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# Book reviews

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**Eduardo Reck Miranda, *Computer Sound Design*, 2<sup>nd</sup> edition. Music Technology Series, Focal Press, Oxford, 2002. 263 pp. With CD-ROM, ISBN 0-240-51693-1**

This volume complements the other titles in Focal Press's Music Technology Series, and especially Miranda's companion contribution, *Composing Music with Computers*, in that it focuses on sound synthesis and associated programming techniques. It is to a degree more targeted on the creation of sound in the computer rather than creating compositions with sounds. An integral part of the package on offer here is the CD-ROM, an invaluable addition to the book's written contents, since this offers the reader the opportunity to try out many powerful programs on his or her own computer, whether PC or Macintosh. Unix users are generally given Internet sources to acquire programs for their own operating system.

The various chapters of the book give an essential grounding to the topic of computer sound synthesis. Chapter 1 is a clear and well-written summary of 'Computer sound synthesis fundamentals', introducing the concepts of digital representation of sound, its storage in computer files, and commonly used techniques, such as sub-routines and unit generators, for generating these representations. Chapter 2 groups a number of 'loose modelling approaches' – a slightly awkward term for a group of programming techniques mostly derived from their beginnings in analogue synthesis. Here we find amplitude and frequency modulation (AM and FM), waveshaping, wavetable and Walsh synthesis. The trade-offs of programming ease against computational demands in each of these methods is well indicated, and a series of appropriate diagrams makes the technical explanations clearer for the reader. This suggests that the book will prove a valuable resource for students on music technology courses, who have a need to acquire the technical understanding quickly in order to pay attention to the creative fascinations of practical computer sound synthesis.

Chapter 3 discusses approaches to the formation and manipulation of sound spectra. Beginning with additive synthesis – the construction of a timbre by adding constituent sine tones – the author then goes on to outline the principles of synthesis through analysis, beginning with a discussion of various forms of Fourier analysis and especially the fast Fourier transform (FFT). From the analysis files, resynthesis can occur through a number of methods from Fourier synthesis reversion, to additive and subtractive resynthesis. The chapter concludes with a look at

some methods of formant synthesis, in the FOF and Vosim techniques.

The next chapter, entitled 'Source modelling approach: from subtractive and waveguides to physical and modal', discusses more recent developments in sound synthesis applications. Waveguide filtering, Karplus–Strong synthesis and the employment of cellular automata for synthesis purposes are introduced here. There is an important section on physical modelling systems, such as mass–spring networks and bond graphs. Examples of dedicated modelling given include Cordis and Genesis. Praat's vocal tract model is outlined, and there is a brief discussion of the modal synthesis employed in the Mosaic system developed at the University of Paris.

Time-domain techniques are considered in the following chapter, and these include granular synthesis, a group of techniques which seems to hold greater fascination for composers than many others, perhaps because of their less abstract features. For many practitioners it is easier to envisage massing varied fragments of sound than it is to master the often abstruse mathematics and complex formulae of waveguide synthesis. In this chapter there are interesting discussions of Xenakis' Gendy system and the sequential waveform composition techniques of Arun Chandra.

Chapter 6 examines a number of 'case studies' in a slightly more relaxed tone. Much of the chapter is devoted to the means of synthesising human-like vocal sounds with worked examples employing F. Richard Moore's *pcmusic* (a PC version of *cmusic*) and Praat's software vocal synthesizer. The author also discusses work developed from his own program *Chaosynth* – employing granular synthesis through cellular automata methods – which makes possible the construction of various types of sound texture. Audio examples of a variety of results are given on the CD-ROM.

Chapter 7, headed 'Towards the cutting edge', looks to the latest research in sound synthesis. We find here the introduction of artificial intelligence, and the attempt to create meaningful classifications of sound which would aid the principles of synthesis. There follows attention to the implications of different parallel computing architectures for sound synthesis – essentially permitting being able to do more processing in real time – and the possibilities of 'evolutionary sound synthesis' through post-Darwinian models like genetic algorithms.

The final chapter serves as an introduction to the software on the accompanying CD-ROM. Programs are supplied for both PC and Macintosh. This reviewer has investigated only

those for the PC. In any case, many of the programs have versions for both systems. A small number only are exclusive to one or another operating system.

### The software

A word of caution. Many of the programs here require a considerable investment of time and effort in order to understand and apply them for a musical purpose. That said, the CD-ROM contains a treasure-trove of very powerful programs for computer sound synthesis, and will continue to reward the intrepid investigator.

For those who perhaps already know programs in the *music-N* category, for example *Csound*, the principles of two programs given here will be familiar. **PCMUSIC** is an implementation and extension of Richard Moore's original **Cmusic** program, designed explicitly for the PC. It is a full program – the complete functionality of the system is given here. Nothing is disabled, everything works and can produce sound of great beauty – if the composer is prepared to put in the work to understand it. As well as incorporating a huge variety of sound-producing algorithms, the system includes score-list features which make it entirely possible to realise complete compositions with the language. A difference from at least the earlier versions of *Csound* is that the 'score' (or note-list) functions are not separated from each other. The instrument definitions and note-lists are included in the same file.

