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The Use of Constraint Systems for Musical Composition by Geraint A. Wiggins

In this paper Wiggins described three tasks of musical composition that are relevant to the use of constraint programming. First he summarized his previous work about using genetic algorithm for four-part harmonization and explained the potential benefits that could be gained from using constraints. Then he presented another musical task, serial composition, and demonstrated how one can achieve it using constraints. In the last part of the paper, Wiggins turned his direction to subtleties of the common notation for pitch, and indicated the importance of musical representation.

In 1998, Wiggins and Phon-Amnuaisuk proposed a system based on genetic algorithms for four-part harmonization. The melody was placed in the first row of the chromosomes, which were operated by musically sensible mutations and evolved based on the fitness function encoded with the basic rules of harmony. Although one of the outcomes was graded a pass on the same criteria as a first-year music undergraduate, they found that there were some “badness” on the fitness profile which were not removable no matter how much running of the algorithm was performed. Wiggins suggested that a constraint-based method with high-level control structure (cadences for example) might perform better in this task.

The second task Wiggins mentioned was serial composition, the “twelve-note method” of composition introduced by Schoenberg. In serial composition, the idea of tonality is abandoned. Instead, a sequence of twelve notes in the chromatic scale is involved in which no note is repeated. Schoenberg suggested three basic operations for composition: inversion, retrograde, and retrograde inversion. Based on these basic operations, Wiggins used the constraint logic programming to perform the serial composition task. The goal was to generate a twelve-note series, and when the notes were played by four instruments, they would form a sequence of twelve of the author’s favorite chords.

In the last part of the paper, Wiggins indicated the problems of assuming equal temperament for music representation. Some problems come from the fact that certain acoustic instruments are not tuned in that way, and more importantly, human pitch perception is not well-tempered and is strongly affected by tonal context. In this case, Wiggins argued that a specialized constraint system which works beyond the equal-tempered scale is necessary.

Personally I think the use of constraints is intuitive for modeling music composition. Similar to the melodic and harmonic rules taught in a composition class, those rules are the constraints in composition. Although the rest of the details in composition are left to senses of aesthetic, it is effective to achieve certain level of harmony by following those rules. Similarly, it is easy to arouse discomfort from disobeying the constraints. However, how to encode the constraints is not straightforward. I am interested in more detailed work from the author on relative topics.