Computer Aided Analysis of Post-Tonal Music:
Benefits of automating music analysis

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The twentieth century has revealed astounding leaps in the compositional complexity of its music. Contemporary theory has evolved along with these advances in compositional style, and serves as an integral part of appreciating and comprehending contemporary repertoire. However, increases in compositional complexity have resulted in a complicated, time-consuming, and tedious analytical process.

Before any meaningful interpretation and explanation of a musical composition, an enormous amount of arithmetic calculations must be performed (note counting, pitch class set normalization, calculations of interval vectors, etc), hindering both speed and accuracy. This strongly suggests a push towards computer automation, which holds the potential to improve the speed, accuracy, and scope of any in-depth musical analysis. This potential for quick examination limited only by an utter lack of musical intuition is the perfect complement for any musician. The musician is able to combine the strengths of each by actually guiding the computer through meaningful analysis, thereby supplying the musical "ear" so lacking in any computer. Automation frees the theorist from mundane tasks, enabling him/ her to reach meaningful conclusions more quickly. In seconds, the software can locate potential note groupings that would take hours to select by hand, which this opens up new doors for large-scale investigations of pitch organization. Grouping multiple compositions sharing a common composer, style, or time period, it is now possible to make broad inferences as to the unity among different works. Analysis of two musical compositions can now be cross-referenced to reveal common characteristics and point out other similarities in a small fraction of the time this would take by hand. Most importantly however, is that in handling the bulk of the tedious work, the computer offers musicians the opportunity to draw musical conclusions from the software's findings without concerning him/her with the prerequisite drudgery associated with them.

The inspiration for this research came from personal frustrations understanding post-tonal works within my own repertoire. While preparing for an upcoming performance, it became readily apparent that although there was some ordering to the piece's pitch content, this ordering was not readily apparent. After pouring over the piece in greater detail, it became evident that although the analysis was essential in comprehending overall pitch structure, inspecting each note was a tedious and time-consuming task. The more time I devoted to such an analysis, the more I began to realize much of the process was deterministic, tedious, and repetitive. In other words, the perfect task for a computer.

Reading a standard MIDI file (allowing input from virtually any musical program), the software is able to translate musical information into another specialized representation simulating an actual musical score. This virtual score can then be examined much the same as an actual one, allowing for automated musical analysis analogous to that which any music theorist might perform. However, the computational speed of computers offers tremendous potential for quickly performing any analytical task. This speed offers the possibility of identifying millions of potential pitch class sets, yielding previously unheard of exhaustive examinations of musical scores.

From any given note, it is possible to view previous/ successive notes (e.g. examine a line melodically), or notes sounding simultaneously (e.g. harmonic analysis). This ability is crucial in that it parallels the way musicians currently perform hand analysis. Once a group of notes are defined as having some relationship, this relation is formalized by calculating the normal form of their respective pitch class interval set. Because normalizing the set gives a common basis to various permutations, inferences regarding musical homogeneity can be made through comparison of these normalized pitch class sets. Following practices of traditional analysis, individual notes are required to occur within certain proximity in order to be grouped. This ensures the notes of a pitch class set contain an actual perceptible relationship, and precludes an overly mathematical analysis overstepping the bounds of audible reality. Comparison of the results of various operations on different note groupings (normal form, interval vector values, transposition of tone rows, etc) will yield a plethora of data from which the musician can draw conclusions.

This research offers a unique tool to champions of contemporary music. It will aid, both in speed and inspectional complexity, efforts to comprehend and explain a still difficult to grasp genre (post-tonal music). These additional insights of the organizational structure of post-tonal music will serve to increase its understanding and popularity among performers, theoreticians, and students alike.

My presentation will focus on outlining both the difficulties and unexplored benefits of automating musical analysis. I will chart out some of the basic obstacles to this application of computers to music, as well as the means by which I have resolved them. A discussion of current work aimed at using computers to understand and analyze music will lead into an outline of what my software offers for theorists. Although my presentation will touch briefly upon the many types of analysis which could benefit from automation, I will focus largely on using the software I created to analyze pitch structure in post-tonal music.

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