About This Issue

Certain installments of *Computer Music Journal* are planned as special issues on a given theme, sometimes by guest editors who issue calls for manuscript submissions, and sometimes by conference organizers who solicit extended versions of highly rated conference papers. However, for regular issues, such as the present one, the topic appearing on the cover is instead arrived at by considering the contents of one or more independently submitted articles that have passed peer review and happen to be ready for publication around the same time. This issue's theme is "Emulative Algorithms and Creative Algorithms." All but one of the issue's articles discuss algorithms that either simulate traditional, non-computer-based musical techniques or else explore original, creative approaches. In these pages, the dichotomy of imitative versus original creation, of standard versus nonstandard musical practice, shows up in three areas: sound synthesis, musical composition, and musical performance. For each of these areas, we present an emulative approach first, followed by a non-emulative one. (For the areas of synthesis and performance, the two types of approach are documented by a corresponding pair of articles; but in the case of musical composition, they are both examined within a single article.)

Imitative digital sound synthesis has played a central role in the history of computer music. For example, Max Mathews and his colleagues organized the first digital audio synthesis languages around traditional musical metaphors, composer Jean-Claude Risset's 1971 *An Introductory Catalogue of Computer Synthesized Sounds* included some 15 recipes for simulating acoustic musical instruments, and so on. All imitative synthesis algorithms need to approximate the time-varying spectral characteristics of the original sound as it reaches the ear. Physical-modeling algorithms go further and attempt to approximate the way that the vibrations are excited and propagated within the musical instrument itself. Mimicking conventional instrumental timbres can fulfill a commercial demand, of course; but going beyond that prosaic motivation (which was, in any case, less germane in the years before real-time digital synthesis became affordable), researchers harnessing such techniques have pointed out that important discoveries in musical acoustics and sound synthesis have been made by comparing synthetic output to a familiar aural reference point. Indeed, even beyond the realm of sound synthesis, emulative algorithms in general entail analysis and tend to serve goals related to science, engineering, and music theory, whereas creative algorithms, which need not analyze any pre-existing model, tend to serve more purely artistic goals.

The present issue's first article, by Niklas Lindroos, Henri Penttinen, and Vesa Välimäki, describes a recent example from the lineage of emulative sound synthesis: a new model of the electric guitar. The authors base their work on earlier research in waveguide synthesis of plucked stringed instruments. Digital waveguide synthesis has constituted an important subset of physical modeling synthesis, and the plucked string appeared as an early example of a physically modeled sound source. The technique introduced here includes several novel alterations. The model's excitation component accounts for the scrape of the plectrum along the string, a variable plectrum angle, and the first reflection of the pluck pulse traveling along the string. The string component is time-varying to permit pitch-bending and to emulate the two-stage decay of an electric guitar tone. Because pickups drastically color the guitar sound, a component that models the magnetic pickup is included; it uses a cascade of all-pass filters to capture the pickup's inharmonicity.

In this issue's second article, Luc Döbereiner throws down the gauntlet in defense of "a body of sound-synthesis techniques that is often misrepresented and discounted." These are the intentionally non-imitative techniques of composers such as Iannis Xenakis, Gottfried Michael Koenig, and Herbert Brün. In contrast to the engineering orientation of the first article, Döbereiner's stance is philosophical, quoting thinkers such as Alain Badiou, Theodor Adorno, and Walter Benjamin, not to mention Brün himself.

Front cover. Clockwise front upper left: Mozart's musical game, K. 516f;a graphical display from Oliver Bown's live algorithm that uses a decision tree; microtonal music by Harriet Padberg; and a virtual timpanist, from software by Alexandre Bouënard and colleagues.

Back cover. Block diagrams of the electric guitar model by Niklas Lindroos, Henri Penttinen, and Vesa Välimäki. The overall diagram appears at the top. Below it are detailed diagrams of various sections: the plucking-noise and excitation-pulse model, the plucking-point filter, the string model, adn the pickup model.

Döbereiner draws upon Brün's provocative concept of the desirability of "anticommunication," i.e., innovative expression that does not rely on guaranteed comprehensibility. In imitative synthesis—and, more generally, in any synthesis technique that models either the physics of sound production (the "source") or its perceptual result (the "receiver")—Döbereiner sees an inherently positivist conception whose dichotomy of empirical reality and representation inhibits aesthetic change. By comparison, in the "nonstandard" synthesis techniques, which he advocates, he sees an "axiomatic disorientation" that helps situate the design of technology within the purview of the creative artwork. (We can view this creative benefit of sonic disorientation as the antipode of the scientific benefit of sonic familiarity, mentioned two paragraphs ago.)