Roger Dannenberg's **Nyquist** program is similar to the extent that it also provides note-list features, here within the LISP programming environment. It helps considerably to know the LISP language. LISP (a name derived from LIST – Processing) provides very powerful general programming facilities which in *Nyquist* are extended to sound synthesis and score generation, and those familiar with the language will be at an advantage in using the system.

**Som-A** is a Brazilian computer music language for additive synthesis. It employs files here called spectral charts, and the note-list features of *PCMUSIC* and *Nyquist*. In the program given on the CD-ROM, many aspects of the presentation seem to be still in the process of development and are thus incomplete.

Both *PCMUSIC* and *Nyquist* employ a command-line interface, which some users may perceive as unfriendly. There are, needless to say, many other programs on the CD-ROM which provide graphical and therefore 'friendly' interfaces. A very good example of this is the program **Virtual Waves**. This is a well-designed graphical package by Nicolas Fournier, which permits the user to drag graphical 'modules' on to a work-space, edit their input parameters (frequency, amplitude, etc., etc. . . .) by a simple process of clicking the icon. This opens up the expanded module, showing the current or default parameter values, which can be modified by the user. On accepting the modified values, lines may be drawn with the mouse from the module outputs to other module inputs, until a complete sonic instrument is graphically defined (the last in line is an output module). Clicking on another icon initiates the synthesis process, causing a – usually short – delay before the sound is heard. There are many types of graphical module, in the general categories of generators, processors and analysis modules, and almost limitless possibilities for combining them.

Among the analysis modules are the phase vocoder and sonogram, allowing sophisticated spectral synthesis and display. Now this program is a commercial product, and so has save facilities disabled. At the time of writing, it does not actually seem possible to buy the product, because the website ([www.synoptic.com](http://www.synoptic.com)) declared as the source for any purchase is itself up for sale!

A similar approach to *Virtual Waves* is taken by **Audio Architect**. Again, modules can be connected together on a workspace, the sound compiled and auditioned. I found it more influenced by the pop industry in the given (repetitive) examples, which were rather over-influenced by the rhythmic note-sequencer module, and therefore less conducive to experimentation.

**SMS-Tools** originates in Spain, from the Music Technology Group of Xavier Serra and his associates at the Audiovisual Institute of the Pompeu Fabra University of Barcelona. SMS stands for 'spectral modelling synthesis', which essentially applies the analysis and re-synthesis model. The version on the CD-ROM is numbered 0.80, and since the program has evolved further since the first release, users are recommended to obtain the latest version from Barcelona at the SMS Homepage: <http://www.iaa.upf.es/~sms/>.

The commercial demonstrations from Native Instruments, **Reaktor** and **Spektral Delay**, are startlingly direct in their response to the user's mouse movements. These are very impressive programs commanding both intuitive control features and novel applications. A sufficient number of example applications are provided to assess the quality of the programs. Again, as is usual with commercial products, the save facilities are disabled.

The Seer Music **Reality** demonstration limits the user to five twenty-minute sessions, which is barely enough to convince the user that here is a software synthesizer utilising a number of powerful synthesis applications incorporating sampling, four-operator FM synthesis and other standard methods.

**CrusherX-Live!** is a shareware program – a 'multichannel vapour synthesizer' – which enables the user to load up to four samples (typically wave files) and create real-time performances of granulated versions with a variety of control parameters. I would recommend a look at this.

**Wigout** and **TrikTraks** are a pair of programs for creating waveforms to given specifications by the user, written by Arun Chandra at the University of Illinois. They employ a command-line interface, and require writing text files in an appropriate format. There is extensive documentation for both programs, and a somewhat didactic tone in the written manuals. These programs are useful for teaching the basics of waveform synthesis, but compared with some of the other offerings here, appear rather dated and limited.

**Praat** was written as a serious research tool for the investigation and synthesis of speech, though it may be employed also for general sound synthesis using the speech model. It provides facilities for displaying analysis data as well as writing sound files, but requires the user to write a text specification file which is then interpreted by the program. **Praat** is available for many different platforms.

The development of Eduardo Miranda's own program, **Chaosynth**, is intriguing in its use of cellular automata to

generate the patterns of granular synthesis. The emerging patterns may be viewed as they are created; usually the chaotic system settles down to regular patterns within a relatively short space of time. The user may intervene to create changes during the course of the performance. However, unlike *CrusherX*, the sounds from which the patterns are made are derived from oscillator waveforms and the results may pall rather quickly.

