Three levels of education in Electroacoustic Music:
The Virtual Sound Project

Riccardo Bianchini* - Alessandro Cipriani**

*Conservatorio di Musica “S.Cecilia”, Rome, Italy
**Istituto Musicale “V.Bellini”, Catania, Italy
EDISON STUDIO - Rome

*via Ternana, 108 - 02034 MONTOPOLI S. (RI) ITALY
**via Voghera, 7 - 00182 ROMA ITALY
rb@fabaris.it  a.cipriani@agora.stm.it

*http://www.geocities.com/Heartland/Acres/4768  **http://www.axnet.it/edison

ABSTRACT
This is a presentation of the first published Computer Music Education project in Italy, that includes a series of printed textbooks, interactive courses via the Internet and a series of CD-ROMs. The aim is to create a deeper and more wide-spread knowledge in the fields of electroacoustic composition, digital sound synthesis and processing.

1. INTRODUCTION
The Virtual Sound Project project consists of three main areas: a series of printed textbooks in Italian (English and possibly Spanish translations are planned), a set of courses via the Internet (complementary to the printed textbooks) and a series of CD-ROMs. The authors teach Electroacoustic Music in the Conservatories of Rome and Catania, and have for some time felt the need for such a project. The project is aiming to create a bridge from the very beginning to an advanced level for non-English speakers in Italy in order to provide them with a level of knowledge that will let them feel comfortable with electroacoustic music fundamentals and more.

2.1 IL SUONO VIRTUALE
The first result of this project is the book *Il Suono Virtuale*, the first textbook on sound synthesis and sound processing in italian (with a CD-ROM enclosed), published by ConTempo in May 1998 and available through its website (www.axnet.it/contempo).

The special feature of this textbook is that it includes theory and practice together, by means of lessons and examples with Csound. For each kind of signal processing and synthesis technique there are discussions about theory and history followed by immediate practice with Csound exercises. The textbook is, therefore, not only a tutorial on synthesis, but also the most extensive tutorial on Csound in any language.

In almost every chapter the student finds a theoretical part (covering the basics of a particular synthesis/processing method), a practical part (with Csound orchestra and score examples and exercises), and an “in depth” part, including more advanced uses and ideas concerning each method, not essential for the comprehension of the chapter, but useful in helping the student to broaden his/her knowledge.

*Il suono virtuale* includes an introductory chapter on the fundamentals of Csound (*Csound: how it works*); additive, subtractive, amplitude modulation, frequency modulation, waveshaping, FOF, granular and physical modelling synthesis; the use of sampled sounds, analysis/resynthesis (by means of *hetro/adsyn, pvanal/pvoc* and *lpanal/lpc*), delay, echo, reverberation, chorus, flanger, phaser, convolution; the basics of flow-charting; the fundamentals of digital audio; the use of MIDI files; the real-time use of Csound; Csound from the viewpoint of a programming language, etc.

The first Appendix is dedicated to WCShell (a Windows® NT/9x front-end for Csound written by Riccardo Bianchini); the second Appendix concisely covers the mathematical and trigonometrical fundamentals required for a “well behaved” use of Csound (or any other synthesis program).

The book concludes with five advanced readings about: real time granular synthesis for Csound (by E.Giordani); sound synthesis by means of non-linear functions iteration (by A.Di Scipio); Max and Csound (by M.Giri); generation and modification of Csound scores by means of general purpose programming languages (by R.Bianchini); Csound and Linux (by N.Bernardini). James Dashow kindly wrote the introductory preface.

*Il Suono Virtuale* provides also a listing of the main Csound Web sites.
A double format (Windows/PowerMac) CD-ROM includes all orchestras, scores, soundfiles, analysis files used throughout the book. Most importantly, the CD-ROM contains Csound for Windows and PowerMac, WCShell for Windows, and the HTML version of Web sites file.

The first five paragraphs of Chapter 1 can be downloaded from Contempo web site.
Since there was no other tutorial in Italian about synthesis, and most of the material for learning synthesis techniques is in English, Italian students had to rely primarily on lessons in class if there was an opportunity to study electroacoustic music in school. The lack of a published project for electroacoustic music education in the publishing field left most of Italian computer music enthusiasts in the hands of the MIDI keyboards market, which hardly promotes a systematic education. It was our notion that a deeper and more wide-spread knowledge about computer music fundamentals and a direct practice with a software like Csound that helps to secure the appropriate skills can make a difference.

The difference between our approach and the commercial approach lies primarily in promoting awareness of each single act involved in the compositional process. The commercial approach merely creates user-friendly black boxes as far as technical issues and the creation of each single sound is concerned (push this button and you’ll obtain that; don’t ask why, just learn all the buttons! And the presto-patches!). We believed that some action had to be taken in order to promote such awareness, and Il Suono Virtuale is our first step. We chose to present the material in as clear and simple a style as possible, to start from the very beginning and always to provide the English for the most basic terms: this should also ease the reader in approaching the literature in English.

