CONDUCTOR PROGRAM

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INTRODUCTION

One mode of using the radio-baton is the CONDUCTOR program. This is a form of sequencer program in which a score is played by the baton as a sequence of predetermined notes. The conductor program differs from most other sequencers by providing the performer with a greater degree of expressive control. Triggers from the baton and trigger points written into the score provide control over timing of events in the score. The XYZ positions of the sticks can be used to control overall dynamics, balance between voices, and timbre factors. The concept which led to the program is the performer as an orchestra conductor and the baton and conductor program providing him with a simulated orchestra.

The score of the piece to be played is on a file on the computer's disk. The score contains all the information necessary to conduct the music including the notes to be played, midi program changes to configure the synthesizer, the trigger points in the score, and the coupling of the xyz movements of the batons to control changes to be sent to the synthesizer.

The performer starts to play by hitting the baton with stick 1. This produces the first trigger. The baton processor sends noteon midi commands to the synthesizer for whatever notes are to be played by the first trigger. This general process is repeated for all the subsequent triggers.

CONDUCTOR PROGRAM SCORE

The conductor program score can best be described with an example. Figure 1 shows the common music notation score and the conductor program notation score for a fragment of a violin-piano sonata.

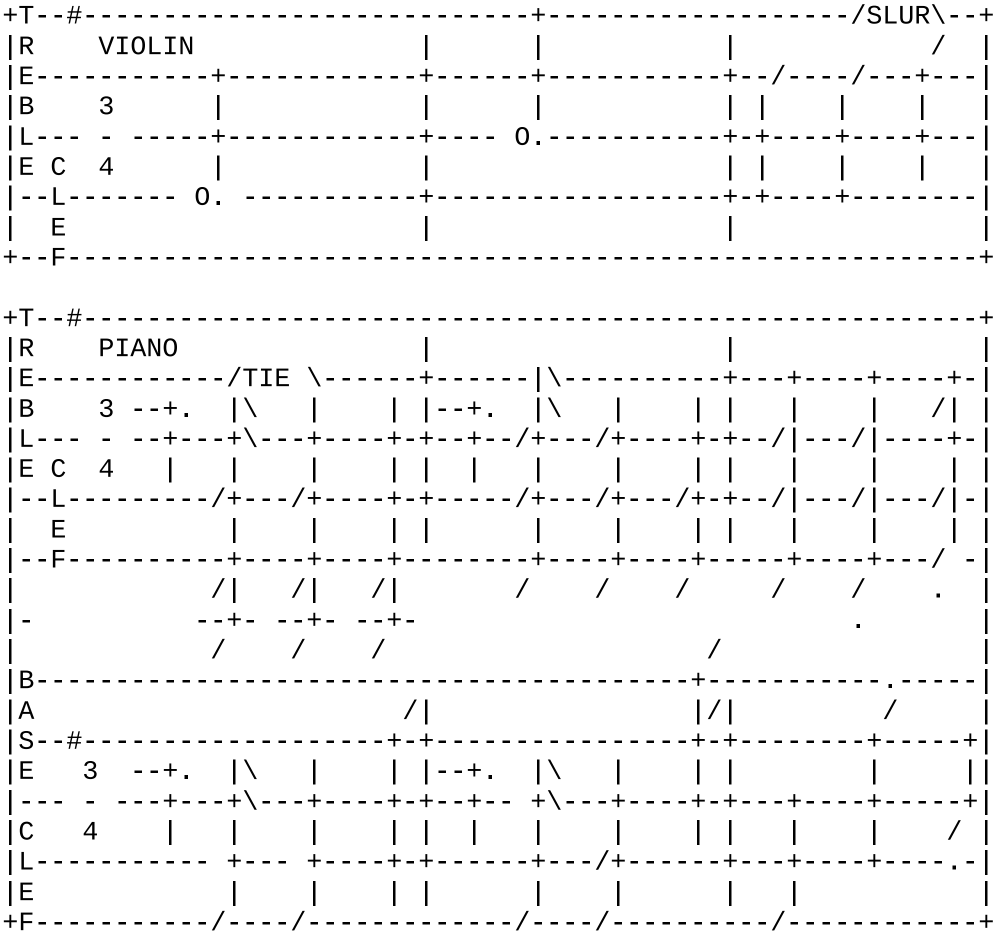

FIGURE 1--SCORE IN COMMON MUSIC NOTATION

```
*-------------CONDUCTOR PROGRAM SCORE SETUP------------------*
I K1# v220              *initialization & key & default tempo*
1 o60 h1 t40 kv100  *violin keyvelocity at constant value 100*
2 o60 h2 t0  kx1  *piano rt hand x1->loudness via keyvelocity*
3 o48 h3 t0  ky1 *piano lft hand y1->loudness via keyvelocity*
q1 h1 y2 c7    *continuous control of violin loudness with y2*
q2 h1 x2 c1     *continuous control of violin vibrato with x2*
*-------------CONDUCTOR PROGRAM SCORE NOTES------------------*
*1* 0  /.... /.... /....   *3 evenly spaced trigs 1st measure*
    1  G....  .... ...r.
    2  r...BDG....r.BD...r.   *chords-- no dots between notes*
    3  r...!G,,,,,,r,,!G...r.G...r.      * 8 commas == 1 dot *
*2* 0  .../../..../....     *3 triggers playing 3 piano chords*
    1  b.... .... ...r.
    2  r...DGb,,,,,,r,,DGb...r.DG...r.
    3  r...!G,,,,,,r,,!GB...r.Gb...r.
*3* 0  /.... /.... /....
    1  d...r.d....e...r.           *2nd & 3rd notes slured*
    2  DGB..r..DGB..r..EGc..r..          *3 stacato chords*
    3  !G...r.G..r..C..r..
    0      *final 0 to play last measure & terminate piece*
```

FIGURE 2--CONDUCTOR PROGRAM SCORE

The conductor program score is divided into two sections--setup and notes. Comments can be included in the score enclosed by asterisk. In the first line of the setup section,

```
                    I K1# v220
```

I initializes the baton processor, K1# sets the key signature, and v220 sets a default "inverse" tempo--ie, the larger the v number, the slower the tempo.

The second, third, and fourth lines initialize the three voices, 1,2, and 3. For voice 1 the:

```
                    1 o60 h1 t40 kv100
```

