

# The Conductor Program and Mechanical Baton

Author: Max V. Mathews  
Presentation: Shih-Jer Lin

## Outline

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## The Father of Computer Music



- Sc.D. in 1954 , MIT
- research on computer methods for speech processing, human speech production and auditory masking, and developed techniques for computer drawing of typography
- <http://www.csounds.com/mathews/>

### 1.Principles of Operation of the Conductor Program

- Performer conducts with a mechanical baton; the scores is in the memory of the computer.
- The performer can change the tempo, loudness, balance of various voices.( by daton and joystick )
- Pitches and durations is controlled by the score.

### 2.Hardware

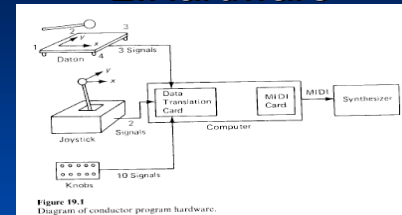


Figure 19.1 Diagram of conductor program hardware.

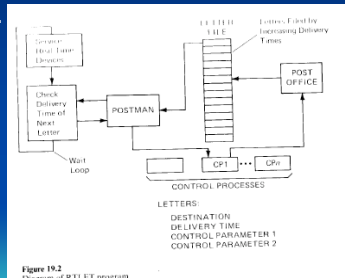
- 2 cards: Signals from the daton, joystick, and knobs A/D converted and put into memory by data translation card; MIDI card generates the signals to be sent to the synthesizer.

- Analog inputs are sampled once per millisecond.
- Daton: each time the plate is struck, 4 electric pulses are generated by the gauges. Circuitry to analyze the peak value of these pulses computes where and how hard the plate was hit.

- Joystick: send continuous information to the computer such as variation of loudness .
- Knobs: sends 10 signals to the computer which set parameters in the program and control individually the loudness in the synthesizer channels.

### 3. Software Design

- RTLET: letter delivery section & control processes.



- Postoffice: receive a letter and put it in the letter bin
- Postman: reads the destination and delivery time of the top letter, when real time equals to delivery time, it send the letter to the control process and transfer control to the control process
- Control process: runs to completion and returns control to the postman.

- Control process: written specially for playing music. It reads the notes from an intermediate score
- Before starting to play, the intermediate score is loaded into an array, score[ ]. The CP maintain a pointer into score[ ] and reads the operation code.

- Operation code of PLAYN:
  1. Which midi channels to play on
  2. is the note part of a chord
  3. Duration of the note
  4. Key number of the note to be played
  5. Delay before the next note starts.

- Multitrack Sequencing: When some notes start at the same time but end in different time (all notes in a chord must start and end simultaneously).
- Use START opcode: send 2 letters from CP with different locations in the score file.

#### 4. Control Processes as Concurrent, Reentrant, Pure Procedures

- From user's point of view, they may want many copies of CP1 exits so they play the notes simultaneously. In fact, there's only one copy of CP1 exist.
- Procedure should be able to store local variables while they are not being used.
- RTLET solution: pass local variables to a procedure via the letter that activate the procedure

#### 5. Servicing of Real-Time Devices

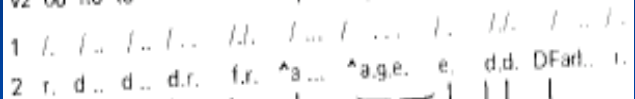
- Servicing done by a wait loop in postm()
- New samples are read into array each millisecond; The wait loop examines this array and act accordingly.
- Comparing the occurrence times of stored score and daton strike : determining to skip/ stop notes in the score . The program follow the conductor very closely.

#### 6. Example of a Conductor Program Score

```
set vel 0 tempo 200
pla k2 # 150
```

```
v1 o6 h8 t31
v2 o6 h0 t3
```

- Set the key signature to two sharps and set some other parameters that the author didn't discuss
- 2 voices in the score, 1<sup>st</sup> being Daton and 2<sup>nd</sup> being instrumental voice
- v: voice ; o: octave
- H: channel ; t: timbre #



- Daton: "r" : where Daton strokes are to be made  
"." : duration. In this case a "." is an eighth note
- Pitch : AB, Gab...
- "r" :rest
- Capital letters are used for lower octave
- "^" accidental mark: move up an octave

- Purposes of stroke: start a note/a group of notes/ chord/ rest
- Each stroke after the 1<sup>st</sup> stroke sets the tempo that will be used until the next stroke; tempo can be changes at each stroke

## 7.Methods of putting scores into the conductor Program

- 1.alphanumeric score (shown as before)
- 2.Ruth Shyu: the notes are displayed in a simplified common practice music notation drawn by the computer on its terminal.
- 3.Leland Smith: use special language to write the score into computer via ASCII keyboard. Also display readable music notation in terminal so it's good for proofreading.

- 4.Use MIDI keyboard to input scores: Pitches are automatically quantized by the keyboard but durations would have to be fitted into some appropriate of standard note lengths.( to be developed )
- 5.music scanner that could read normal printed music and convert it to machine readable form (to be developed)

## 8. Use of the Conductor Program

- 1. perform new compositions written for this program
- 2. Accompaniment of soloists  
(reduce the load of accompanist or let the hand free soloists accompany themselves)
- 3. music appreciator could get a computer score and conduct his own interpretation of the piece