: simple musical concepts can be expressed in a simple way, while complex musical notions may require more complex representations. GUIDO Notation can be used for a broad range of applications, including notation software, compositional and analytical systems and tools, music databases, and music on the WWW.

Introduction and Background

The GUIDO Music Notation Format[1] is a novel, general purpose formal language for representing score level music in a platform independent, plain-text and human-readable way. The GUIDO design concentrates on general musical concepts (as opposed to only notational, i.e., graphical features). Its key feature is *representational adequacy*, meaning that simple musical concepts should be represented in a simple way and only complex notions should require complex representations.

The GUIDO design is organised in three layers: Basic, Advanced, and Extended GUIDO Music Notation. *Basic GUIDO* introduces the basic GUIDO syntactical structures and covers basic musical notions; *Advanced GUIDO* extends this layer to support exact score formatting and more sophisticated musical concepts; and *Extended GUIDO* introduces features which are beyond conventional music notation. GUIDO Music Notation is designed as a flexible and easily extensible open standard. Thus, it can be easily adapted and customised to cover specialised musical concepts as might be required in the context of research projects in computational musicology. GUIDO has not been developed with a particular application in mind but to provide an adequate representation formalism for score-level music over a broad range of applications. The intended application areas include notation software, compositional and analytical systems and tools, musical databases, performance systems, and music on the WWW.

Comparing GUIDO to other music representation formalisms, several differences can be found: Unlike the MIDI File Format [Hewlett, Selfridge 1997] or NIFF [Grande, Belkin; 1996], GUIDO is a plain-text, human-readable format. This facilitates the realisation of GUIDO support for music software and has considerable advantages for using GUIDO to interchange musical data between applications or across platforms and over the internet. Compared to other plain-text approaches like DARMS [Selfridge; 1997], SMDL [Sloan; 1997], or music representations based on HTML or XML, GUIDO shows improved representational adequacy (in the sense defined above) which again facilitates its usage and implementation. Finally, in contrast to representations which are specifically designed for graphic music notation, like Common Music Notation (cmn) [Schottstaedt; 1997], the GUIDO design is focussed on musical information, while also supporting exact score formatting features. Therefore, we believe that GUIDO is equally well suited for score setting and other music applications. In this respect, GUIDO follows a similar goal to DARMS, which was used for a wide range of applications until the early 1980s.

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[1] GUIDO Music Notation is named after Guido d'Arezzo (ca. 992-1050), a renowned music theorist of his time and important contributor to today's conventional musical notation. His achievements include the perfection of the staff system for music notation and the invention of solmisation (solfege).

```
[ \title<"Frère Jacques">
\tempo<"Moderato"> \clef<"treble"> \meter<"4/4">
\slur(c1/4 d e c) \slur(c d e c)
\slur(e f g/2) \slur(e/4 f g/2)
\slur(g/8 a g f e/4 c) \slur( g/8 a g f e/4 c)
\slur(c g0 c1/2) \slur(c/4 g0 c1/2) ]
```

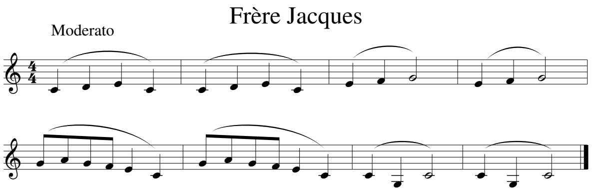

Figure 1: Example for Basic GUIDO

Basic GUIDO Notation

Basic GUIDO Notation covers many of the relevant aspects of specifying "simple" music. It is designed for the adequate representation of musical material, which can then be interpreted by computer music software and also be used for conventional music notation. All syntactical elements important to GUIDO are contained within Basic GUIDO. Within GUIDO notation, two basic syntatic elements are distinguished: events and tags. An *event* is a musical entity which has a duration (e.g. notes and rests) whereas *tags* are used to define musical attributes (such as a meter, a clef, or a key). GUIDO can also be used to represent incompletely specified music material; e.g. a scale can be represented without durations.