the o60 sets the pitch transposition so a "C" in the score means middle C. Middle C has keyno 60 in most synthesizers. The "o" setting can transpose a voice up or down by any number of half steps. The h1 says this voice will be played on midi channel 1, the t40 sends a program change 40 on midi channel 1 to select the general midi timbre 40 which is a "violin" timbre, and the kv100 sets the key velocity of all notes played in voice 1 to a constant value of 100.

The setup for voices 2 and 3 is similar except that the key velocity for voice 2, the piano right hand is controlled by the x position of stick 1 when it makes a trigger. The key velocity for the piano left hand is controlled by the y position of stick 1. Thus we have independent control over the loudness of the left and right hands. By the nature of key velocity in synthesizers, this control can only be set at the beginning of each note, but such control is appropriate for a piano.

The last two lines in the setup use "patch cords" q1 and q2 to connect x2 and y2 to synthesizer control changes. There are 16 patch cords, q0--q15, in the nc program. They can only be used for one function at a time. The statement:

```
                    q1 h1 y2 c7
```

uses patch cord q1 to connect the y position of stick2 to control change 7 on midi channel 1. In this way, the loudness of the violin is continuously controlled by the y position of stick 2. Similarly the x position of stick 2 control is assumed to control the vibrato strength. The control of loudness with c7 is standard in most synthesizers. Control of vibrato is not standard and usually the specific desired control must be programmed into the synthesizer.

In the notes section of the score, pitches are designated by the letter names of the notes. Upper and lower case letters are used to span a two octave range. Although the "o" transposition control can associate any pitch with a given letter, o60 is usually used to write treble clef passages and o48 for bass clef passages. For these setting, the pitch-letter equivalences are as shown on Figure 3

```
                      -^c-                                     -e-
                       ^b                                       d
                      -^a-                                     -c-
                        g                                       b
         +T-------------f-------              +B----------------a----
         |R             e                     |A                G
         |E-------------d-------              |S----------------F----
         |B             c                     |E                E
         |L-------------b-------              |-----------------D----
         |E C           a                     |C                C
         |--L-----------G-------              |L----------------B----
         |  E           F                     |E                A
         +--F-----------E-------              +F---------------!G--
                        D                                      !F
                       -C-
                        B
                       -A-
                       !G
          A. TREBLE CLEF NOTES                    B. BASS CLEF NOTES
             WRITTEN AT o60                          WRITTEN AT o48
```

FIGURE 3--USUAL NOTATION FOR WRITING
TREBLE AND BASS CLEF NOTES

The key signature and five accidentals modify the letter pitches. The accidentals are #-sharp, @-flat, $-natural, ^up-one octave, and !-down one octave. Accidentals precede the pitch letter. Several-as many as desired--accidentals can be applied to a pitch letter. Accidentals apply only to one note--they do not carry to the end of the measure.

