

## The Radio Baton and Conductor Program or: Pitch, the Most Important and Least Expressive Part of Music

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*Presented by Erdem Unal, for ISE 575/b Spring '06  
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## The Author: **The Father of Computer Music**

- Massachusetts Institute of Technology receiving a Sc.D. in 1954.
- He worked in acoustic research at AT&T Bell Laboratories from 1955 to 1987
- 1974 to 1980 he was the Scientific Advisor to the Institute de Recherche et Coordination Acoustique/Musique (IRCAM), Paris, France
- In 1987 joined the Stanford University Music Department in the Center for Computer Research in Music and Acoustics (CCRMA) as Professor of Music (Research)



## Outline

- Radio Batons
- The Conductor Program
- Expressive and Predetermined Components of Music
- Pitch
- Data Processing
- Training Performers
- Discussion



## Radio Batons

- LF Radio transmitter for  $x, y, z$  on a square board
- Capacitance between the transmitting & receiving antenna is inversely proportional to the distance
- 1 ms motion resolution
- When the transmitter is close to the antenna plane, accurate measurement of  $x, y$  is possible. When it is far from the plane reading from  $z$  is useful
- Trigger based control of reading  $x, y$  when the transmitter is close enough, and  $z$  when the transmitter is away from threshold.



## The Conductor Program

- Collects the triggers generated from the radio baton system.
- Program sends midi signals to a synthesizer
- A type of sequencer in which the sequence of pitches and durations of the piece to be played are stored in the computer memory.
- With the help of the triggers, conductor controls the midi information sent to the synthesizer so that the expression of music stored in the memory can be manipulated by the baton movements

## The Conductor Program

### ■ Control Algorithms

- Time control: Measuring the time between successive triggers
  - Divide the time into the number of beats in the score between trigger points
  - Tempo is calculated at each trigger point
  - Computer plays the music with the calculated tempo until a new tempo value is obtained
- Two Special Conditions
  - If the computer plays the music before the conductor reaches the next trigger, the system stops and wait
  - If the conductor plays the music before the computer finishes the calculated segment, computer skips some notes for synchronizations
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## The Conductor Program

### ■ *cntd.*

- Trigger Positioning
  - Triggers can be located for each note synchronized with the x,y location of the baton in a continuous manner
  - Triggers can also specify the starting and the ending of a note played
  - Continuous control is useful to smoothly change the speed of fast passages in which one does not wish to use a beat.
  - All methods can be used in one piece and a transition from one to another is possible during the performance
  - Specific values of x or y associated with the position of a baton at the time it touches the trigger plane often mapped onto the key velocity associated with a note played by the trigger.
  - Key velocity can also be controlled by the velocity of the z parameter

## Expressive and Predetermined Components of Music

- Most pieces of music can be divided into two parts
  - A part which is predetermined by the composer
  - A part over which the performer can exercise his own choice
- Predetermined parts
  - Pitches, and relative durations of the notes
- Expressive factors
  - Choice of tempo
  - Changes in tempo
  - Lengthening or shortening the durations of silence between notes
  - Making specific notes louder or softer than their neighbors

**Pitch:** The most important predetermined factor and the least expressive factor

- Playing a different pitch from that written in the score will almost always be considered a mistake
- By contrast, duration and loudness are subject to substantial performance variations
- For composers of Western music of the last centuries pitch is the prime importance
- In the last century some composers focused on timber capabilities of the instruments such as Debussy (timber), Varese (percussion)
- We are happy to hear these kinds of innovations in music, however, we still know that the pitch is the most dominant factor in music

**Data Processing:** to aid performers by supplying the predetermined parts of the music

- Two ways of assisting the performer
  - One consists of programs which automatically add expression to the score
  - The other, such as the conductor program: leaves the expressive part to the performer, and provide the predetermined factors of the music.
    - Sequence of pitch is controlled by the performer with some certain gestures, which are easier than playing a real instruments
      - *The performer can devote much more of his attention to expression*
      - *No longer has to do the complex and real-time mental data processing involved in decoding notes on a printed page*
      - *And converting them to muscle movements*
      - *In short, no need to worry about the instrument technique*

## Training Performers

- If computer programs to aid the performance:
  - -eliminate or much reduce technical demands and training time
- Questions to think about:
  - What will be the effect on performers
  - What else the performer learn during the long hours of technical training
  - How challenging a task do humans prefer
- In addition to technique, they train other musical aspects: ie. Training of ear
  - Can we find more direct and faster ways of training these musical aspects?
- Pitch Perception
  - What will happen with instruments which never make pitch mistakes
  - Will the performer become less interested in pitch because he does not need to have to struggle to achieve it?
  - Will his ear become less acute?
- New instruments
  - Can they make music too easy to play and hence uninteresting?

## Conclusion Discussion

- Boulanger: So I'm just wondering how we might control or direct development of this kind of tool so that it still gratifies musicians to play with it...
- Boulanger: Are you worried about it becoming a kind of toy, though, or something about the direction in which this technology could lead?
- Gutmann: Perhaps the most expressive instrument is the voice
- Morill: (about pitch being the least expressive factor)... and I am convinced that I disagree, but it has been a marvelously provocative statement for me.

■ Please read it!!!

THANK YOU