Electronic Locator of Vertical Interval Successions

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Inspiration

Inspired by Sinclair's *Corpus, Concordance, Collocation* (1991), Cumming and Schubert sought the most commonly repeated patterns in corpora of polyphonic music. Without clearly-separated words and sentences however, polyphonic music is more complex than text. As experts in counterpoint, they chose contrapuntal modules as a stand-in for words (refer to the description at right). Much like grammar, after thousands of years of study, scholars disagree on how counterpoint works, yet it is almost ubiquitous in Western music.

Objectives

1. Create an **online database** of polyphonic music.
2. Create **software tools** to find repeated musical patterns in counterpoint and harmony.
3. Conduct research about **musical style periods**.

Online Database

Our database has more than 6000 pieces with carefully-curated metadata. We consolidated various collections for easier searching by all types of scholars.

VIS Framework

We designed a Python API to accomodate a wide range of music analysis queries. This Framework is highly modular, and we provide a number of templates with extensive documentation to encourage other researchers to use and extend the Framework. We use the music21 and pandas software libraries for greater flexibility in query design.

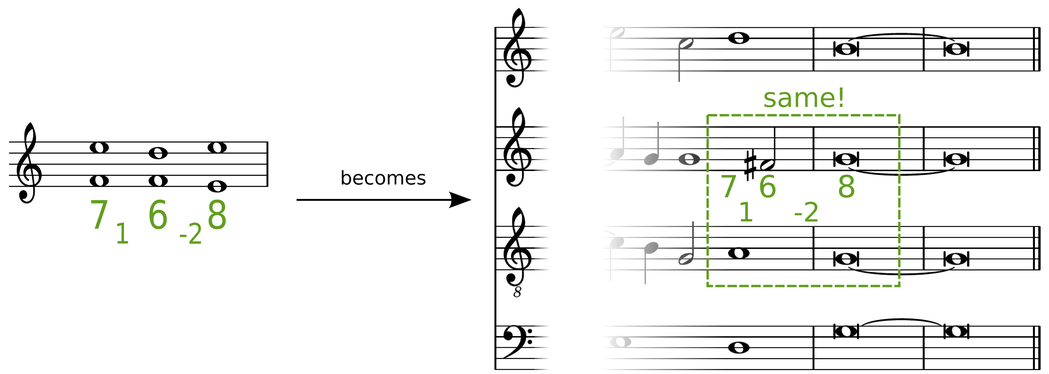
So far, our development efforts have focussed on the program components for contrapuntal analysis, including many-part, arbitrary-length contrpuntal modules. We developed extensive tests to ensure the correctness of our results, and a number of components for statistical analysis and visualization—including score-based output.

Like all our software, the Framework is copyrighted under the free-and-open GNU AGPL software licence.

Contrapuntal Modules

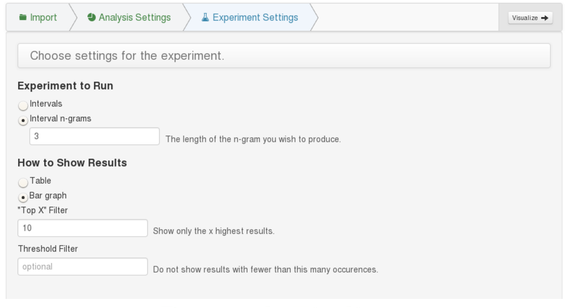
Polyphonic music has two or more simultaneous parts at the same time. We represent the pitch distance between two notes with numbers called "intervals." An interval between two simultaneous notes is "vertical" or "harmonic;" between two consecutive notes either "horizontal" or "melodic." Counterpoint studies the most appropriate order of vertical intervals, and the horizontal intervals of the lower part that connects them. We at ELVIS collect these into "contrapuntal modules."

In the leftmost example, vertical intervals appear directly under the relevant sonority, with horizontal intervals of the lower voice between them. This module, **7 1 6 -2 8**, is by far the most common in Renaissance-period music, where it represents a "cadence." The rightmost example is an excerpt from the "Kyrie" of Giovanni Palestrina's Missa *Dies Sanctificatus*. Note that, even though the music is more complicated, we can still recognize the **7 1 6 -2 8** module.



Counterpoint Web App

Our Web app is the first application built on the VIS Framework. The app offers contrapuntal module analysis—a subset of the Framework's functionality—with greatly increased ease of use. Music scholars can conduct computer-driven research without installing the Framework on their own computer or learning to program.



Research Findings

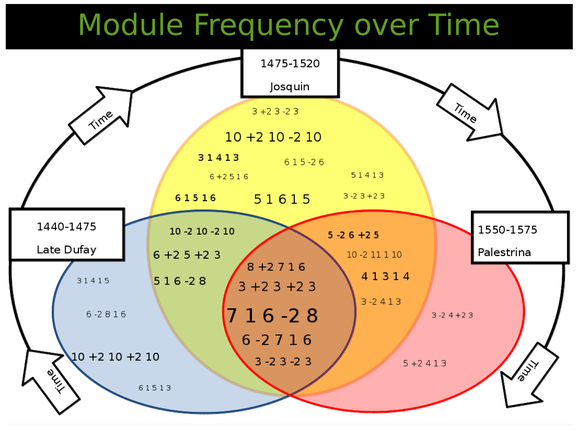
Morgan compared the **counterpoint rules of Johannes Tinctoris** against a collection of music by composers Tinctoris admired. He found a notable correlation between frequency of contrapuntal module and relative "strength" of descriptive adverb (e.g., *always* is stronger than *sometimes*), but no correlation between frequency and strength of verb.

Rusch is researching **four-part modules in J.S. Bach's church chorales**. Still in the early stages, she has already found that "cadence" modules are the most common. She hopes to connect common educational paradigms with real-world compositional practice.

Research Findings, Continued

Cumming and **Schubert** quantified contrapuntal **repetition in a collection of two-part compositions**. They found three ways to characterize contrpuntal repetition: (1) how long is the module? (2) how many times does the module repeat? (3) how many different repeated modules appear?

Collectively, we compared the most common **modules in three Renaissance style periods**. We found some modules shared between all periods, some between temporally-adjacent periods, and some unique to each period—but none shared between the earliest and latest periods. This is evidence of stylistic development over time. (See visualization below).



Our Team

The ELVIS Project was a collaboration between teams at McGill University, Yale University (led by Ian Quinn), Massachusetts Institute of Technology (led by Myke Cuthbert), and University of Aberdeen (led by Frauke Jürgensen).

The Montréal team appears below.

Professors:

- Julie Cumming (Musicology—Principal Investigator)
- Ichiro Fujinaga (Music Technology)
- Cynthia Leive (Marvin Duchow Music Library)
- René Rusch (Music Theory)
- Peter Schubert (Music Theory)
- Jon Wild (Music Theory)

Students:

- Christopher Antila (MA Music Theory—Lead Programmer)
- Ashley Burgoyne (PhD Music Technology)
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- Morgane Ciot (BA Computer Science and Linguistics)
- Natasha Dillabough (MA Music Theory)
- Daniel Donnelly (PhD Musicology)
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More Information

For more information on the ELVIS Project, please refer to our Website at `elvisproject.ca`.

You may also contact us by email:

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Funding

DIGGING INTO DATA CHALLENGE

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