An early case of algorithmic composition in Italy

FRANCESCO GIOMI

Via G. Silvani, 180, 50125 Florence, Italy
E-mail: art@mailserver.idg.fi.cnr.it

Pietro Grossi was the first pioneer of computer music in Italy. During his activities from 1961 to the 1980s he devoted much research to algorithmic composition. Grossi's first experiments in this field are discussed, dealing particularly with three important phases of his work: initiating algorithmic composition at the S 2F M studio in Florence, writing digital programs at the CNUCE Institute in Pisa, and realising a musical algorithm by translating the curve designed by the mathematician Peano into a sonic form.

1. INTRODUCTION

The Italian musician Pietro Grossi was the first composer to investigate algorithmic composition in Italy, but he was also a pioneer of experimental music: born in 1917, in the early 1950s he started to deal with electroacoustic music, and in 1962 he was the first Italian musician to carry out research in the computer music field. His constant search for new musical ideas led him to promote innovative experiences like the first Electronic Music and Computer Music courses in an Italian Conservatory, the research activity at the National Research Council in Pisa and Florence, the first attempts with real-time music systems and automated composition, and the first Italian database of traditional music pieces (Grossi 1973). In 1961 he decided to create the S 2F M studio in Florence *(Studio di Fonologia Musicale di Firenze)*. From 1963 to 1965 the studio was at Grossi's home and it included an oscillator rack, a white noise generator, some filters, a frequency meter and some tape recorders. In 1965, the S 2F M studio was moved to the Conservatory of Music in Florence, where Grossi started to teach the Electronic Music course. A complete list of the early electronic music pieces produced in the studio is included in Davies (1967).

2. ALGORITHMIC MUSIC IN THE EARLY 1960S

In September 1964 the Italian institution *La Biennale di Venezia* arranged a concert entitled 'Audizione di Musica Algoritmica' (Concert of Algorithmic Music) at *La Fenice* theatre. The performances included a series of electronic pieces realised by Pietro Grossi and his staff at the S 2F M Studio of Florence three years earlier (see the programme notes in figure 1).

It was the first time in Italy that a composer had used the concept of algorithms in music and, even though computing machines were not well developed at that time, it can be considered an important step towards future electronic music trends. The pieces for tape included in the Venice concert had titles composed of just a few characters: R B 1, G 11/7/5/3, P 4, F 5, R 1/01 (at that time composers of the Florentine group tried to drop the concept of intellectual property by presenting the pieces under the studio mark). To record them Grossi used seven analogue sinusoidal oscillators following the outcomes of five different algorithms (designed in 1961) for the generation of pitches, durations and dynamics. Such algorithms, usually very simple, were implemented in the Fortran IV programming language on the IBM 1620 mainframe computer located at the Department of Mathematics at the University of Florence.

Figure 1 shows the cover and programme of the concert together with an excerpt from the routine used for the computation of the dynamics of the P 4 piece. Actually, this work includes bundles of seven sinusoidal tones: their frequencies and durations were calculated by the algorithm following a series of rules derived from combinatorial analysis. For dynamics Grossi used a rule to calculate a series of values interpolated from two given extremes, and applied them to the tones again by means of combinatorial formulae.

3. COMPUTER PROGRAMS AND PROCESSES

After a period of initial research begun in 1962 (Giomi 1995), his systematic activity in computer music started in 1969 when Grossi moved to the CNUCE Institute of the National Research Council of Pisa. There, he designed, together with some experts, one of the first Italian interactive computer music systems, the DCMP, based on an IBM 360/67 architecture (Grossi 1970); for the audio output one bit was taken from a specific register, to build a square-wave monophonic sequence without any loudness control.

