MUSIC 5 MAC

Simone Bettini

C.S.C, Padova University
Via Gradenigo, 6a,
35100 Padova (Italy)
home telephone 0429/86230
E-Mail (internet) space@maya.dei.unipd.it

Music V and Music 5 Mac.

Music V is, from an historical point of view, a very important sound synthesis and music composition language.

Music V was the last of a series of Music languages carried out, starting from the end of fifties, by Max V. Mathews, researcher at Murray Hill Bell Laboratories [1]. It was the first language to allow the realisation of a virtual digital synthesiser.

It can be used to define, starting from their describing algorithms, the instrument of an "orchestra" to which pass a score to perform.

Music V, although it is now used mainly for didactic purposes, still stands out for its versatility and power and can be considered the first of a whole generation of music synthesis languages based on the same operation principles.

The first Music V compiler was implemented on the General Electric 650 computer of Bell Laboratories, then, with the increase of raw computational power, on smaller systems and finally on personal computers.

In the beginning Music 5 Mac (M5Mac) was conceived as the Macintosh port of a PC Music V compiler written by Daniel Arfib, CNRS Marseille [2].

A preliminary straight port of the compiler resulted in a non Macintosh application: in particular it lacked a user-friendly graphical user interface allowing to simplify and speed up the scores writing. It indeed behaved as every other command line version of the package:

- the composer has to draw on paper a directed acyclic graph (DAG) representing the connections of the components of an instrument.
- the composer himself then translates this graph in the Music V language and completes the score adding the instructions relative to the motif execution. This sequence of instructions goes in a text file.
- such file is then passed to the Music V compiler which generates the sample file, eventually requiring long computational times.

To simplify this lengthy and

quite error prone procedure, at the same time speeding up instrument creation, it was then decided to add to this version of Music V a graphic user interface following the Macintosh Human Interface Guidelines [3]. Thus a complete visual development environment consisting in a text editor and a graphical editor was integrated in M5Mac beside the language compiler itself and other general purpose tools.

Such an environment offers the composer powerful and flexible tools for score writing and allows to generate the sample files in background, in several output formats, and to listen directly to the result of computation.

The score development can thus be realised entirely in M5Mac following those steps:

- the DAG of the instrument is done at the computer using a dedicate graphic editor.
- then, instrument translation to the textual representation is executed automatically by a code generating procedure.
- the score can be completed in a text editing M5Mac window.
- the score is executed directly in M5Mac choosing the output format.

At the end of the samples generation it's possible to listen directly to the result.

Music 5 Mac features.

M5Mac manages two kinds of data types: the scores(text) and instruments (DAGs).

Besides it can generate sample files in three formats: AIFF, Macintosh audio format ("snd " in "sfil" file) and 16 bit integers.

Two conversion routines between instruments and scores are available. The first allows to obtain the Music V language textual definition from its DAG, the second performs the opposite operation: it allows to get an equivalent DAG for any instrument present in a score, pleasantly formatted on screen.

Several algorithms have been developed for those routines:

- tree analysis and code generation are done to translate DAGs to scores.
- text parsing, tree weighing and arranging are used to extrapolate a DAG relative to any instrument described in a score. This output can then be modified and reused.

This Music V version, among other things, allows reuse of already existent samples files as input data. 16 bit mono AIFF has been chosen as input format. Some conversion routines between the various formats generated by M5Mac have been specially written in order to ease the use of this feature.

M5Mac environment.

The global structure of the application has been developed following Apple's Human

Interface Guidelines:

- Standard File and Edit Menus, as well as application specific menus.
- Dialogs for opening and closing files and for other miscellaneous functions, such as confirmation dialogs to avoid accidental closing of files, with consequent loss of data.
- Full multitasking capability (the user can perform other tasks while M5Mac compiles in the background).
- Multi-window environment with cut-copy-paste capability between windows.
- Possibility to print both scores and instruments diagrams through a consistent user interface.

The handling of the two different representations of instruments is carried out by two different types of windows (fig. 1).

For the score a normal text window, with usual cut, copy, paste possibility and an additional search and replace function is provided.

For the instrument DAGs a dedicated window has been designed. It contains a palette with six pop-up menus from which it is possible to choose the modules for building instrument.

