Composing with Melomics: Delving into the Computational World for Musical Inspiration

Gustavo Diaz-Jerez

ABSTRACT

The author describes his work with the Melomics approach to music composition. Taking the melody as its main object of study, Melomics, mimicking biology, implements a simulated evolution of music composition using generative methods. The goal of this work is to model the full process of professional music composition using sophisticated strategies for algorithm design.

One of my main concerns as a composer is investigating musical structures that serve as general frameworks in the creative process of composition. For more than 15 years, I have been incorporating models from different scientific disciplines into a coherent compositional language. These include mathematical processes, formal grammars (L-systems), cellular automata and sonification of fractal images.

In 1998 I developed FractMus, a program for algorithmic/generative music composition that integrates algorithms drawn from different branches of mathematics (such as number theory, non-linear equations, $1/f$ noise and cellular automata) and maps the algorithm's numerical output onto user-defined musical parameters. Audio Paint and Photosounder are well-known applications for image-to-sound transcription that likewise map image information to musical parameters (e.g. height maps to frequency, length to time and pixel brightness to dynamic intensity). In practice, the source image becomes the spectral map of the generated sound. In addition, I often write custom routines for specific processes not included within FractMus or other software packages.

The results of these programs are output as "raw" material, usually as MIDI [1] or audio files that are subsequently imported and refined with the help of general-purpose programs such as score editors or sequencers. This can be a very tedious and time-consuming task. With audio files, in most cases there is no other alternative than to notate the results using one's own ear, as audio-to-MIDI converters do not yet produce satisfactory results.

I have used this compositional strategy for years, with great success. *Aranfaybo* (2009), for chamber orchestra, premiered

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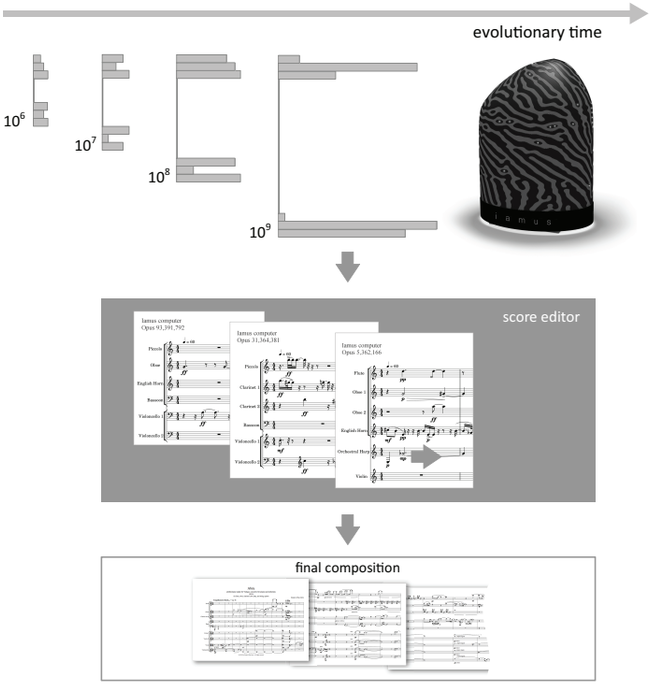

Fig. 1. The dedicated Melomics hardware Iamus (represented on the top right) manages an ever-growing repository of compositions (gray bars). The repository evolves as new musical compositions are generated from previous ones; not only does the number of compositions increase but so does their complexity (duration, musical structure, instrumentation, etc.). These compositions are available to composers, who can use this material in its written form (MusicXML files). After being loaded in the score editor, virtually any change can be made to the final score in order to adapt fragments that have attracted the compositor's interest. (© Gustavo Diaz-Jerez)

by the Hungarian Chamber Symphony Orchestra, employs melodic lines derived from a fractal transformation of the digits of the square root of 2. *Ymarxa* (2010), for large orchestra, premiered by the Royal Philharmonic Orchestra under maestro Charles Dutoit, also uses mathematically derived melodic lines as well as background textures generated from fractal image-to-sound transformations. So does *Havan* (2011), a concerto for viola *d'amore* and orchestra, which will premiere in 2012.

In 2009, I joined the Melomics crew [2] as a researcher specializing in music composition and generative methods. Our goal is to model the full process of professional music composition using sophisticated strategies for algorithm design and employing dedicated hardware (the Iamus computer) for all the calculus. The Iamus currently is able not only to generate musical material of variable duration and instrumentation but also to notate it automatically using the MusicXML [3] specification. This allows composers to work with professional scores, not just raw material, thus making the creative process of transforming, recombining and developing the source material more intuitive and musically satisfying (see Fig. 1).

Melomics (a name formulated with the *–omics* suffix, as in genomics or proteomics) takes the melody as its main object of study. Mimicking biology, the technology developed by Melomics implements a simulated evolution of music compositions. The interaction with professional composers, which can score the compositions on a web interface, provides the "environment" within which the works must fit. Natural selection, as the main force in evolutionary processes, shapes the musical structure of the scores toward more sophisticated and complex compositions.

In 2010, a prototypic Iamus ignited the creation of what today constitutes the largest repository of music content in the world ($>10^9$ compositions at the time of this writing). Iamus's composition *Opus one* [4] (generated by Iamus on 15 October 2010) is a good example of the quality of the resulting compositional process and, to our knowledge, the first musical fragment ever conceived and written in professional music notation by a computer without human intervention. The huge repository generated by Iamus dramatically increases the amount of written music available on-line and provides, in practice, an endless source of inspiration for composers. This source material is available in different file formats: standard MIDI Files, FLAC [5] lossless audio, printer-friendly PDF and, most important, the MusicXML file format.

Yshqur (2011), a concerto for piano and orchestra, to premiere in 2012 with the composer as the soloist, incorporates material generated by Iamus [6]. The Melomics approach constitutes a new strategy in music composition—a strategy that is, like all others, at the disposal of the composer's creativity.

References and Notes

1. MIDI (Musical Instrument Digital Interface) is a protocol that enables communication between electronic musical instruments and other equipment (computers, samplers, etc.). MIDI files do not contain audio signals, but instead contain event messages about pitch, duration, intensity (dynamics), tempo, etc., that can be imported by most score editors.

2. Melomics provides state-of-the-art computer-generated music by integrating different technologies, from bioinspired computing to music information retrieval methods. Developed at Universidad de Málaga (Spain), Melomics's ten-figure repository is used through a web-based tool to support the composition process (contemporary music, soundtracks and other multimedia content) and to offer on-line music therapy services. Melomics has been partially funded by the Spanish Ministerio de Ciencia e Innovación under project IPT-300000-2010-0010. (See <http://melomics.com>.)

3. MusicXML is an open, XML-based music notation file format, designed for the exchange of musical scores, which is supported by most music-editing applications.

4. <http://melomics.com/@Iamus>.

5. FLAC (Free Lossless Audio Codec) is an open and royalty-free audio compression codec.

6. <http://melomics.com/@Gustavo-Diaz-Jerez>.

Related Discography

Gustavo Díaz-Jerez, *Chamber Music Works*, RALS, Ref. 884502924978 CD (2010). Available at <www.gustavodiazjerez.com/recordings.html>.

Gustavo Diaz-Jerez is a professional pianist and composer. He studied piano with Solomon Mikowsky and composition with Ludmila Ulehla at Manhattan School of Music in New York City. He has won numerous awards and prizes and has performed extensively worldwide. He teaches piano at the Superior Conservatory of Music of the Basque Country (San Sebastian, Spain).