Organised Sound **1**(3): 179–82 © 1996 Cambridge University Press

https://doi.org/10.1017/S1355771896000258 Published online by Cambridge University Press

(a)



(b)

7 SETTEMBRE - ORE 11

SALE APOLLINEE DEL TEATRO LA FENICE

Audizione di Musica Algoritmica

R B 1

G 11, 7, 5, 3 (R 1, 01)

P 4

F 5

R 1, 01

Presentazione di
PIETRO GROSSI

Realizzazioni dello
STUDIO FONOLOGICO DI FIRENZE

(c)

```
ENTER SOURCE PROGRAM, PUSH START

08300  C      RICERCA AMPIEZZA PROGR. 4
08300    501 FORMAT(F4.1,F4.1,F6.1,F6.1,F4.1,F4.1,F5.1,F4.1,F4.1,F4.1,F5.1)
08372    502 FORMAT(I4,F10.3,F10.3,F10.3,F10.3,F10.3,F10.3,F10.3)
08430    503 FORMAT(/)
08452    504 FORMAT(F5.1,F5.1,F7.1,F7.1,F5.1,F5.1,F6.1,F5.1,F5.1,F5.1,F6.1)
08524    505 FORMAT(I5)
08546    506 FORMAT(23HGROSSI MUSICAL PROGR. 4/)
08622        DIMENSION C(6),D(7)
08622        PRINT 506
08646      1 READ 501,A,B,X1,X2,R,C(1),C(2),C(3),C(4),C(5),C(6)
08790        C1=C(1)+C(2)+C(3)+C(4)+C(5)+C(6)
08874        PRINT 504,A,B,X1,X2,R,C(1),C(2),C(3),C(4),C(5),C(6)
09006        X1=X2-X1
09042        PRINT 503
09066        ACCEPT 505,N
09090        PRINT 503
09114        X=X1
09138        D(1)=X1
09162        DO 25 I=1,N
09174        DO 15 J=2,7
09186   15   D(J)=D(J-1)+X*C(J-1)/C1
09354        PRINT 502,I,D(1),D(2),D(3),D(4),D(5),D(6),D(7)
09462        X=X*A/B
09510        A=A+R
09546        B=B+R
09582        D(1)=X1-(X-X1)/2.
09654   25 PRINT 503
09714        PAUSE
09726        GO TO 1
09734        END

PROG SW 1 ONFOR SYMBOL TABLE, PUSH START
SW 1 OFF TO IGNORE SUBROUTINES, PUSH START

PROCESSING COMPLETE
3100003000028S16000100000000S
ENTER SUBROUTINES, PUSH START
1620 FORTRAN SUBR.   9/30/61
LOAD DATA
```

Figure 1. (a) Cover and (b) programme of the concert in Venice together with (c) an excerpt from the computer routine for the P4 piece. Unfortunately the original documents no longer exist and Grossi owns only a copy of some programmes of his early concerts of algorithmic music.

https://doi.org/10.1017/S1355771896000258 Published online by Cambridge University Press

