BEYOND MIDI: KNOWLEDGE-BASED SUPPORT FOR
COMPUTER AIDED COMPOSITION

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ABSTRACT: Although MIDI as a driving force behind modern computer
music systems is sufficient to represent the manifold aspects of performed music
we consider it insufficient to build higher level musical concepts upon. Compo-
sitional tasks like the derivation of new musical material conforming to specific
musical styles (e.g. harmonizing a melody) require higher levels of musical rep-
resentation. The paper describes a collection of Smalltalk-80 based tools built
upon an explicit representation of deep musical knowledge. Using the AMUSED
editor as a core they provide knowledge-based support for compositional tasks.
Prototypical parts of the system undergo thorough evaluation by being used in
compositional classes.

Computer music systems have become more and more sophisticated. There also has
been a tendency towards integrated computer music systems that manage a diversity of
musical tasks like processing and recording of MIDI I/O and printing scores. Unfortunately,
most of the more recent developments are still technology driven and refer to a technically
motivated representation of music, namely MIDI. Although MIDI is a sufficient language to
represent the manifold aspects of performed music, since, for instance, it allows a precise
description of a piano player's keystrokes with respect to timing, loudness, and sound we
don't think that the level of individual keystrokes is adequate to build higher level musical
concepts upon. Compositional tasks like the derivation of new musical material conforming
to specific musical styles (e.g. harmonizing a melody) have to be based on higher levels of
musical representation.

AMUSED. Our practical teaching experience at the Staatliche Hochschule für Musik
und Darstellende Kunst in Stuttgart with AMUSED (BöckelerMahling 88), a knowledge-based
editor for conventional music notation clearly demonstrates that the availability of higher
level musical constructs within a computer music systems dramatically facilitates the acce-
tance and usage of computers. Independent of any external notations AMUSED provides a
set of musical objects at several levels of abstraction, e.g. pitches, intervals, scales, metron,
instruments, chords and harmonic function interpretations. The message protocol of those
objects which comprise the deep musical knowledge, strongly resembles conventional musical
taxonomy. AMUSED links the objects of a conventional music notation to the objects of its
deep musical knowledge. Any task that accesses the deep musical knowledge, e.g. musi-
ting a manifestische Gestalt as part of a compositional process, may add new aspects, i.e.
more musical knowledge, to the deep musical knowledge associated with a piece of music.
This approach leads to an incrementally growing net of semantic entities which, as a whole,
describe the multitude of aspects of a musical composition.

For us, AMUSED has served as a starting point for research on what can be gained by
supporting highly interactive user front ends with domain specific knowledge: with AMU-
SED it is easy to accomplish a musical task: a musician need not issue lots of musically
meaningless or trivial commands but may use meaningful commands supported by the mu-
sical knowledge base. Although the currently available support is restricted to stereotypical
musical tasks (like certain types of arranging) or compositional experimentation this is a
great step forward in facilitating a more musically oriented use of computer music systems

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in that it enables a musician to concentrate on the music and forget about the technical steps necessary to reach a certain musical result.

MUNCK. We are currently extending AMUSED in several ways. First, the notational component of AMUSED are broadened by a Musical Notation Construction Kit, MUNCK', providing a set of tools to easily build new user interfaces for musical notations, e.g. tablatures, or to simply augment existing interfaces by adding new symbols, e.g. quarter or eighth note accidentals (see [Kurkochka 86] for a detailed description of musical notations). Building and integrating compositional tools like an editor for transforming musical phrases/patterns (cf. the GestaltTransformation window at the bottom of Fig. 1) will be eased with the aid of MUNCK too.

A Net Editor. Since nets play an important role both in deep musical knowledge representations and in representing their external forms we have developed a tool for designing, implementing and maintaining net representations in Smalltalk-80. The basic classes provide methods for comparing, copying, topological sorting of nets, adding new nodes to or removing nodes from an already existing net. The tool also provides prefabricated classes of frequently used net representations, like trees or nets whose nodes are connected by named links. Our notational user interfaces represent extensions of these classes, e.g. a conventional music notation represents a net of notational objects with subparts and links. These classes provide the full functionality normally encapsulated within the standard SMALLTALK-80 MVC-triangle, thereby replacing it.

Knowledge-Based Computer Supported Composition. Features is sneaking into commercial computer music systems. The "No threshold, no ceiling" philosophy behind these systems unfortunately does not eliminate the need to eventually read hundreds of handbook pages when the musician wants to utilize the more sophisticated capabilities of a system. This problem aggravates when upgrading from "plain" computer music systems, e.g. Cubase to knowledge-based music systems like AMUSED. The need for online support components that monitor the dialogue between the computer music system and the possibly unskilled users becomes obvious. Starting with HYPERDOC, a hyper documentation tool for Smalltalk-80, a set of such tools is currently under development for the AMUSED environment.

Implementation and Evaluation. For practical results, i.e. musical output, we are implementing a set of tools for MIDI I/O and MIDI processing, e.g. an n-track sequencer for MIDI recording, editors for monitoring MIDI port activity, and an editor construction kit based on VICK² [BoeckerPawlitschek 80] to build editors for whatever kind of MIDI device. The whole system is implemented in Smalltalk-80 using a Sun 3/60 (and an Atari 1024 as MIDI interface) as a development environment. Prototypical parts of the system undergo thorough examination and evaluation by being used in educational settings at the Musikhochschule Stuttgart.

Figure 1 displays some of the tools supporting AMUSED: an editor for conventional music notation, a VICKToolView which has been opened to construct an interface for a mixing console, a view for monitoring and (low-level) manipulation of MIDI I/O, a 16-track sequencer (each track is composed of several patterns) and an editor for transforming musikalische Gestalten, e.g. rhythmicization. The GestaltTransformationEditor, the Sequencer and the Note-Editor are based on MUNCK and any view designed as a MUNCK application could be used as a subview within VICK. The lower left corner of figure 1 displays some icons of a proprietary hypertext system for Smalltalk that is used as a tool for on-line help and documentation.

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Notes

1. The system's name, MUNCK, resembles the surname of the famous Norwegian painter Edvard Munch who painted pictures of uncomparably expressive scenes, e.g. Der Schrei.

2. VICK is a Visualization Construction Kit, a tool to build user interfaces, by means of a set of attributed gauges, e.g. counters, sliders, knobs, etc.

References


