Antescofo

Dynamic Language for Musician-Computer Interaction

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http://repmus.ircam.fr/mutant
Departments
- R&D (9 teams)
- Production & Diffusion
- Educational & Cultural Outreach
- Multimedia Library
- Research/Creativity Interfaces

> 180 collaborators
- ~ 65 researchers
- 20 PhD students
- 20 Composition students
- 15 invited scholars
- 25 internships
- Composers, Artists, etc.
Mixed Music

Interpretation / Realtime

Composing / Programming
Musical Times

- Elastic time

- Heterogeneous Times

Stockhausen: Inori one or two soloists with orchestra
REAL TIME PERFORMANCE

Listening Module → Reactive Engine

External Data

commands

Sound Generation / Transformation
improvising electronic music

http://vimeo.com/90623564

Antescofo

contemporary music

automatic accompaniment

http://vimeo.com/83860325

https://www.youtube.com/watch?v=iN9MmiSlBj0
Writing electronic

Anthèmes 2 (Pierre Boulez)

https://www.youtube.com/watch?v=HSab_znc_y8
Audio Analysis/Synthesis

Spatialization

MIDI / Control

Improvisation

Physical Models

Gesture

Antescofo

More than 50 Creations
New York Philharmonics, Chicago Symphony, Los Angeles Philharmonics, Berlin Philharmonics, BBC Orchestra, ...
Antescofo language

- musical scenarios description
- reaction to discreet event
- management of dynamic duration
- strong coupling with the listening machine
- synchronization strategies
- errors management
- impérative style
Writing parallel and hierarchical phrases

simple example
events:

- NOTE 60 2.0
- CHORDS (66 43) 2.0

atomics actions:

- $v := \sin(x)$
- superVP ($v+3$)

structured actions:

```plaintext
 group { 
   a_name arg1 arg2 
   2.0 a_name2 arg21 
} 
```

```plaintext
 curve @grain 0.1s 
   @action synth $x$ 
   { 
     $x$ { 
     0.3 
     4s 0.9 } 
   } 
} during [2#] 
```

```plaintext
 whenever ( $y > 3.0$ ) { 
   print "$y = \ y" 
 } 
```

```plaintext
 @proc_def ::my_proc($p) 
 { 
   loop 2.0 { 
     actions... 
   } during [2#] 
} 
```

```plaintext
 loop 3.0 { 
   a_name arg 
 } during [6#] 
```
durations & delays are expressed

- in seconds or

- in beats depending on global or local tempo

```
NOTE C4 2.0
    (1/4 + 1/8) action1
    1/4 s       action2
NOTE D4 1.0
    group @tempo = ( $RT_TEMPO * 2 )
    { 
        action_group1
        1/2   action_group2
        $v    action_group3
    }
```
expressions

- values:
  int - float - bool - string - tab - map - function - process

- variables:
  history:
  
  \[
  \begin{array}{|c|}
  \hline
  [2\#]:$v \\
  [2.5]:$v \\
  [3s]:$v \\
  \hline
  \end{array}
  \]

  \[\begin{array}{|c|c|c|c|c|}
  \hline
  \ $v$ & $0.0$ & $1.0$ & $2.5$ & $4.0$ & $5.5$ \\
  \hline
  \text{timestamps in beats} & $0.0$ & $1.0$ & $2.5$ & $4.0$ & $5.5$ \\
  \text{timestamps in sec} & $0.0$ & $2.3$ & $4.2$ & $5.9$ & $7.5$ \\
  \hline
  \end{array}\]

  system variables:
  \ $RT\_TEMPO$ - $NOW$ - $RNOW$ - $PITCH$ - etc.