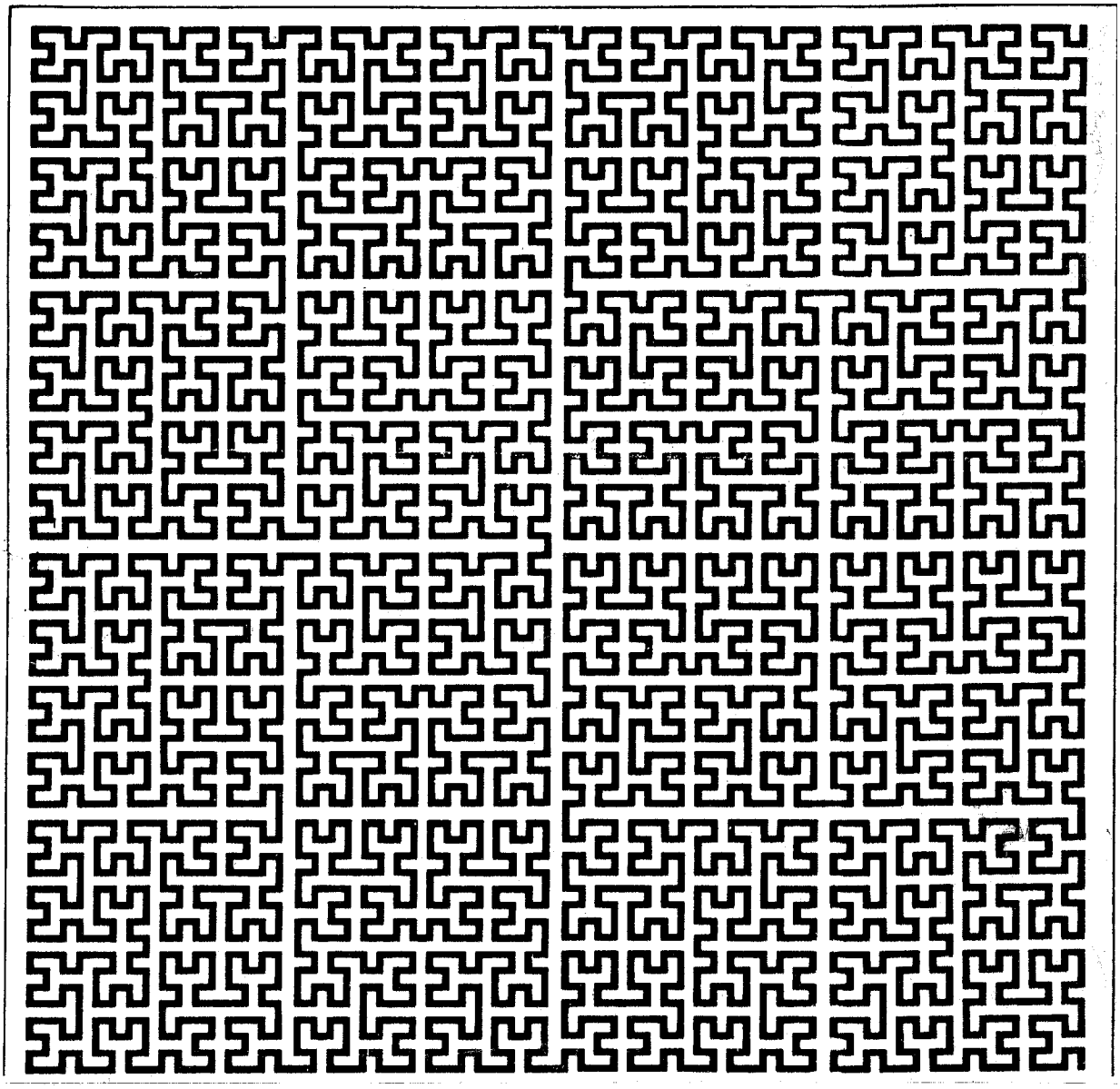


Figure 2. A graphic example of Peano's curve.

From the algorithmic composition point of view, he included in the software two specific programs called *Algor* and *Create* to control the DCMP system; such programs allowed, with different modalities, the creation of aleatory musical structures in real time through algorithms able to generate pseudo-random numbers using Lehmer's method (Grossi, Baruzzi and Milani 1975). They were built with an interface where users could specify a series of 23 parameters in order to control some characteristics of the sounds such as global duration, the range of pitches, the percentage of silence, and others.

After the DCMP, the PLAY 1800 system was the next to be developed; running on an IBM 1800, it could use good D/A converters, and it allowed a precise control both of loudness and timbre. From 1970 to 1972, both with the DCMP and the PLAY 1800 machines, Grossi composed a group of algorithmic works including *Algoritmi*, *Combinatoria*, *Polifonia*, *Monodia* and *Unending music*, all included in recordings realised with the aid of the Italian National Research Council and private recording companies (see Discography).

