

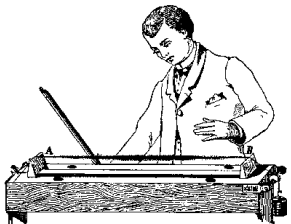
# Gesture in Interaction: Expressive Control Strategies (Part II)

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KTH Computer Science and Communication  
Department of Speech Music and Hearing



**KTH Computer Science  
and Communication**



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# Outlook 1/2

## Chapter 7: Control of music performance

- A fuzzy analyzer of emotional expression in music and gestures
- Application:
  - Visualization of music performance

### In the afternoon session:

- The KTH rule system for music performance
  - pDM - Real time control of the KTH rule system

# Outlook 2/2

## Chapter 8: Controlling Sound Production

- Sound and motion
- Sound and interaction
- Examples:
  - Control of musical instruments
    - DJ scratching (KTH)
    - Virtual Air Guitar (TKK)
  - Control of sounding objects
    - reacTable\* (UPF)
    - The Interactive Book (VIPS)

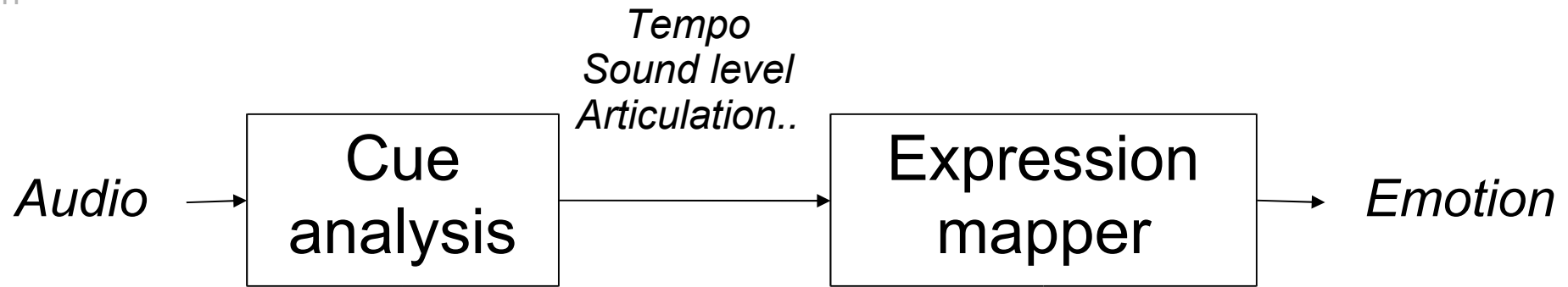
# Recognition of Emotion

## ► Fuzzy analyzer of emotional expression

Real-time  
Visualization of  
Musical Expression

## Controlling Sound Production

DJ scratching  
Virtual Air Guitar  
reacTable\*  
The Interactive  
Book



► **Fuzzy analyzer  
of emotional  
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# CUEX- Extraction of Tone Parameters

A Friberg, E Schoonderwaldt, P N Juslin

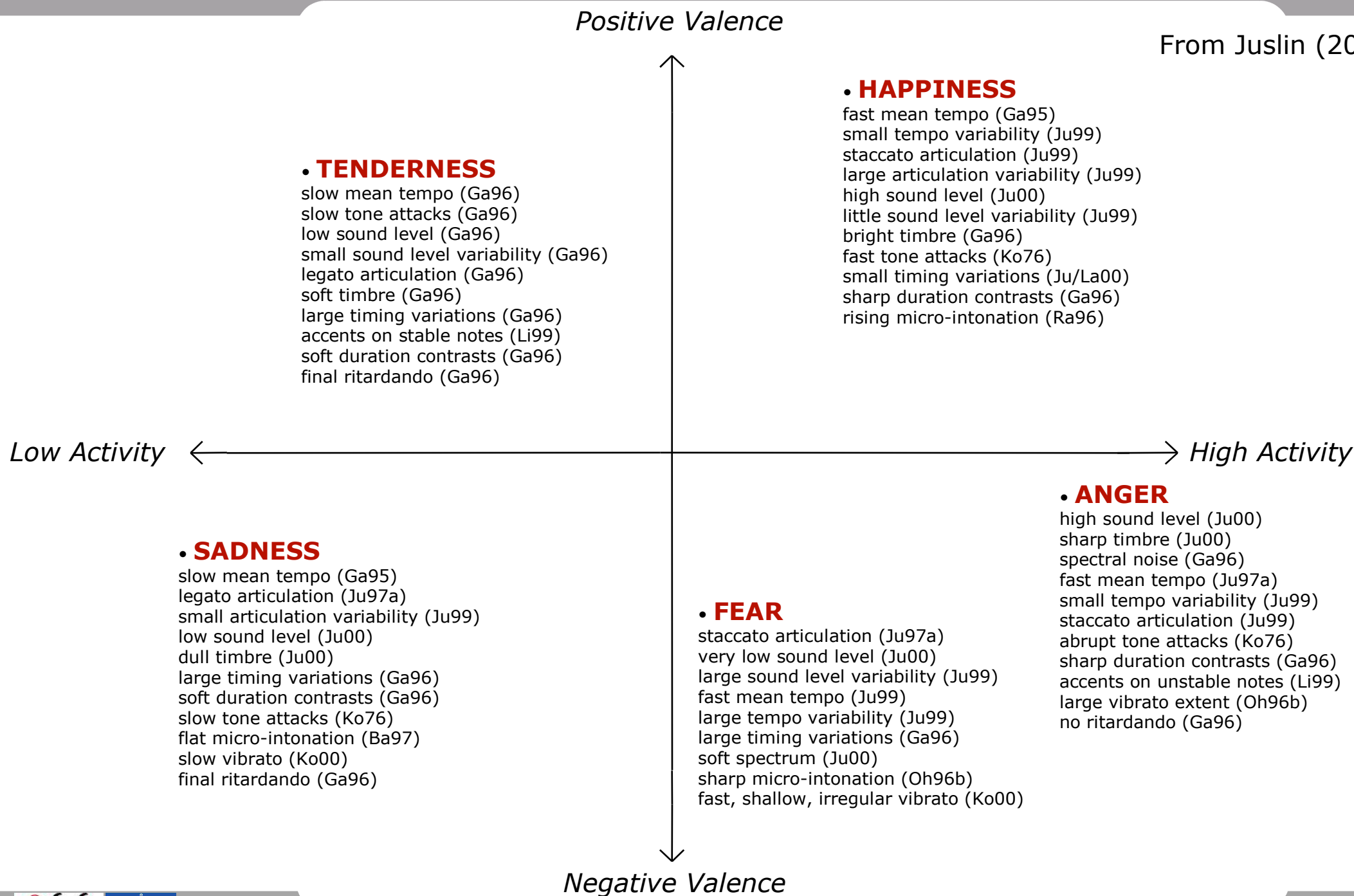
## *Method*

### **Find tone boundaries**

Tone start/tone end

### **Calculate cues**

- Tempo (tones/second)
- Sound Level
- Articulation (staccato/legato)
- Attack Velocity
- Spectrum
- Vibrato rate
- Vibrato extent
- Pitch