Durations are designated by the dots and commas between the pitch letters. The time between two note, in rabbiter time units, is the number of dots + 1/8 the number of commas between the pitch letters for the notes. Thus a dot by default equals 8 commas. The equivalence between dots and commas can be set to other values. (See the complete list of score symbols in the appendix.) The relation between dots and note values is arbitrary and can be selected by the composer. In the example we have chosen 4 dots to equal one quarter note.

In the rest of this text, we will usually talk about dots as the time specifier, but in all cases we mean dots and commas.

Each measure has 4 voices. Voice 0 is always the baton triggers from stick 1 In this voice a "/" indicates the location of a trigger. Voices 2,3, and 4 are as defined in the setup.

The duration of each measure is dominated by the number of dots in voice 0. If some other voice has more dots than voice zero, an ERROR comment will occur. If some other voice has fewer dots than voice zero, additional dots will be automatically added to the end of this voice .

Simultaneity between the events in different voices (including the baton voice) is specified entirely by dots. Thus, any notes that are written following the same number of dots after the beginning of the measure will be played simultaneously. In a given voice, pitches with no intervening dots and commas will be played as a chord.

Notes in a given voice are sustained until a new note is written or until a rest "r" is written. Thus to play staccato notes, rests must be used.

All notes of a chord in a given voice end at the same time. If it is desired to have the notes of a chord end at different times, the +/- notation described in the appendix can be used.

TEMPO CONTROL

Four methods of tempo control are available. The primary control is the trigger marks ("/") and dots in voice 0. After the first trigger, the performance starts at the default tempo (v220 in the example) specified in the setup. For each subsequent trigger, the computer recomputes the tempo by dividing the time (in milliseconds) taken by the performer between the last two triggers by the number of dots in the score between the corresponding two trigger marks. The section FOLLOWING the second trigger mark is played at the new tempo. Thus the performer automatically resets the tempo with each trigger. However, the tempo always lags one trigger mark behind the performer's actions. Thus the tempo between any two trigger marks is determined by the time he or she took one mark previously. If this lag causes problems in a particular section, the usual solution is to add more trigger marks thus giving finer tempo control at the expense of more gestures on the part of the performer.

If the performer changes tempo rapidly, an irregular performance may result. If the performer slows the tempo the baton will reach the next trigger mark before the performer gives the next trigger. In this case (unlike a real orchestra) the baton will simply stop playing and wait for the performer to make the next trigger. If the performer speeds up and makes the next trigger before the baton has played all the notes leading up to this trigger, the baton will jump to the next trigger point, omitting any unplayed notes.

The second method of tempo control is to write default tempos into the score. A statement, vn, where n is any integer, can be put just ahead of any trigger mark. At that trigger mark the baton with start playing at the default temp. After subsequent triggers it will recompute the tempo using the primary method of tempo control.

The third method of tempo control is to designate a section of the score by writing two w's in the baton voice. In this section, trigger marks will be ignored and the tempo will be continuously modified by y1. This method is useful to make smooth accelerando and retards.

The last method of tempo control is to designate a section of the score by writing two W's in the baton voice. In this section, trigger marks

will be ignored and the tempo will be constant at
whatever value it had at the beginning of the section.

RUNNING THE COND PROGRAM

The cond program in the computer manages score and voicing files and downloads information in the baton processor for performance. When the program is executed, the command menu shown in Figure 4 appears on the computer screen.

```
Baton MIDI input set to device 0 = SB16 MIDI In [330]
Baton MIDI output set to device -1
Synthesizer output set to device 0 = SB16 MIDI Out [330]
Other Computer MIDI input set to device -1
Other Computer MIDI output set to device -1

   D = print a description of this program given by the programmer
   ? = print this command list         M = print more commands
   Q = quit the program
   S = silence synthesizer
   P = position display toggle         B = buf display toggle

CONDUCTOR COMMANDS s--select score   z--play   n--no baton mode on/off
type NEXT COMMAND  (type Q to quit, type ? to print list of commands)
```

Figure 4--COMMAND SCREEN FOR THE COND PROGRAM

Commands are executed by typing the indicated letter. Most of the commands do not require additional explanation. We will make a few comments about some of them.