Notes and Rests In GUIDO notes are represented by their names (e.g. 'c', 'd', 'e' or 'do', 're', 'mi') followed by optional additional parameters: accidentals, register and duration. By omitting these parameters, incompletly specified music can be represented in GUIDO. A complete note description in GUIDO looks like '`c#1*1/4.`' which is a dotted quarter note middle c-sharp.[2] Note that register and duration information is carried over from one note to the next within note sequences. Rests are represented like notes; instead of a notename, an underscore is used: '`_*1/4`'; durations are specified as for notes.

Sequences and segments GUIDO offers two orthogonal concepts for the description of complete pieces of music: *sequences* and *segments*. A *sequence* describes a series of temporally consecutive musical objects, whereas a *segment* describes a number of simultaneous musical objects. The most simple form of a segment is a chord where the voices consist of single notes. Sequences and segments are realised in GUIDO using the following syntax: A sequence begins with a square bracket '`[`' and ends with the corresponding closing bracket '`]`'. Segments are enclosed in curly braces '`{ ... }`'; musical objects within segments are seperated by commas. Within sequences and chords, octaves and durations are implied from the previous note, if they are not explicitly specified.

Tags and basic musical concepts Written and played music does not only consist of notes and rests but also contains additional musical and graphical information. GUIDO can represent all the commonly known musical attributes using *tags*; a *tag* has a name, optional parameters, and an optional range of application. A multitude of tags are defined in Basic GUIDO; for a complete description see [Hoos, Hamel; 1997]. Just to name a view, there are tags to describe clefs, meter, tempo, intensity, crescendo, accelerando, and more. The semantics of the tags defined in GUIDO can normally be inferred easily from their names. The example in Figure 1 illustrates the usage of tags in Basic GUIDO.

Advanced GUIDO Notation

Advanced GUIDO Notation addresses issues of exact score formatting such as exact spacing and exact positioning and sizing of notational and arbitrary graphical elements. It also comprises some of the more advanced concepts not covered in Basic GUIDO Notation, such as glissandos, arpeggios, note clusters, different types of noteheads and staves, and some established features from contemporary notation. All tags defined in Basic GUIDO can be used within Advanced GUIDO; many of these tags have additional optional parameters for specifying exact positioning and scaling information. Using Advanced GUIDO, it is possible to represent exact score formatting information which could be imported by any kind of notation software

[2]The '*' between the register and the duration is needed to distinguish between register and duration-information.

```
{[ % 1st voice
  \pageFormat<"A4"> \title<"Quartett",dx=0cm,dy=1cm,adj="tc">
  \composer<"Ludwig van Beethoven\n op.130",dx=0,dy=1.4cm>
  \staff<1> \clef<"g2"> \key<"G"> \meter<"3/8">
  \tempo<"Allegro asai",dx=0,dy=9.6>
  \space<7.36> \i<"p",dy=-5.76>
  \beam(\slur<y=1.92>(
    \crescBegin<dx=1.28,dy=-5.76> d2/8 \space<6.4>
    \merge( b1/16 \crescEnd<dy=-5.76>
          \dimBegin<dx=1.28,dy=-5.76> b )
    \space<6.4> d2/16 \dimEnd<dx=0,dy=-5.76>)) _/16 ... ],
 [ % 2nd voice
  \staff<2> \clef<"g2"> \key<"G"> \meter<"3/8">
  \space<7.36> \i<"p",dy=-8,dx=0>
  \beam(\slur<dy=-1.92>(
    \crescBegin<dx=1.92,dy=-8.96> b0/8 \space<6.4>
    \merge( d1/16 \crescEnd<dx=0,dy=-8.96>
         \dimBegin<dx=1.28,dy=-8.96> d )
    \space<6.4> b0/8 \dimEnd<dx=0,dy=-8.96>))  ... ],
 [ % 3rd voice
  \staff<3> \clef<"c3"> \key<"G"> \meter<"3/8">
  \space<7.36> \i<"p",dy=-5.76,dx=0>
  \beam(\slur<dy=1.92>(
    \crescBegin<dx=1.28,dy=-5.76> g0/8 \space<6.4>
    \merge( b1/16 \crescEnd<dx=0,dy=-5.76>
       \dimBegin<dx=1.28,dy=-5.76> b )
    \space<6.4> g0/8 \dimEnd<dx=0,dy=-5.76>))  ... ],
 [ % 4th voice
  \staff<4> \clef<"f4"> \key<"G"> \meter<"3/8">
  \space<7.36> \i<"p",dy=-5.76,dx=0>
  \crescBegin<dx=1.28,dy=-5.76>
  \merge( g0*3/16 \crescEnd<dx=0,dy=-5.76>
    \dimBegin<dx=8.32,dy=-5.76> g0/16 )
  \space<12.8> _/8 \dimEnd<dx=0,dy=-5.76> ... ] }
```