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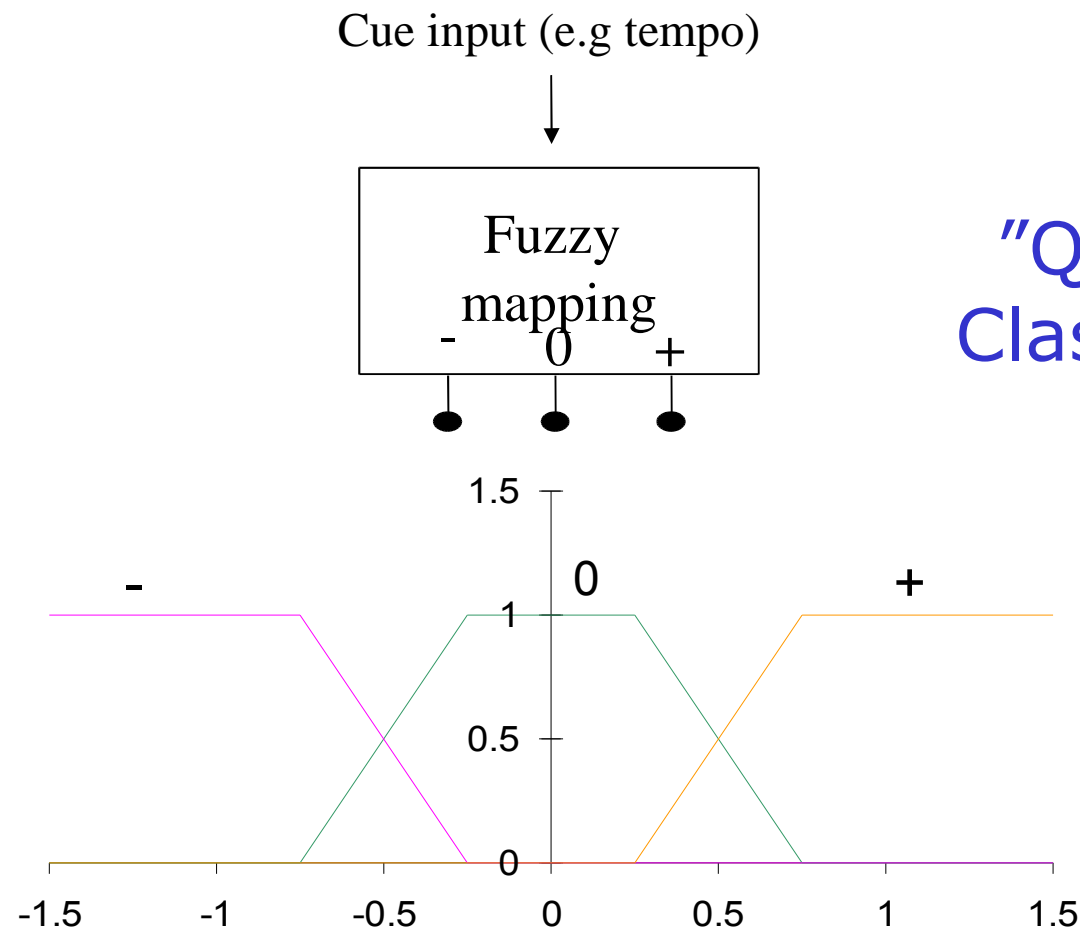
Controlling  
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# FUZZY MAPPING

## from acoustic cues to emotion recognition

**Section 7.0.8.1:** A fuzzy analyzer of emotional expression in music and gestures



"Qualitative  
Classification"

