About This Issue

This issue's first three articles focus on applications of mathematics in music representation, composition, and sound synthesis. The topics announced on the cover, "Simplicial Chord Spaces" and "Dynamical Systems," refer, respectively, to the first article and to the second and third articles.

The first article is an extended version of the paper that won the Best Paper award at the jointly held Sound and Music Computing (SMC) Conference and International Computer Music Conference (ICMC) in Athens in 2014. In this work, Louis Bigo and his colleagues present a geometrical model of musical pitch, along with two software programs that use that model. The model generalizes the *Tonnetz*, a network of harmonic relationships that was formulated by Leonhard Euler in the 18th century, further developed by German thinkers in the 19th century, and expanded upon by music theorists in the last few decades. A piece of music, considered as a sequence of simultaneously sounding pitches, is represented as a series of spatial locations in a generalized *Tonnetz* that the authors refer to as a simplicial chord space. They show how some well-known spatial transformations within such a chord space can result in interesting musical transformations, as can some unusual mappings from one space into another. They then discuss two pieces of software: HexaChord, an environment for music analysis (which is depicted on the front cover); and a *Tonnetz* object from the Max library known as bach (which was presented in our previous issue).

The two articles related to dynamical systems examine applications of such systems in sound processing and sound synthesis. The first of these, by Miroslav Spasov, is similar to the article by Bigo et al. in that it describes a Max library for use by composers. Spasov's software, named the Attractors Library, utilizes iterative mathematical equations that represent nonlinear dynamical systems. Specifically, the library contains Max objects that each implement one of the following dynamical systems: logistic, circle, Duffing, Gingerbreadman, Hénon, Lorenz, Tinkerbell, De Jong, and trigonometric. The article serves as a practice-based catalog of these systems; for each, Spasov describes how he used the Max object to apply real-time signal processing to the sound of acoustic instruments in his own electroacoustic compositions, accompanying the discussion with not only the system's mathematical basis (the equations and 2-D plots), but also at least one sound example and the corresponding excerpt from the musical score.

Whereas Spasov's practice-based article mentions the use of dynamical systems for controlling certain synthesis parameters, the technical article by Nikolaos Stefanakis et al. ventures more deeply into sound synthesis, giving a detailed mathematical exposition of how ordinary differential equations (ODEs) may be used directly for synthesizing sound. Longtime readers of *CMJ* may recall a number of relevant articles, including those by Xavier Rodet and Christophe Vergez (*CMJ* 23:3) and by Axel Röbel (*CMJ* 25:2). In the present article, Stefanakis et al. lay out a general framework for synthesis using coupled nonlinear ODEs. The authors demonstrate a significant advantage of using complex numbers in the ODEs: the control parameters become more meaningful. The ODEs can be used for additive synthesis as well as nonlinear synthesis, and they can accept external signals as input. Sound examples are provided.

Next, we include an article on sonification. The authors' software (which again is implemented in the Max environment) was used in a demonstration of the facilities of a research "wave tank." This is a swimming pool-sized tank in which scientists can generate various patterns of water waves by controlling mechanized paddles. To create a more engaging and impressive introduction of the wave tank to a general audience, the authors added electronic sound, reinforcing the visual impressions produced by the waves. A demonstrator's gestures controlled both the sound and the water waves themselves. The authors detail their interactive sonification technique, and, as an informal evaluation of their system, they provide quotes from the audience.

In Vol. 35, No. 3 of *Computer Music Journal*, Dor and Reich published an article on a task in the area of music information retrieval: automatically grouping musical pieces in a database according to the computer's judgment as to which composer most likely created each one. In the current issue's final article, researchers at the University of Antwerp continue in that vein. Dorien Herreman and colleagues have built a rule set and a decision tree that sheds light on some features that differ statistically between composers. Going further, they have taken this research into the realm of algorithmic composition. In previous work, they had developed a system that automatically generates

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Front cover. A screen image from the HexaChord software, which Bigo et al. describe in this issue's opening article.

Back cover. Two score excerpts from compositions by Miroslav Spasov, with three plots of so-called strange attractors interposed.

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simple counterpoint. Their current article reports on how they enhanced that technology to generate, in real time, contrapuntal music that contains some stylistic tendencies of specific composers.

Reviewers in this issue offer their thoughts on a recently published book as well as a recent major upgrade to a software environment for composition and sound design. In the first review, Jeffrey Trevino takes a look at the "intriguing new volume" by Marilyn Nonken on the effect of the computer, and of spectral music in particular, on piano music. Spectral composer and theorist Hugues Dufourt wrote the final chapter of the book. The second review, by electronic music veteran Barton McLean, sings the praises of Carla Scaletti's Kyma software in its newest incarnation, version 7.

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