- operators and functions:
  \ $\sin$ - $\exp$ - if(\ldots, \ldots, \ldots) - etc.
Antescofo environment:
- history variables
- notifications

Scheduler:
- Static Timing - Static Order
- Dynamic Timing - Static Order
- Dynamic Timing - Dynamic Order

Runtime:
- Event-trigger
- Time-trigger

External environment:
- External Events

Score and actions data:
- Internal events
- Timing dispatch
- Output

Runtime:
- Clock
- Timing variables
Runtime

Antescofo environment
- history variables
- notifications

Scheduler
- Static Timing - Static Order
- Dynamic Timing - Static Order
- Dynamic Timing - Dynamic Order

Score and actions data

Event-trigger
iseenvironment
External Events

Internal events

Timing dispatch

Time-trigger

Output

External environment

Clock
Scheduler

group{
  4 a11
  2 a12
}
group{
  3 a21
  2 a22
}

Dynamic Timing - Static Order

group{
  2s a31
  1s a32
}
group
  @tempo=65{
    4 a41
    2 a42
  }

Static Timing - Static Order

Dynamic Timing - Dynamic Order

@tempo=$RT_TEMPO*2{
  1/2 a51
  1   a52
}
group
  @tempo=$v{
    2 a61
    3 a62
  }
Runtime

Score and actions datas

External Events

Event-trigger

Internal events

Time-trigger

Scheduler

Static Timing - Static Order

Dynamic Timing - Static Order

Dynamic Timing - Dynamic Order

Antescofo environment

- History variables
- Notifications

External environment

Clock

Output
Whenever ($x > y$)

```
@label w1
{
    $v := v + 1$
}
```

Whenever ($v = 10$)

```
@label w2
{
    $y := 34$
}
```
$x := 2$

\begin{verbatim}
group g1{
    @local $y$
    $y := $x + 3
    
    loop l1 2{
        @local $x$
        $x := 1$
        $y := 2$
        send $x$ $y$
    }
}
\end{verbatim}
Stratégies de Synchronisation

Ideal Performance

Constant Actions Tempo

Semi-Loose

Loose

Tight

Ante-Tight

Tight-Target

Loose-Target

Dynamic-Target
Ideal Performance

- musician events
- continuous actions
- discrete actions
Loose Strategie

- Musician events
- Tempo update
- Continuous actions
- Discrete actions

Antescofa
Tight

musician events

tempo update

continuous actions

discrete actions

Antescofo
Ante-Tight

1. Musician events
2. Tempo update
3. Continuous actions
4. Discrete actions

Diagram showing the relationship between musician events and continuous actions, with discrete actions as a subset.
Static Target

- Musician events
- Tempo update
- Continuous actions
- Discrete actions

Antescofa
NOTE 60 2.0
   group @target:={sync}
   {
     action
     1.0 action
     1.0 action
     1.0 action
     1.0 action
   }
NOTE 60 1.0
NOTE 60 1.0
NOTE 60 1.0 sync
Examples
Sketches of C. Trapani
whenever ($RT\_TEMPO)$
{
\$t' := $t' + (@date($t'$)-$NOW) \times \$speed)\\

\$end := $NOW+($end\_pos-$RNOW) \times 60/$RT\_TEMPO \\
\$sync := $NOW+($sync\_pos-$RNOW) \times 60/$RT\_TEMPO \\

\$speed := ($end-\$t')/($sync-\$NOW) \\
ph\_voc speed $speed \\
}
until ($RNOW \geq $end\_pos)
Recorded 21 March 2013 at IRCAM
Jérôme Comte, clarinet
sketch by Christopher Trapani

collaboration in the framework of a Musical Research Residency with the MuTant team

contributions from José Echeveste,
Jean-Louis Giavitto, and Arshia Cont
Antescofo for Composing

- “Tensio” by P. Manoury for string quartet & live electronics
Others...

- Andrea Agostini
  “Legno sabbia vetro cenere”, for string quartet & electronics (2010)
  - concurrent synchronous sound synthesis phrasing

- Emmanuel Nunes
  “Einspielung I”, for Violin & live electronics (2011)
  José Miguel Fernandez, Computer Music Design
Static Verification and Test Methods
Perspectives

- distributed coordination (multimodal, multi-objective listening)
Perspectives

- audio computation
- dynamic scheduling
- more synchronization strategies
Further Reading

Papers and seminars:
http://repmus.ircam.fr/mutant

Get Antescofo:
http://forumnet.ircam.fr/product/antescofo/