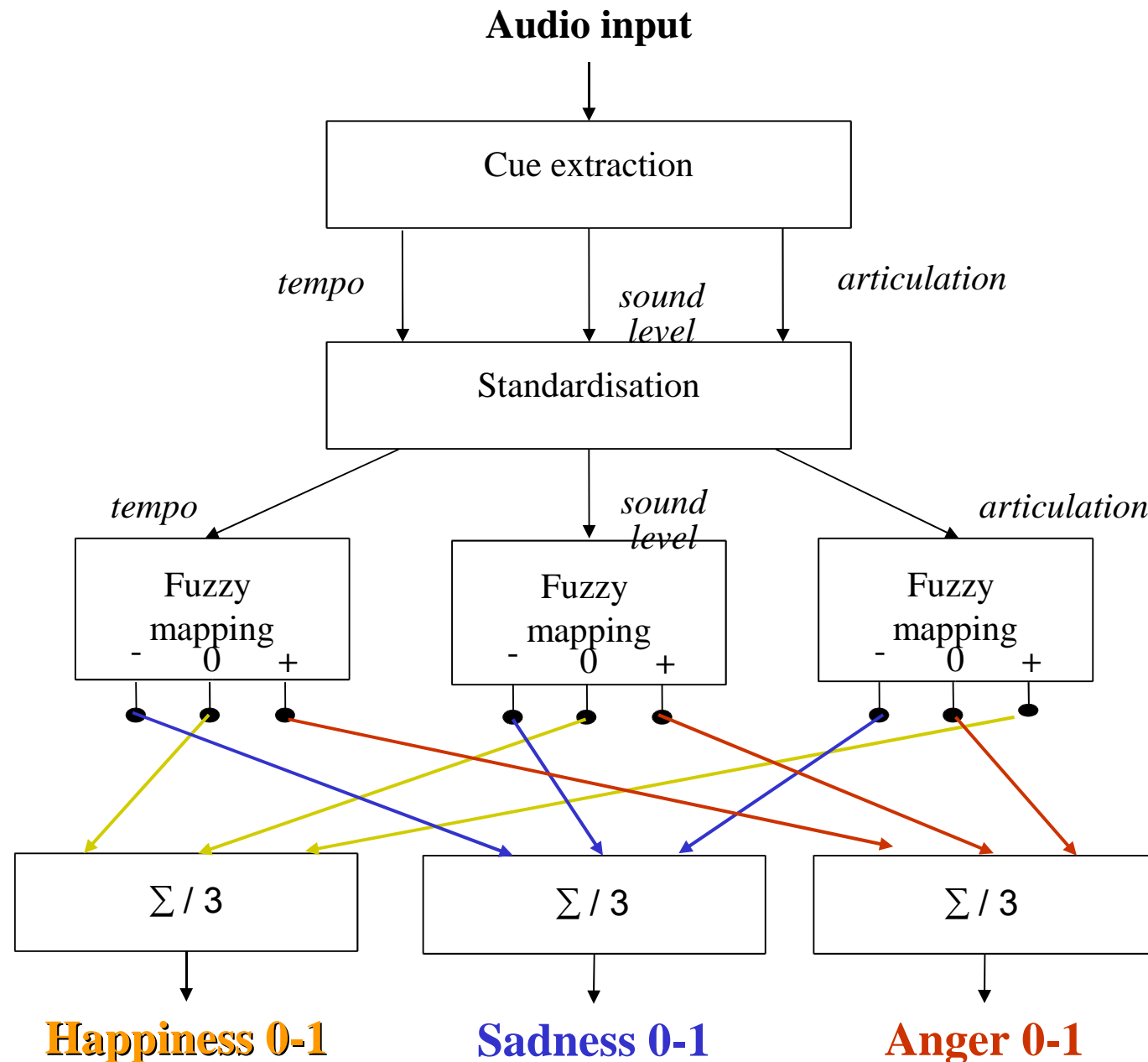
# From audio to emotion recognition

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# Application: visual feedback

Fuzzy analyzer  
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Design a tool for real-time visual feedback to expressive performance

→ Mapping of acoustic cues:

- Non-verbal
- Intuitive
- Informative (including emotional expression)

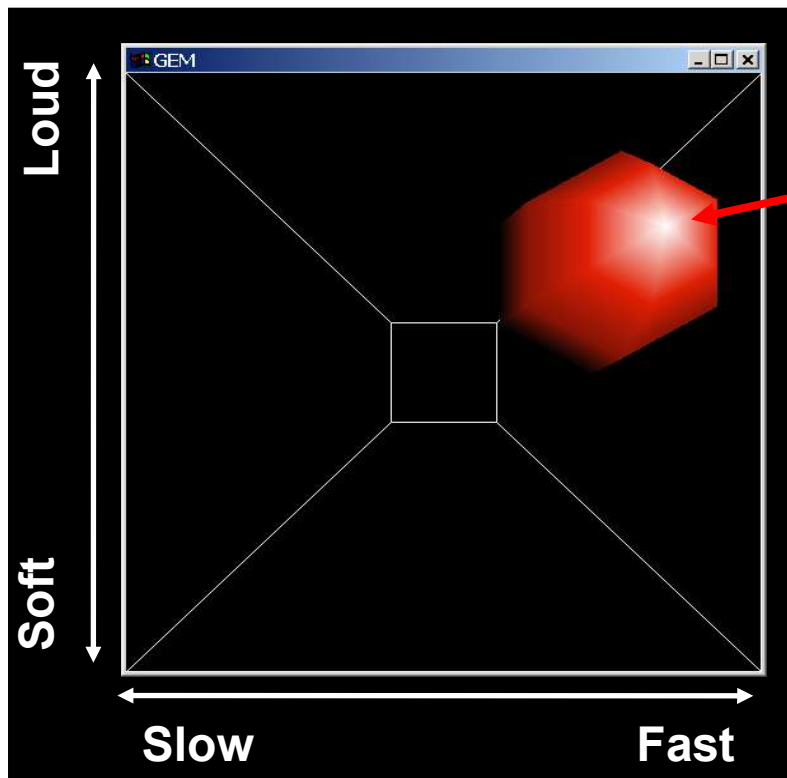
Previous studies: cross-modality speeds stimuli discrimination

# The ExpressiBall

Expressive performance space as a mapping of acoustical cues and emotions

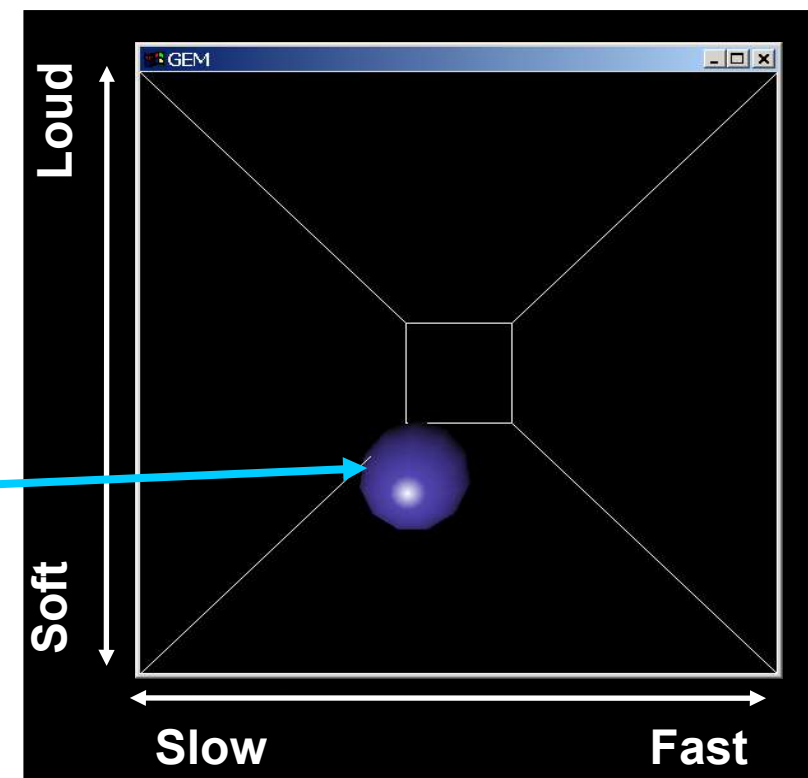
**X** → Tempo  
**Y** → Sound level  
**Z** → Attack velocity & Spectrum energy