The "s" command will select a compiled score. A compiled score has the same name as a source score, but with the extension ".p".
The name of the score can also be written in the command line
which calls the conductor program.

The z command will start playing the score. A source score can be compiled with the compile.exe program. The source score can either be a conductor program score or a type 1 midi file plus a header file. The header file is a conductor program score that sets the expressive controls and makes certain initializations.

Normally the score will start playing at measure 1. The "m" command allows the score to start at the beginning of any measure. The measure will remain in effect until a new "m" command is typed.

APPENDIX A--CONDUCTOR PROGRAM SYMBALS & REAL-TIME CONTROLS

0 through 24	Select voice
A through G, a through g	Specify note pitch
An,Bn,etc	Pitch letter can be followed immediately (no space) by an accent number, n, which will be added to the key velocity. Accent on a note of chord will be applied to subsequent notes to end of chord or until a new accent is written
+A,+B, etc	Start note using midi noteon convention. Midi notes must be explicitedly turned off
-A,-B, etc	Midi noteoffs
RESET button	Resets baton to power-up state
B14- button	Advances to next measure in score
B15- button	Can be used as sustain pedal (see qn hm s15 c64 command below)
.	Specify one dot beat-time duration One dot normally equals 8 commas (see j command below)
,	Specity one comma beat-time duration
/	Trigger point
#	Sharp accidental
@	Flat accidental
!	Octave down accidental
^	Octave up accidental
$	Natural accidental
* xxxxxx *	Comment (max length--240 charactors)
hn	Set midi channel of voice to n
I	Initialize ns score compiler program
jn	Set one "dot" equal to n "commas" note--jn must be at the beginning of a voice number 0 line
Kn# Kn@	Set key signature n is number of flats or sharps
kun	Set key velocity control un can be: x1,y1,or z1--#1 stick control x2,y2,or z2--#2 stick control p1,p2, or p3--pot control vi--where -1<i<128--setting constant
M	Transfer score reading to Midi file
on (o is lower case "oh")	Set transpose for one voice. Keyno of note "C" is n
p	Turn sustain of one voice on
P	Turn sustain of one voice off

```
qn hm si [wj ek rl tp] ck             Setup control change
                             qn specifies patchcord n (0...15)
                             hm specifies midi channel m
                             si can be:
                               x1,y1,or z1--#1 stick control
                               x2,y2,or z2--#2 stick control
                               p1, p2, or p3--pot control
                               vi where -1<i<128--setting constant
                               ck where k is control change #
                                  k=0 will remove patchord
                               [wj ek rl tp] optional linear
                                  transform of the x,y,or z
                                     stick variables
                                  j,k,l,p are integers
                                     in the range 0 to 127
qn hm s15 c64              make B15- a sustain pedal for
                                   midi channel m
r                          Rest
tn                         Send midi program change n
vn                         Set tempo n = 240,000/tempo (0<n<256)
                                where tempo is commas/minute
Vn                         Set tempo, n = dots/min
w                          Set or reset continuous tempo control
W                          Set or reset fixed tempo, ignor
                                   triggers
(vvvvv)z                   Define macro z where z is a letter
                              a,b,...z which names the macro
                              v may be any charactor. the
                              charactor X is a dummy variable
                              which will be repaced by a
                              substituted variable when the macro
                              is evaluated
'zn                        Evoke macro z n times. If n is omitted
                              the macro will be evoked once
[u v w]'z                  Define sequence of substitutions for
                                dummy variables in a macro. u v
                                and w are substitution variables
                                which are successively substituted
                                for dummy variables in the macro.
                                Substitution variables
                                are one or more charactors. A
                                A blank is the spearation
                                charactor between substitiution
                                variables.
x (key on computer)        Quiet synthesizer (works only when
                                batan is in COMMAND mode)
Zn                         Change keyvelocity in midi noteon's by
                                   subtracting n from the
                                   keyvelocity that would
                                   otherwise be used
0                          0 required at end of score
```