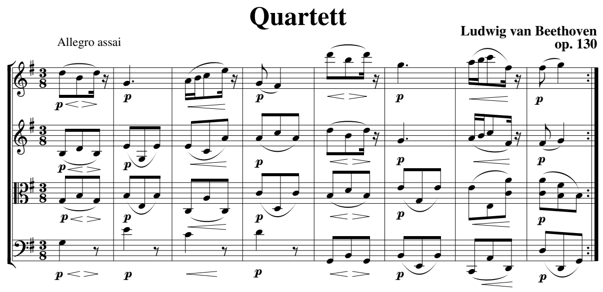

Figure 2: Example for Advanced GUIDO; The GMN source (left) demonstrates how exact score formatting information can be specified for the first measure of the Beethoven excerpt (right).

supporting GUIDO. This feature should make Advanced GUIDO an ideal format for transmitting and exchanging musical and notational information in a platform- and application-independent way.

Exact formatting and score layout Exact score formatting is realised in Advanced GUIDO using additional tag parameters and new tags: the most important formatting tags are `\pageFormat`, `\systemFormat`, `\staffFormat`, and `\space`. Using these tags it is possible to exactly specify the layout and graphical appearance of a piece. The `\staffFormat`-tag, for example, specifies the size and type of a staff. The complete specification and further examples can be obtained at our WEB site. Some of the exact score formatting features of Advanced GUIDO are exemplified in Figure 2. Such Advanced GUIDO representations are more complex than Basic GUIDO descriptions (see Figure 1), but they are extremly useful for exchanging formatted scores between notation applications.

Advanced notation and advanced musical concepts Advanced GUIDO also supports features like glissandos, arpeggios, or note clusters, which can be found in some scores. Another feature of Advanced GUIDO lies in the possibility to include and use arbitrary graphical elements. Using this feature it becomes possible to describe part of a score using newly constructed graphical elements. This feature seems to be important for notating contemporary music that expands the conventions of standard music notation.

Conclusions and Future Work

While the specification of Basic and Advanced GUIDO has been completed, we are currently working on the Extended GUIDO specification which covers issues beyond conventional music notation such as exact timing, micro-tonal tuning, and user-defined GUIDO tags and events. To further promote GUIDO and its wide-spread use, converters between GUIDO and MIDI as well as a parser kit that can be used as a basis for realising GUIDO import is available from the GUIDO website.[3]

[3] http://www.informatik.tu-darmstadt.de/AFS/GUIDO

We also developed the GUIDO NoteServer which is presented elsewhere in these proceedings [Renz, Hoos; 1998]. Furthermore, we are currently realising full GUIDO support for Keith Hamel's notation program NoteAbility [Hamel; 1997]. Further projects include GUIDO support and a customised GUIDO extension for Elody [Orlarey *et.al.* 1997], HARMONET [Hild *et.al.* 1992], and Mutabor [Abel *et.al.*; 1992]. There are also plans for realising GUIDO support for OpenMusic [Assayag *et.al.*; 1997]. From our experience so far, GUIDO has proven to be extremely useful, both as a music representation format and as a data exchange format for musical information. It is our hope that, based on more experience gathered by propagating the ideas and the use of GUIDO within the community, GUIDO Music Notation will finally become what we want it to be: an adequate and widely used formalism for representing score-level music.

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