**Color** → Emotion  
**Shape** → Articulation



Staccato  
Angry  
Fast attack  
High energy

Legato  
Sad  
Slow attack  
Low energy



# From music expression to facial expression

M Mancini<sup>1</sup>, R Bresin<sup>2</sup>, C Pelachaud<sup>1</sup> (<sup>1</sup>LINC-LIA, <sup>2</sup>KTH)  
**HUMAINE NoE** <http://emotion-research.net>

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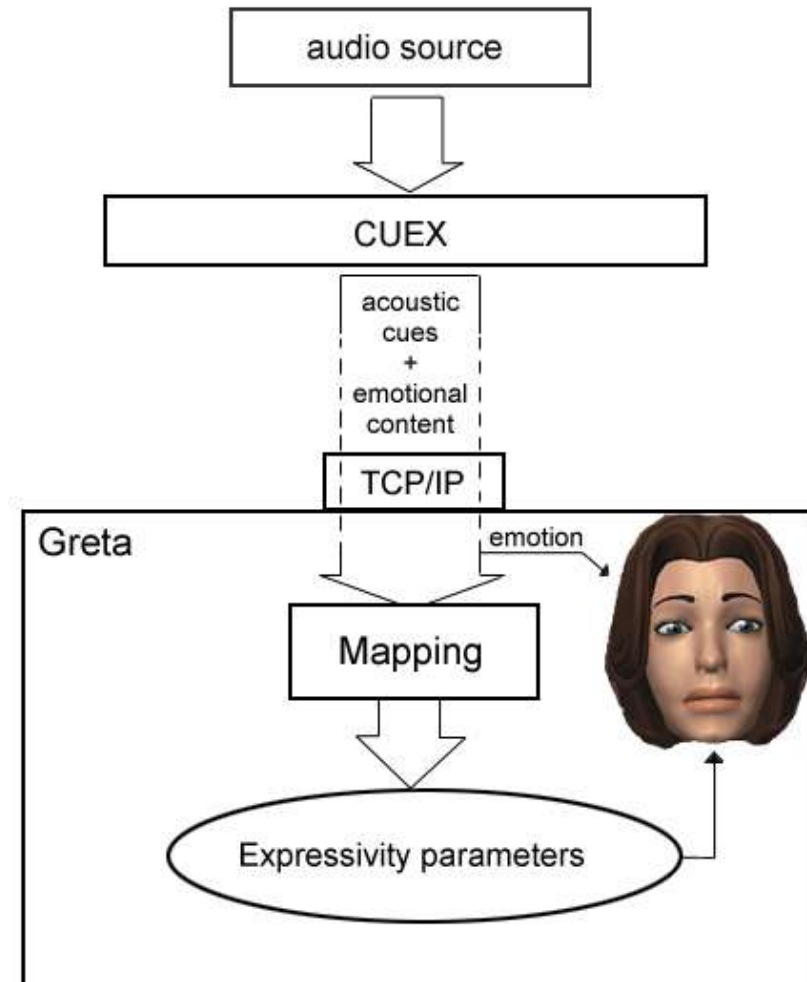
Parameters are received  
by the ECA Greta via  
TCP/IP:

music emotion →  
*facial expression*

sound level →  
*spatial and power*

music tempo →  
*temporal and overall  
activation*

music articulation →  
*fluidity*



# Sound and motion

**Section 8.0.11.1:** Sounds are related to motion, as they are usually the result of actions:

- body gestures (e.g. the singing voice)
- mechanical movements (e.g. the sound of train wheels on rails)
- ...

**Example:** the sound of a step in isolation is difficult to identify, while it gives the idea of walking if repeated a number of times. If the time sequence is organized according to equations resembling biological motion, then walking sounds can be perceived as more natural (Bresin and Dahl 2003). In addition, if sound level and timing are varied, it is possible to communicate different emotional intentions with walking sounds.

# Sound and interaction

**Section 8.0.11.2:** Feedback plays an important role in any controlling action:

- sound resulting from the user's gestures on an object or a musical instrument
- sound carries information about the user's actions
- sound is a multidimensional information carrier

**Example:** Temporal control of sound events helps in communicating the nature of the sound source (e.g. a footstep), the action that is being performed (walking/running), and the intention (e.g. anger, happiness).

Fuzzy analyzer  
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► DJ scratching

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# DJ scratching with Skipproof

K F Hansen, R Bresin (KTH)

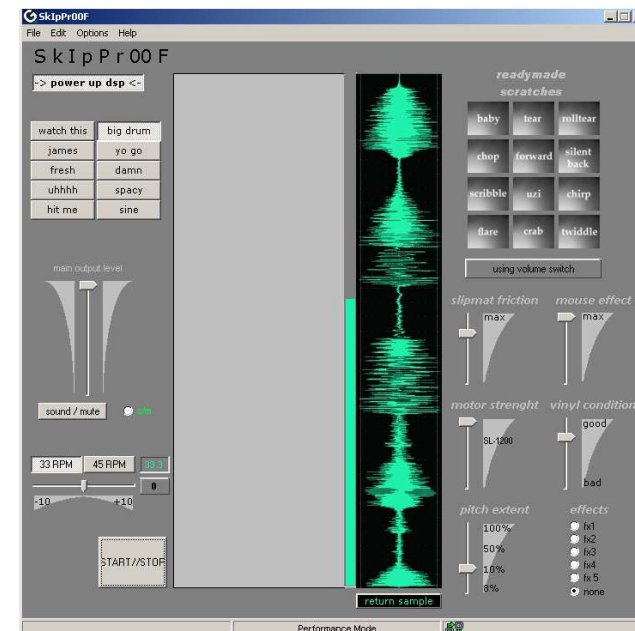
**Section 8.0.12:** a program for the simulation of typical DJ scratching gestures:

- This interface allows the novice musician to emulate DJs' techniques
- Use of gesture controllers instead of the traditional turntable, mixer and vinyl record set-up