4. PEANO'S CURVE

One of the most significant works in algorithmic composition realised by the Italian composer was the auditory transposition of Peano's mathematical curve (Peano 1890), composed in the early 1970s. A two-dimensional representation of Peano's curve is shown in figure 2.

https://doi.org/10.1017/S1355771896000258 Published online by Cambridge University Press

In Grossi's musical version, a group of twelve synchronous sinusoidal tones (each with a distance of one third of a semitone from the next) moves along the trace of the curve following a step of one third of a semitone on the vertical (pitch) axis and of 3 seconds on the horizontal (time) axis. The sonic result is a 3′25″ piece where the whole sound mass continuously changes its melodic profile giving rise, in the meantime, to a cluster of variable beat-tones.

The hardware used for this composition was the TAU2 audio system, built from 1970 to 1975 at the IEI/CNR Institute in Pisa: this was a polyphonic instrument with twelve voices, capable of performing music in real time under the control of a general purpose mainframe computer. Grossi used the high-speed features of the system and the possibilities of instantaneous change of the sound parameters to build many other different programs for automated composition, often ruled by pseudo-random processes. This is the case with the later *Sound Life*, *Unicum* and *Mixed Unicum* series, realised from 1980 to 1989 in Pisa and Florence. But these pieces can be defined rather as musical processes, with continuously and instantaneously different sonic results, where Grossi often showed no interest in the timbral aspect, but concentrated on the main points of the automated compositional procedures.

5. CONCLUDING REMARKS

I have described just a few examples of Pietro Grossi's intense activity in the computer music field; they derived from his constant ideas about the concept of total automation of compositional processes. In his opinion algorithms implemented on high-speed computers seemed to be the best instruments to give shape to such concepts.

REFERENCES

Davies, H. (ed.) 1967. *International Electronic Music Catalog*. Paris–New York: GRM-ORTF/IEMC.

Giomi, F. 1995. The Italian artist Pietro Grossi. From early electronic music to computer art. *Leonardo* **28**(1).

Grossi, P. 1970. *Manuale di impiego del DCMP*. Studi Musicali. Pisa: CNUCE/CNR.

Grossi, P. 1973. Computer and music. *Int. Rev. of the Aesthetics and Sociology of Music* **4**(2).

Grossi, P. 1987. *Musica senza musicisti*. L. Camilleri, F. Carreras and A. Mayr (eds.). Pisa: CNUCE/CNR.

Grossi, P., Baruzzi, G., and Milani, M. 1975. *Compendio dell'attività svolta nel periodo 1969–1975*. Studi Musicali. Pisa: CNUCE/CNR.

Peano, G. 1890. Sur une courbe, qui remplit toute une aire plane. *Matematische Annalen* Bd. 36.

DISCOGRAPHY[1]

Grossi, P. 1972. *Computer Music* (FONOS, TNC 30001/1-2).

Grossi, P. 1973. *Computer Music* (CNUCE/CNR, CM 00001/2).

Grossi, P. 1978. *Computer Music* (CNUCE-IEI/CNR).

Grossi, P. 1983. *Computer Music – Satie Joplin Grossi* (EDIPAN, PAN PRC S20-14).

Grossi, P. 1984. *Sound Life* (EDIPAN, PAN PRC S20-25).

Grossi, P., Camilleri, L., Giomi, F., Mayr, A., and Ligabue, M. 1988. *Computer Music* (EDIPAN, PAN PRC S20-54).

Grossi, P. 1990. *Computer Music* (EDIPAN, CD PAN 3006).

Francesco Giomi was born in 1963 in Florence. From 1992 to 1995 he taught computer music at the Conservatory of Music in Florence; since 1995 he has taught electronic music at the Conservatory of Music in Cagliari; he is also a member of the computational musicology group of CNUCE (Institute of the National Research Council). His research is concerned mainly with electroacoustic music analysis and computational musicology; he has published articles and issues for Mouton de Gruyter, MIT Press, Swets & Zeitlinger, Harwood Academic Publishers, Il Mulino and others.

[1] This is not Grossi's complete discography, but a list of only those records which include algorithmic compositions.

https://doi.org/10.1017/S1355771896000258 Published online by Cambridge University Press