A dynamic data type in which coexist both a tree and a queue was conceived in order to manage the graphic representation of instruments.

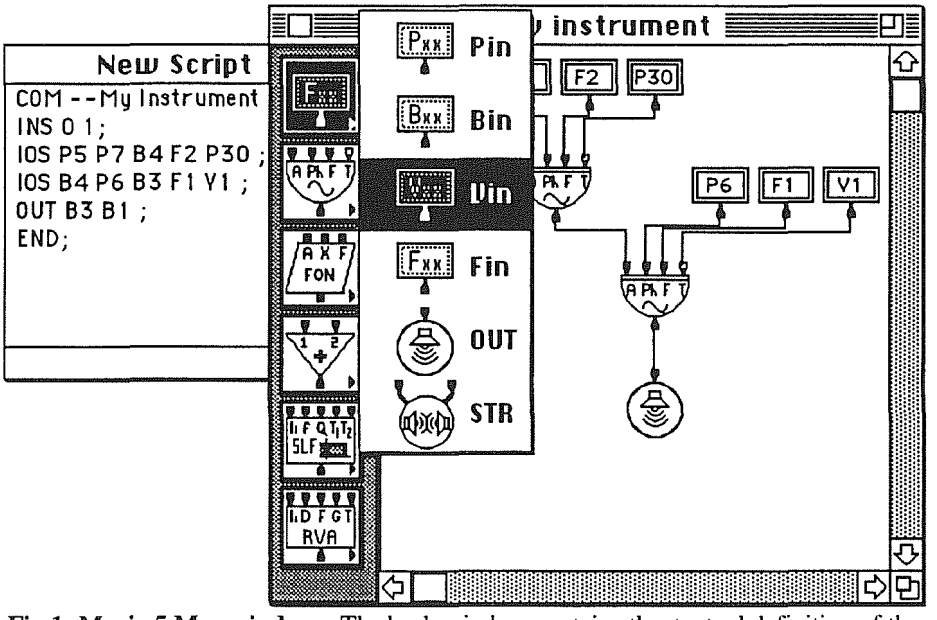

Fig.1: Music 5 Mac windows. The back window contains the textual definition of the instrument in the graphic one. On the left of graphic window there is the palette for the modules selection. The inputs menu is open.

The use of the graphic window and of the palette is very intuituve.

compilation, a movable modal dialog with a progress bar is shown (fig. 2). The user can stop

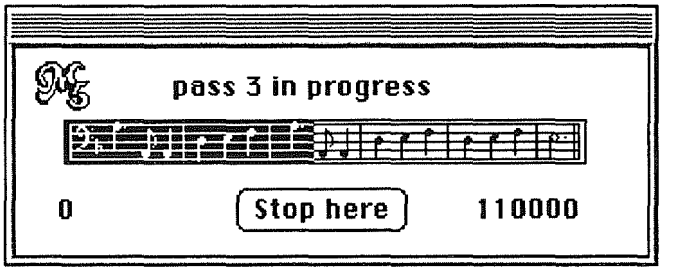

Fig. 2: The progress dialog

The modules can be joined in a easy and intuitive way simply clicking and holding the mouse button on an input [output] hot-spot, dragging to an output [input] hot-spot and releasing the button, thus forming arbitrarily complex pipelines. Eventual unacceptable connections (output-output, input-input) are not permitted.

The input pseudo-modules P, B, V, F icons show the value of the relative field. This value can be assigned using a command in the Edit menu.

The cursor shape changes according to the function performed (joining, selecting, dragging) to provide the user with good visual feedback.

It's possible to select one or more modules and copy, move or delete them. Connections between modules are copied along with the modules themselves.

Dragging the selection over the window borders causes the latter to scroll.

During score generation and

the current operation by hitting a button labeled "Stop" on this dialog. Doing this does not cause the loss of the already generated samples, which are saved in the output file, and then can be subsequently used.

Acknowledgement.

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References.

[1] Max V. Mathews and others: "*The Technology of computer music*", The M.I.T. Press, 1992.

[2] Daniel Arfib: "*Music V pour PC manual*", internal report, CNRS Marseille,1990

[3] Apple Computer, Inc. "*Inside Macintosh*", volumes I-VI, Addison Wesley.