*DJ A-trak*



*Right hand controls the crossfader on the sound mixer. In the run of 1 mm, the fader goes from silent to full volume.*



# DJ gestures (1/2)

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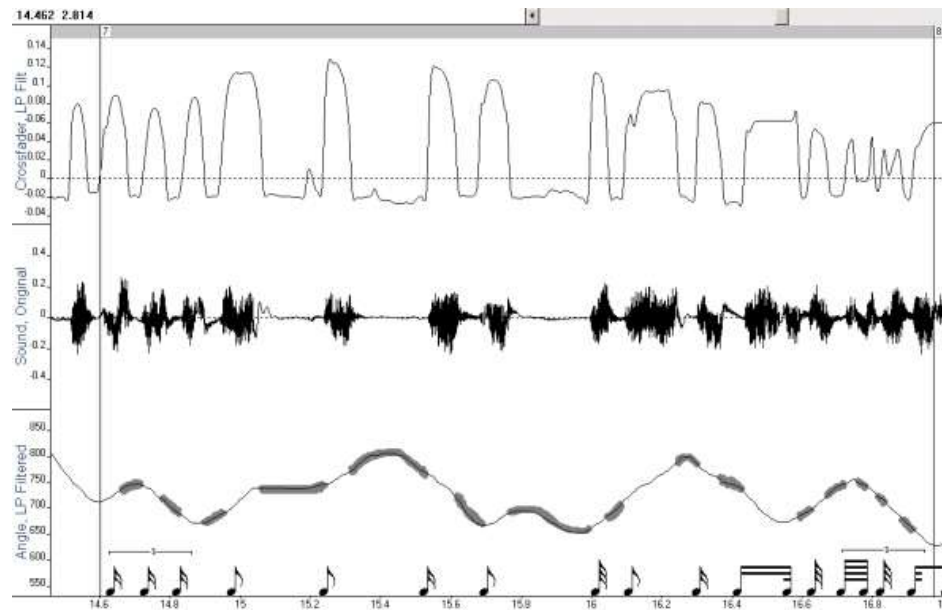
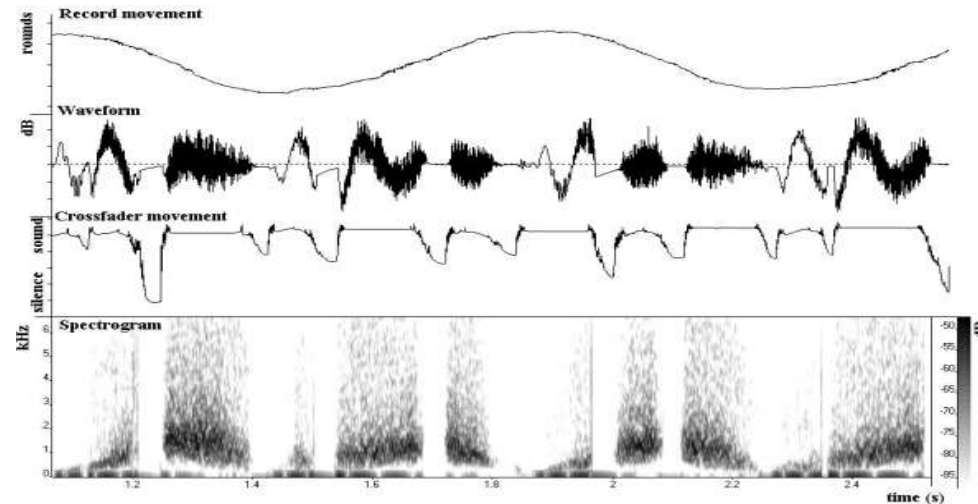
Controlling  
Sound  
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Single  
technique:  
(twiddle scratch)

Musical  
phrase:  
(one bar)





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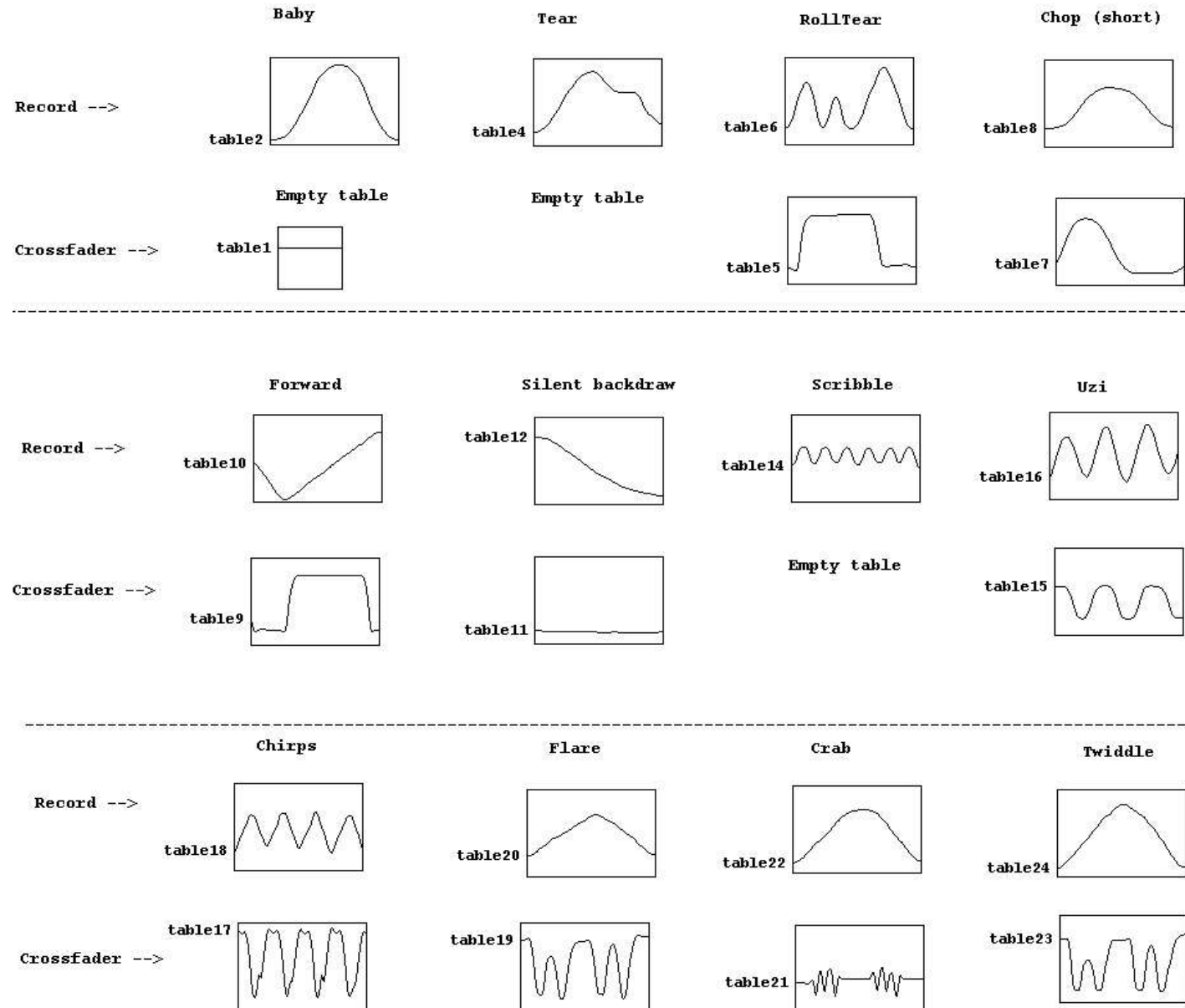
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## ► DJ scratching