2.2 WCSHELL AND INTEGRATION WITH THE TEXTBOOK
As the power of personal computers increases, Csound becomes faster and faster. Two of the main problems with Csound, however, are the non-graphical approach (inherited from Unix text-only user interface) and the text writing of the score on a note by note basis.

![Fig.1 - WCShell](image-url)
The use of *WCShell* for Windows NT/9x (see Fig.1) helps to create a different approach to Csound. This front-end for Csound includes the possibility of graphically creating functions, to convert a Csound score into a spreadsheet and generally work in a faster way, or to write a score by drawing lines in a field that represents durations, frequency values etc. In the spreadsheet software called *Scorex*, for example, the notes and the functions are put in the rows and parameters fields in the columns. Therefore larger groups of notes can be created at once filling spaces with particular values, adding, multiplying, applying functions to groups of cells values, using linear or exponential interpolations between initial and final values, converting amplitudes and frequency values from/to any format etc. Via *WCShell* it is also possible to edit the analysis file produced by *hetro*: for example you can graphically re-design the frequency or the amplitude values of all the harmonics. It is also possible to save the flags configurations and eliminate a significant amount of other time-consuming activities.

![Fig.2 - CSGraph](image)

R.Bianchini is now working on *CSGraph* (see Fig.2), a new Windows software by which the user can generate Csound orchestras by using a graphic, object-oriented interface. These are just some examples of how this set of programs can help the student to have a more intuitive approach to synthesis and thereby help him/her overcome some of the difficulties of Csound’s steep initial learning curve. With the new implementation of real-time Csound by Gabriel Maldonado (this uses DirectX, a Windows method to drastically reduce latency time in sound input/output), the interaction with real-time MIDI control becomes very appealing, and we believe that the combination of a textbook like *Il Suono Virtuale*, plus the use of a front-end for Csound like WCShell combined with the use of satisfactory real-time control can provide an environment for education in which the interaction between theory and practice achieves a rare degree of integration.

2.3 VIRTUAL SOUND
The book *Il Suono Virtuale* is now being translated into English, since the interest for this kind of approach goes well beyond that of an exclusively Italian audience.

2.4 CINEMA PER L’ORECCHIO

The first step of the educational project will continue with a series of printed textbooks called *Cinema per l’Orecchio* (Ear Cinema) (series editor Alessandro Cipriani, publisher Contempo). As well as the above mentioned textbook, this series on electroacoustic music education and production, multimedia and intermedial art includes:

a) A textbook on acoustics and psychoacoustics
b) A textbook for ear-training, practice of analysis of the "*texte sonore*", study of the interrelationships between new sounds for acoustic instruments and electroacoustic sounds seen from the spectromorphological and compositional point of view
c) A textbook on studio techniques, multimedia practice, intermedial art
d) A textbook on the history and analysis of electroacoustic music

3. THE SECOND STEP: COURSES VIA THE INTERNET

Before approaching an interactive expansion and re-issuing of the first project on CD-ROM, we are experimenting with students’ interaction via the Internet. We are working with the Edison Studio in Rome which will host the project in its web site.

This step, which we plan to start in November 1998 and which should continue for two months, will consist of the following:

3.1 A series of on-line lessons, which will take as a basis the first few chapters of the book *Il suono virtuale*, and will exploit the same arguments, treated in deeper detail, and with a much larger quantity of examples (Csound orchestras and scores).

3.2 At the end of each lesson the student will practice with incomplete orchestras and scores, orchestras and scores with syntax errors, orchestras and scores without syntax errors, but containing subtle bugs. Furthermore the student will find a series of tests. He/she will send by E-Mail his/her orchestra and score corrections, and his/her test answers, and will be graded accordingly.

3.3 The student can ask a maximum of 20 questions, which will be put on line on a special page of FAQ (Frequently Asked Questions).

3.4 At the end of the course, the student, if he/she has a sufficient cumulative grade, will be rewarded with a certificate allowing him/her to start the next course.

4. THE THIRD STEP: INTERACTIVITY AND CD-ROM

This is obviously the most problematic of the steps, especially regarding its funding. We are only just beginning to work on this idea, and its realization depends on various factors, including the availability of a greater number of experts.

In our project the CD-ROM reissue of *Cinema per l’Orecchio* should be interactive, multimedia and multilingual. *Interactive*: the CD-ROM should exploit the maximum of interactivity, with real-time generation of sounds by means of Csound, and interactive correction of tests, so that the student can use a trial-and-error approach. An online method of updating should allow the user to enrich his/her repertoire of orchestras, scores and sounds. *Multimedial*: the CD-ROM should contain animations, sounds and text. *Multilingual*: the CD-ROM should be in Italian, English and other languages such as Spanish.

SUMMARY

The Virtual Sound Project has just been started by the authors, Contempo and Edison Studio. The first book in Italian is already available, the interactive course will start in November 1998, the English version of *Il Suono Virtuale* should be available for the ICMC ’99. We hope to be able to publish other two textbooks within year 2000.