About This Issue

The first two articles of this issue present research on topics unrelated to the theme of "emotion and expression" announced on the cover. In the first article, Grégoire Carpentier and Jean Bresson of Paris's Institut de Recherche et Coordination Acoustique/Musique (IRCAM) introduce Orchidée, their software for computer-assisted orchestration. Similarly to the work by François Rose and James Hetrick published in the Spring 2009 issue of *Computer Music Journal*, the IRCAM software retrieves, from a database, a set of instrument tones that in combination best approximate the timbre of a specified target sound. A composer or orchestrator can then choose to adopt the recommended instrumental combination for a certain spot in the piece. Orchidée offers a number of enhancements. For example, the sound-similarity model is based on a number of perceptual features rather than just the spectrum. A generic client–server framework is offered, with an emphasis on connecting sonic to symbolic (musical) data and perceptual feature spaces. This architecture facilitates the design of flexible graphical user interfaces, and the authors provide an example implementation based on OpenMusic. When no target recording is available, the user can approximate the desired sound using sound-synthesis controls within the OpenMusic tool. The program lends itself to a progressive, interactive fine-tuning of the instrumentation constraints and the target sound during the search task. This software was used for orchestral emulation of vocal sounds in the composition of Jonathan Harvey's *Speakings* (2008).

The second article, by Victor Lazzarini and Joseph Timoney in Ireland, reviews techniques for digitally emulating the oscillators of classic analog synthesis. Ironically, although analog synthesizers use mathematically simple waveforms (sawtooth, square, triangle, etc.), it is not so simple to construct these same signals digitally in a computationally efficient manner without incurring the penalty of aliasing. One of the article's main contributions is to show that the existing digital techniques are all related to nonlinear distortion synthesis. Another is to propose novel nonlinear distortion-synthesis algorithms for approximating those classic analog waveforms. An advantage of distortion techniques is that they allow timbral control without the computational expense of separate digital filters.

The next three articles relate to the theme of "emotion and expression," presenting research that quantitatively approaches these aspects of music that are often thought of as subjective. The first of these articles, by Steven Livingstone et al., describes their research using software for altering a MIDI "score" (not necessarily represented as music notation) in a way that changes the emotion that the music is perceived to express. The system changes not only the dynamics and timing (parameters that are traditionally modifiable in expressive performance), but also sometimes the pitches (a parameter that the Western classical music tradition usually considers to be the composer's territory, not the performer's). Music in a major key can thus be switched to minor and vice versa. The authors' tool is intended to help researchers analyze how music conveys emotions. This article makes use of a two-dimensional representation of emotion in which the axes are valence (positive or negative) and arousal (active or passive). For example, happiness is considered to have active arousal and positive valence, and anger is considered to have active arousal but negative valence. The authors conducted two psychological experiments using their software. The first of these showed that subjects usually were able to identify the intended emotion. The second showed that the authors' software accomplished significant shifts in both valence and arousal, whereas software that did not modify pitches shifted only the arousal.

The valence/arousal model is also central to the article by Luca Mion et al. In addition to this affective model, these authors use a sensorial model in which the two axes are kinematics and energy. Whereas the affective domain contains emotions represented by adjectives such as happy, angry, sad, and calm, the sensorial domain's descriptors include hard, soft, heavy, and light. The authors' focus is not music with its attendant structure so much as isolated sounds (including single tones and short musical gestures) such as might be used in human–computer interfaces. Using machine-learning techniques, they extracted audio features relevant for conveying expressive intentions in the affective and sensorial spaces. Two listening tests were conducted with human subjects. The authors found that in addition to timing and intensity (two variables frequently used in MIDI-based research on expression), other acoustic properties such as attack time, roughness, and spectral centroid affected valence and arousal and therefore might be useful for making user interfaces more expressive.

The final article, by Eduardo Miranda et al., is a bit different in

Front cover. Image by composer and visual artist Kyong Mee Choi.

Back cover. Two screen images from the article by Grégoire Carpentier and Jean Bresson.

that the research emphasis is not on analyzing expression, but rather on applying previous researchers' findings on expression in a new sort of application. Specifically, the authors are interested in evolving expressive performances. Rather than employ the most well-known sort of evolutionary computation, namely, genetic algorithms, the authors explore the use of a multi-agent system. In their system, the agents are virtual performers who render a piece of music using various rules of expressive performance. An agent can imitate other "performers," and it can vary the values of the different expressive parameters using its own individual "preferences." By running experiments with their software, the authors demonstrated that an agent's performances did embody the agent's preferences, that agents influenced each other, and that the system allowed the user to control the amount of diversity in the resulting performances.

The Reviews section of this issue includes two reviews of events. The first describes sound art at a major art show, and the second reports on a conference on mathematics and music. The three book reviews evaluate David Temperley's analytical volume on probability in musical meter and key, alongside two anthologies concerning the history of what used to be called tape music: one about Pierre Schaeffer, the founder of *musique concrète,* and another on the activities in San Francisco during the 1960s. Finally, reviewers assess five CDs by computer music composers (one by Amnon Wolman, and two each by Barry Schrader and Natasha Barrett).