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# DJ gestures (2/2)

## Overview of synthesized scratching techniques



Upper rows:  
record  
movement

Lower rows:  
crossfader  
movement



# Controllers for Skipproof

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DJ in concert with the  
*thimble controller* and a  
conventional crossfader.



*Thimble controller*  
is a 3D  
sensor for the *Radio  
Baton*. Can be mapped  
to both record and  
crossfader movement.



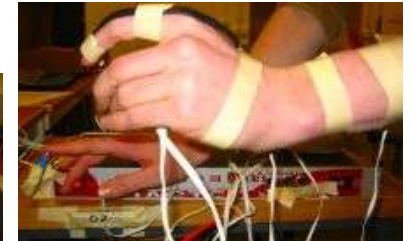
Audience playing  
with the *thimble  
controller* and a *light  
switch* crossfader.



*Mouse controller*  
for record  
movement and  
*light switch* for  
crossfader  
movement.

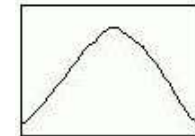


Various mappings to record and crossfader with  
Toaster's numerous sensors. Here *pressure*,  
*accelerometer* and  
*bending* sensors.

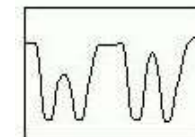


The *twiddle scratch* as recorded by the DJ  
(left column) and reproduced with the  
above gesture controllers (right column).

Record  
movement



Crossfader  
movement



original

reproduced

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DJ scratching

► Virtual Air  
Guitar

reactTable\*

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# Virtual Air Guitar (TKK)

M Karjalainen, T Mäki-Patola, A Kanerva, A Huovilainen  
<http://airguitar.tml.hut.fi/>

**Section 8.0.13:** a model for the control of guitar  
playing without a guitar.

A physics-based sound model (virtual stratocaster) is  
controlled with the player's hands using web camera or  
gesture sensors.



## Control Sticks

Ultrasonic sensors monitor the  
position of the hands



Fuzzy analyzer  
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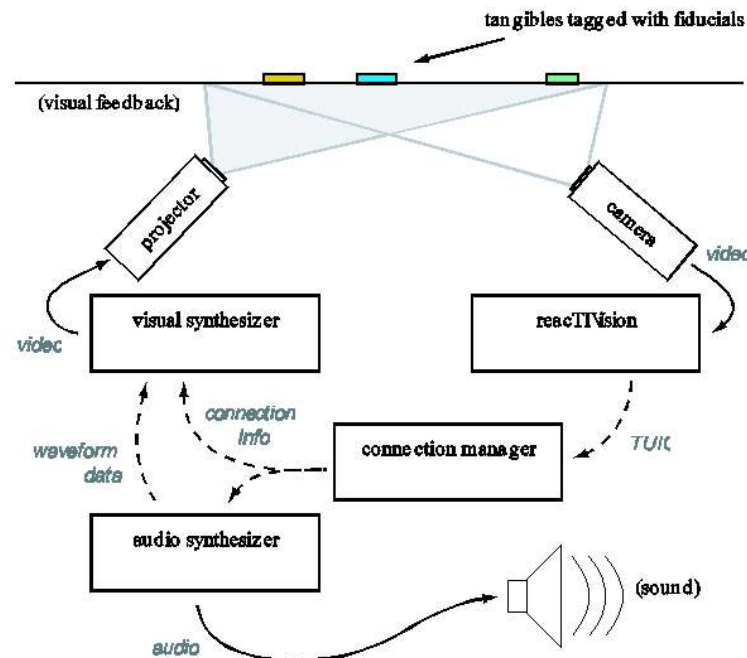
# reactTable\* (UPF)

S Jordà, M Kaltenbrunner, G Geiger, R Bencina

<http://www.iua.upf.es/mtg/reactTable/>

**Section 8.0.14:** reactTable\* is a musical instrument based on a tabletop tangible user interface:

- It allows cooperative and distributed multi-user music performance and composition
- Can be played by manipulating a set of objects distributed on top of a table surface



Fuzzy analyzer  
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# The Interactive Book