The powerful **CDP** (Composer's Desktop Project) system is given some representation not only in the form of the original command-line programs, but also in the very user-friendly graphic environment written by Robert Fraser called *Sound Shaper*, and is well designed and intuitive. (This is one of a pair of such 'front-ends' available from CDP for the system, the other being Trevor Wishart's *Sound Loom*.) The CDP programs excel in their wealth of spectral facilities through filtering, vocoding and morphing. It is a pity that, especially in this second edition of the book, the CDP coordinator's name is given wrongly – for 'Acher Hendirch' read 'Archer Endrich' (p. 217)!

#### In summary

Miranda's book, and the accompanying CD-ROM, represent excellent value for any composer, sound artist, designer or engineer who wishes to evaluate the field of sound synthesis on modern computers. Highly recommended.

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**Petri Kuljuntausta, *On/Off – Eetteriäänistä Sähkömusiikkiin* (trans. 'On/Off – from ether sounds to electronic music'). Like & Kiasma, Helsinki, 2002. 793 pp. ISBN 951-578-934-6 (PBK). Available from <http://www.likekustannus.fi>**

Petri Kuljuntausta has belonged for more than a decade to a new generation of composers in Finland interested in experimental and electronic music, music incorporating environmental and concrete elements, and work in musical multimedia. In addition to his work as a composer, he has been a catalytic figure in the promotion of these forms of music in his journalistic writing and work for Finnish national radio (YLE), and he was the driving force behind the founding of the experimental music and arts organisation Charm of Sound, which has proved to be an effective vehicle for the propagation and support of boundary-crossing musical projects in Finland. *On/Off* began its life as a radio series compiled and presented by Kuljuntausta and broadcast by YLE. His original intention was to publish a CD charting the genesis of electronic music in Finland and focusing specifically on the mid-1950s to 1960s. This remains the main stated aim of the project, although Kuljuntausta's CD liner notes eventually metamorphosed into a 793-page book that to some extent diverts attention from the CD packaged with it. Unfortunately for those without the requisite linguistic skills, the book is written entirely in Finnish, although some related material translated into English can be found online. The CD/book package is worth ordering for the CD alone, however, which

does much, even without the accompanying book, to supplement knowledge on early electronic music in Scandinavia. The author hopes to secure funding for the translation of some sections of the book into English in the near future.

Stylistically, as well as in terms of the musical territory covered, Kuljuntausta's book has much in common with David Toop's *Ocean of Sound: Aether Talk, Ambient Sound and Imaginary Worlds* (London: Serpent's Tail, 1995) and Mark Prendergast's *The Ambient Century: from Mahler to Trance – the Evolution of Sound in the Electronic Age* (London: Bloomsbury, 2000). Like these books, the sweep of the writing is broad and discursive indulgences are frequent. Those looking for an authoritative academic text in which non-sequiturs and speculative forays are avoided at all cost are likely to be disappointed. *On/Off* is more than simply an entertaining read, however, and it is certainly not written exclusively in journalese; the painstaking documentation and probing investigative work that infuses the main text of the book and its appendices are valuable resources to scholars interested in the genesis of electronic music in Finland and elsewhere. Indeed, the combination of academic, journalistic, and more writerly approaches seems particularly apposite in this and the other books mentioned given the irreverence of much of the music that is their subject matter towards conventional stylistic boundaries.

In *On/Off*, Kuljuntausta provides a kind of micro-history of the genesis of electronic music in Finland, acting frequently as a guide to, or curator of, the material (re)presented more than a historian seeking to encompass his subject matter within an overarching narrative design. In this respect, his work is in tune with recent historiographical work, particularly with Foucault's notion of 'archaeology', which allows unearthed material (the documents and recordings Kuljuntausta has gathered from YLE's radio archives, personal correspondence with composers and performers, and a wealth of journalistic and historical data) to speak for itself rather than have the historian impose on it his or her own explicit agenda. Ploughing through this mammoth opus in a short period of time, as I have done prior to writing this review, is probably not desirable or possible to most readers, but it is paradoxically the detailed nature of the material provided that makes some sections of the book so compelling. It is as if one can hear the voices of the protagonists as events unfold, sometime warts and all, rather hearing mere snippets of voices as they are relayed to the reader in the author's prose and then extrapolating what the actors must have thought or felt. In fairness, Kuljuntausta has stated that it was never his intention that the book be read cover-to-cover in a focused, linear way; rather that sections of interest be dipped into as the reader's curiosity dictates.

What distinguishes Kuljuntausta's book from other literature on the subject, aside from its language, is its focus on Finland as an unlikely meeting point for a wealth innovative and eccentric musical talent, which does not imply that *On/Off* is exclusively concerned with Finnish composers. The book begins with a roaming survey of electronic music, which starts not in the twentieth century as one might expect, but traces a genealogical line that extends back to the use of mechanical instruments in earlier historical periods and culminates in a thoughtful consideration of the impact of recent technologies pertaining to the production of