In the area of computer-aided composition, the duality of imitation vis-à-vis originality goes right back to the 1956 composition *Illiac Suite* for string quartet: Its first two movements mimic conventional musical styles, whereas the last two explore experimental styles. That kind of pairing is echoed in Christopher Ariza's historical article in this issue, which starts by documenting what may be the first example of musical style emulation by computer, then goes on to describe an early project in nontraditional algorithmic composition. The former of these projects, conducted in Amsterdam in 1955, is David Caplin and Dietrich Prinz's implementation of the algorithm for Mozart's *Musikalisches Würfelspiel* [Musical Dice Game], complete with computer-generated sound. The latter, conducted in St. Louis, Missouri, in the early 1960s, is Harriett Padberg's creation of Fortran programs for five experimental pieces featuring algorithmically generated rhythms and microtonal tone rows. Besides fleshing out the historical record of these efforts, Ariza has obtained audio recordings of Caplin and Prinz's work and has implemented new realizations of Padberg's music, as can be heard on the DVD that will accompany the next issue of *CMJ*.

Our final pairing of emulative and creative algorithms involves the area of musical performance. In the first case, the article concerns simulation of musicians' physical gestures, for purposes of controlling sound synthesis. For a quarter-century, physical modeling has been an active research field in computer music, focused on models of musical instruments. But this article's authors (Alexandre Bouënard and colleagues from McGill University and Université de Bretagne-Sud) switch the primary target of investigation from the instrument to the performer. They implemented a physics-based model of a timpanist that can be driven by what the authors call a "gesture score." A gesture score contains a sequence of concatenated "gesture units." Each type of gesture unit has been derived from motion capture and segmentation of real timpani performances. This approach permits the realistic editing and assembly of prerecorded as well as novel percussion sequences. The virtual percussionist and virtual instrument are displayed graphically using 3-D visual rendering. This animation, in synchrony with the sound produced by a physical model of the timpani, not only facilitates understanding and refinement of the performer-plus-instrument model itself, but also has pedagogical potential for percussionists and composers.

On the creative side of the performance coin, Oliver Bown's article delves into "live algorithms." He defines these as "live music performance systems that exhibit autonomy or agency in some form" and "are intended for real-time performance, usually with instrumental musicians, but also on their own or with other live algorithms." Bown explains that although live algorithms can simulate human musicians and can be constrained to standard musical styles (the emulative side of the coin), he instead focuses on live algorithms that reveal "novel ways in which a computer can act as an improvising partner." The algorithms of interest to the author consist of three parts: (1) a fixed analysis component that "listens" to the simultaneously performing human musician; (2) a behavioral component, which is an abstract dynamical system whose input comes from the analysis component; and (3) a creatively composed generative component that takes the output of the dynamical system and converts it into sound. Bown stresses a modular approach in which different options in the behavioral component can be substituted for each other. For this article, he first implemented the behavioral component using a continuous-time recurrent neural network, and later using a decision tree. In both cases, genetic algorithms were employed to evolve the system toward exhibiting desired dynamical properties. Sound examples are provided.

This issue also contains a sixth and final article unrelated to the theme of emulation and originality. The topic of this article, by Ofer Dor and Yoram Reich, lies within the sphere of music information retrieval. Their research concerns an automatic classification task that takes a data set of musical scores in a MIDI-like format and (without knowledge of the scores' composers) tries to separate the set into non-overlapping groups, each of which contains all the music by a different composer. The features that the authors use consist of manually selected low-level features, such as the proportional occurrence of each pitch class in the composition, as well as features detected by a machine-learning program, such as the mean and variance of the note durations. The authors found that pitch class and octave features contributed the most to successful classification, followed by note duration and pitch gradient features. (The pitch gradient features are statistics that measure whether notes tend to be higher or lower than the previous note, or the same.) In most data sets containing only two composers, the classification accuracy was over 90 percent. For example, Bach was distinguished from Chopin with 97 percent accuracy. Mozart's keyboard music could be distinguished from Haydn's with 75 percent accuracy, which is not bad, considering that even well-trained musicians often have trouble making this distinction.

Items evaluated in this issue's Reviews section include a South African electroacoustic music festival, a history of technology and performance from 1900 to 2010, a set of interviews with women in electronic music, a CD of music by composer Ron Herrema, and a CD anthology from Bowling Green State University in Ohio, USA. An assortment of product announcements conclude the issue.