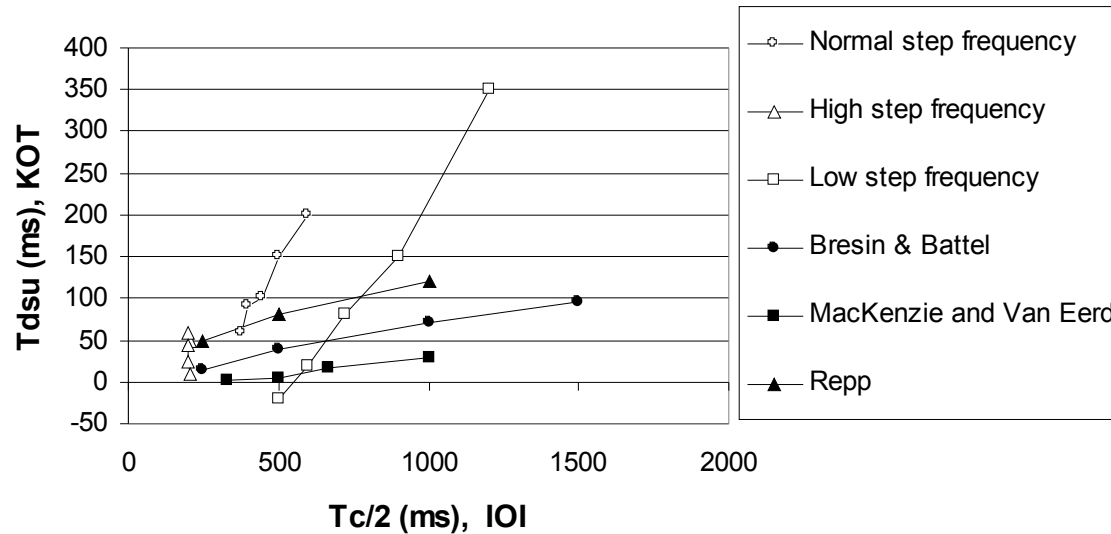
A de Götzen, D Rocchesso (VIPS)

**Section 8.0.15:** Overview of book interfaces focusing on future developments of children books. This class of books is ideal for the design of innovative applications associating sounds to interaction and therefore enhancing both narrative of the story and immersion of the reader.

