MusAssist: A Domain Specific Language for Music Notation

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ABSTRACT

MusAssist is an external, declarative domain specific language for music notation. Users can change key signatures, start a new measure, and describe musical structures such as notes, rests, and custom chords in MusAssist's straightforward syntax much in the same way they would when composing. MusAssist is unique in that users can also describe complex musical templates for triads and seventh chords, cadences, and the four primary harmonic sequences with desired length. The level of abstraction of a MusAssist template MusAssist matches that of the theoretical musical structure it describes (e.g. users can describe a harmonic sequence without lowering the abstraction level to chords and notes). This allows users to write out specifications precisely at the conceptual levels of the musical structures they would organically conceive when composing by hand. The musical expressions described by the specifications are expanded out (i.e. the level of abstraction is fully lowered) by the Haskell-based MusAssist compiler and are translated to MusicXML, a language accepted by most major notation software, allowing for further manual editing.

1. INTRODUCTION

When writing music, composers must manually transition from musical theoretical concepts to notes on a page. This process can be tedious and slow, requiring the composer to expand complex structures, such as cadences and sequences, by hand to the notes that they constitute. The level of abstraction of the musical theoretical structure is higher than what the composer actually writes. MusAssist, an external, declarative domain specific language (DSL) for music notation, attempts bridge the divide between theory and notation. Users describe a composition in MusAssist's straightforward syntax, and the MusAssist compiler writes out the music via these instructions.

Fundamentally, MusAssist supports notes (including rests) and custom chords (i.e. any desired collection of notes) in the octave and key of choice, as well as change the key signature or start a new measure at any point. MusAssist is unique in that users can also write specifications for complex musical templates *at the same level of abstraction as the musical theoretical structures they describe*. MusAssist supports **chords** (all triads and seventh chords in any inversion), **cadences** (perfect authentic, imperfect authentic, plagal, half, deceptive), and **harmonic sequences** (ascending fifths, descending fifths, ascending 5-6, descending 5-6) of a desired length. The musical expression described by this specification is completely expanded out (i.e. the level of abstraction is fully lowered) by the Haskell-based MusAssist compiler.

The target language of the MusAssist compiler is MusicXML, itself a DSL that is an extension of XML (Extensible Markup Language). MusicXML is accepted by most major notation software programs (such as MuseScore). Thus users can open can open the resulting MusicXML file of a compiled MusAssist composition in MuseScore or another program for further customization and editing, thus bypassing the need to write out complex musical templates by hand at a note- and chord-level of abstraction. Beyond a professional music compositional aid, MusAssist may be particularly helpful to music theory students as an educational tool, enabling them to visualize the relationship between a theortical musical structure and its expanded form, such as a cadence and the chords resulting from its expansion.

2. RELATED WORK

The era of music DSLs began in 2008 with Ge Wang's ChucK audio processing language, which spans the application domains of "methods for sound synthesis, physical modeling of real-time world artifacts and spaces (e.g., musical instruments, environmental sounds), analysis and information retrieval of sound and music, to mapping and crafting of new controllers and interfaces (both software and physical) for music, algorithmic/generative processes for automated or semi-automatic composition and accompaniment, [and] real-time music performance." Since then, researchers have taken advantage of the increased flexibility afforded to DSLs via their limited expressiveness to create music DSLs tailored towards notation, algorithmic composition, signal processing, live coding with music performance, and more. In the notation domain, MusicXML and LilyPond stand out.

Michael Good's MusicXML is an Internet-friendly, XML-based, declarative DSL capable of representing Western music notation and sheet music since c. 1600. It acts as an "interchange format for applications in music notation, music analysis, music information retrieval, and musical performance," thus supporting sharing between specialized applications.

MusicXML attempts to emulate for online sheet music and music software what the popular MIDI format did for electronic instruments. It is derived from XML in order to help solve the music interchange problem: to create a standardized method to represent complex, structured data in order to support smooth interchange between ”musical notation, performance, analysis, and retrieval applications.” XML has the desired qualities of ”straightforward usability over the Internet, ease of creating documents, and human readability” that translate directly into the musical domain, and it is more powerful and expressive than MIDI.

MusicXML is more expressive than MusAssist, but the level of abstraction of all musical elements is extremely low (i.e. chords must be written out as individual notes) and its syntax is very difficult and tedious to write by hand. However, its flexibility and expressiveness make MusicXML an excellent target compilation language for MusAssist's user-friendly syntax and high-level musical theoretical templates.

LilyPond, an external declarative DSL created by Han-Wen Nienhuys and Jan Nieuwenhuizen, is more similar to MusAssist. It features a ”modular, extensible and programmable compiler” written in Scheme to generate music notation of excellent quality and supports the mixing of text and music elements. Text-based *musical expressions*, or fragments of music with set durations, are compiled to an aesthetically formatted score.

LilyPond and MusAssist are both music notation DSLs tailored to non-programming audiences. However, they differ in two fundamental areas: (1) MusAssist is more expressive than LilyPond as it supports complex music templates at the levels of abstraction of the musical structures they represent and (2) the output of the MusAssist compiler is intentionally editable via notation software (unlike LilyPond's compiler, which produces a static, printable PostScript or PDF file by taking in a file with a formal representation of the desired music).

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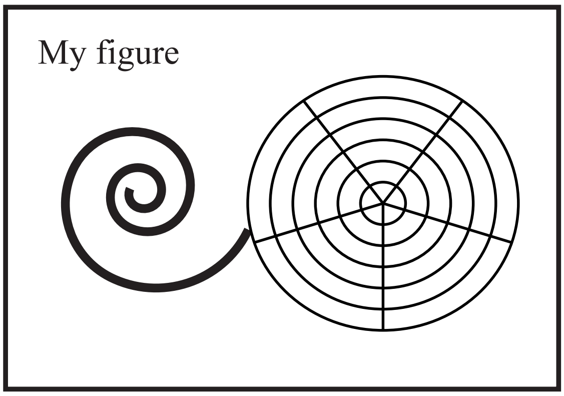

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Acknowledgments

At the end of the Conclusions, acknowledgements to people, projects, funding agencies, etc. can be included after the second-level heading “Acknowledgments” (with no numbering).

8. REFERENCES

[1] A. Someone, B. Someone, and C. Someone, “The Title of the Journal Paper,” *J. New Music Research*, vol. 12, no. 2, pp. 111–222, 2009.

[2] X. Someone and Y. Someone, *The Title of the Book*. Springer-Verlag, 2004.

[3] A. Someone, B. Someone, and C. Someone, “The Title of the Conference Paper,” in *Proceedings of the 2005 International Computer Music Conference*, Barcelona, 2005, pp. 213–218.