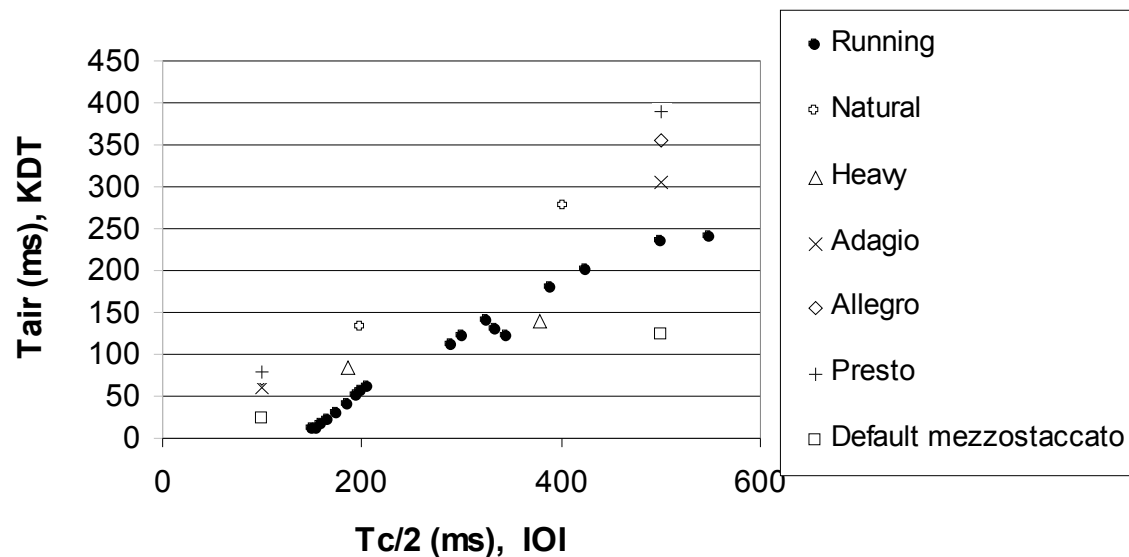


# Legato and Staccato Allude to Walking and Running?

Step and key overlap time



Step and key detached time



**Legato and walking**



**Control model  
for  
step sounds**

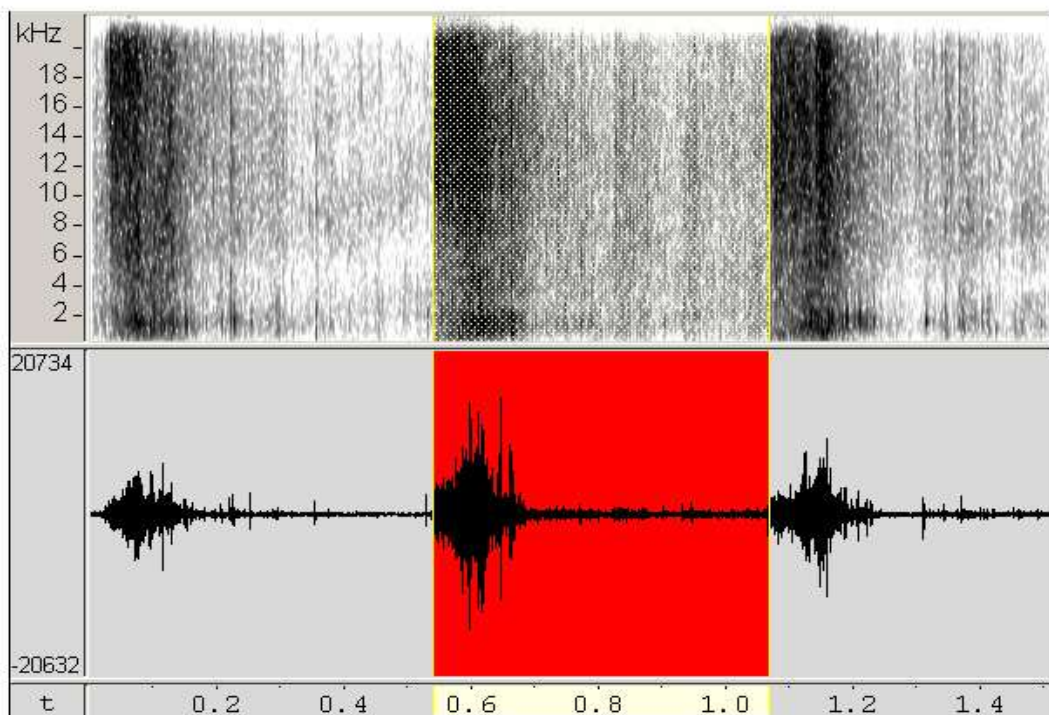


**Staccato and running**

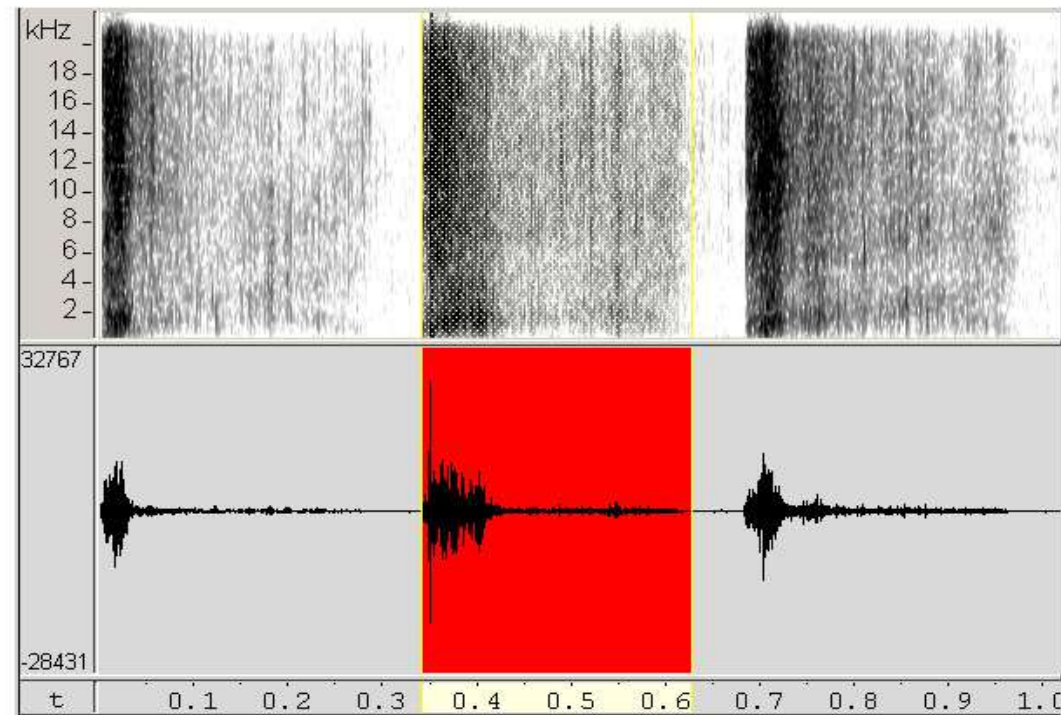


# Footsteps

**Walking** 📢



**Running** 📢



# Controlling Footsteps

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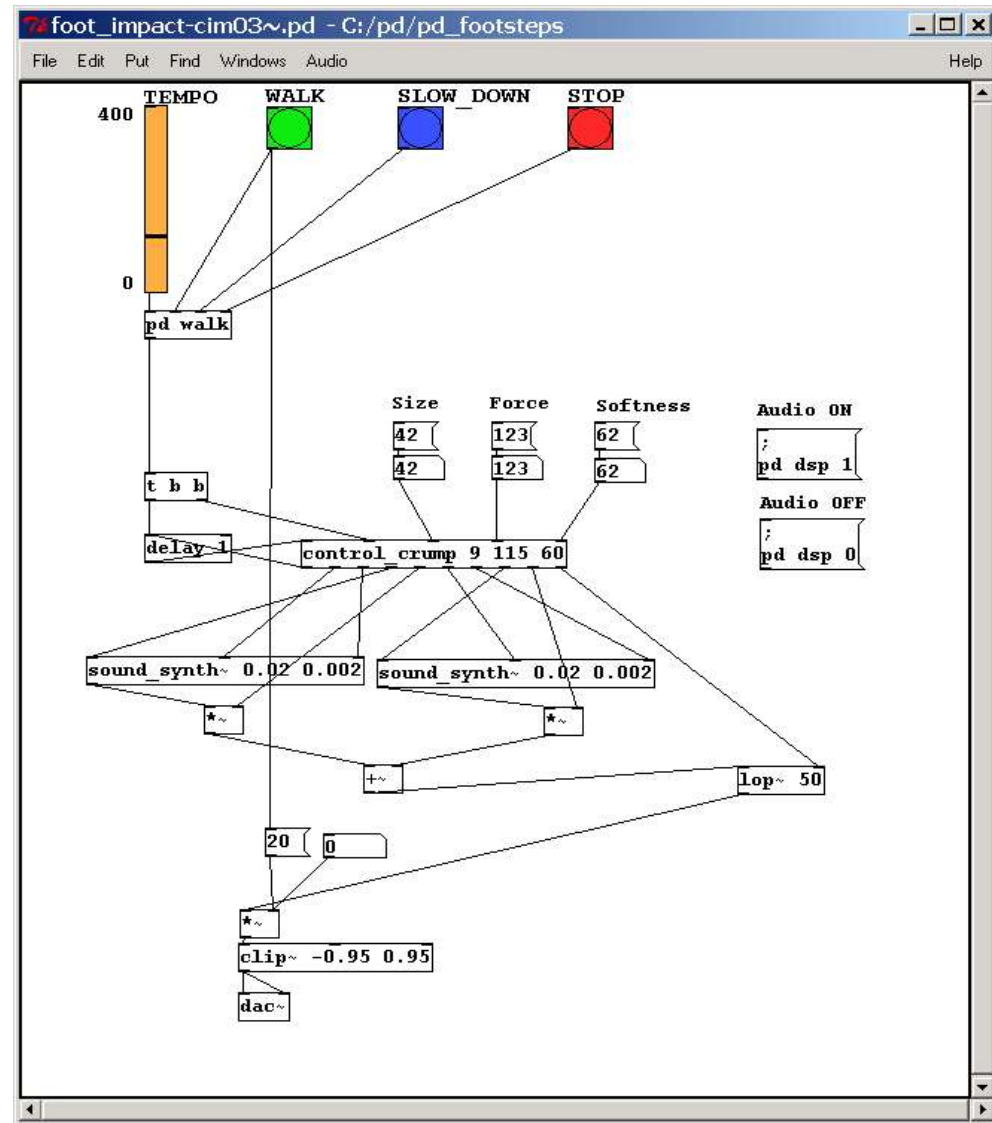
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Pd model for  
crumpling  
sounds  
controlled with  
performance  
rules



# The End

FINE