Multimedia Improvisation for brainwaves, cello, and live electronics

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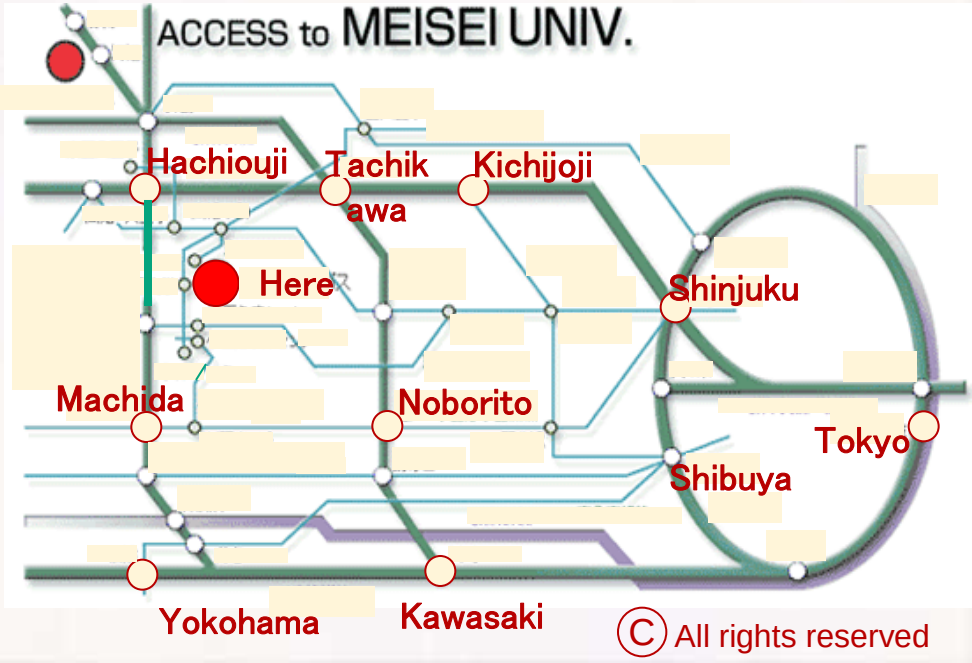
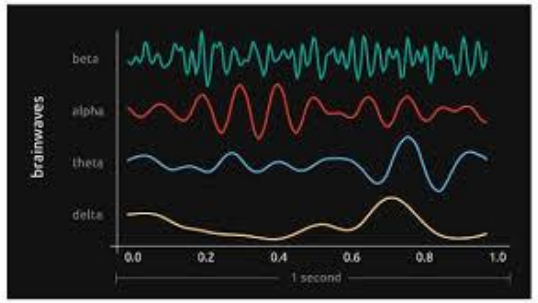
We come from…



Outline

- We have been developing brain-waves music systems using MUSE.
- We demonstrate our systems as an audio-visual output using Processing and Max/MSP.
- Our live performance consists of
  - 2 performers
  - 1 cellist and 1 live electronics
  - Visualization based on one performer's brain waves
  - Improvisation score generated by the same performer's brain-waves data
  - Improvisation for cello and live-electronis

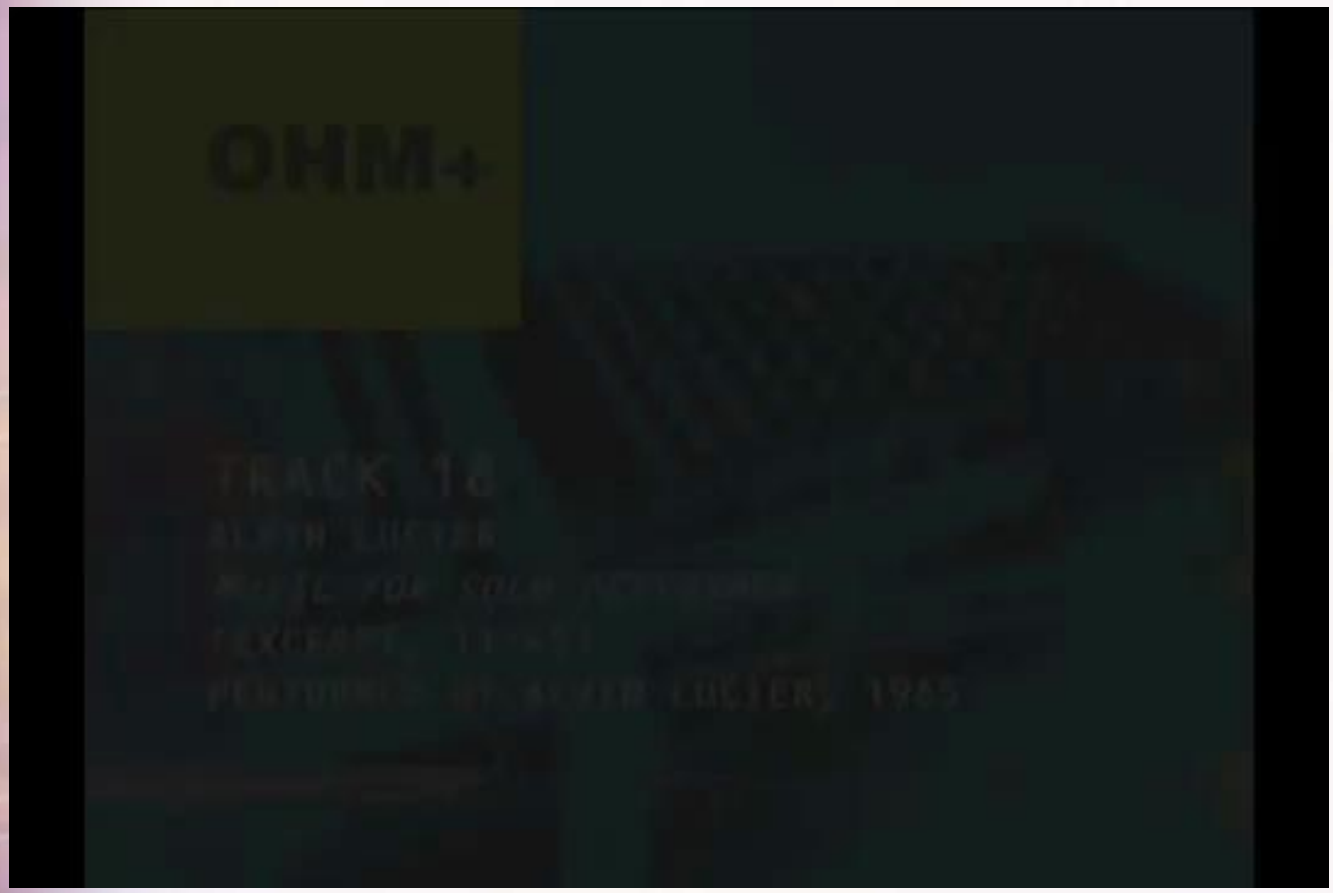
About Brain-Wave



- Brain-waves of human being we use in our performance are:
  - α : relaxation, closing eyes / frequency is 7 to 13 pulses per second(Hz) (Berger wave)
  - β : agitated, tense, afraid / 13 to 60 Hz
  - γ : fastest wave, high concentration or meditation / 26 to 70 Hz
  - θ : somnolence, reduced consciousness / 4 to 8 Hz
  - δ : unconsciousness, deep sleep / 0.1 to 4 Hz
- Muse can measure 5 brain-waves.

Brain-wave Music

- Alvin Lucier "Music For Solo Performer" 1965



Objectives and Questions

- In the context of interactive computer music creation how data of brain waves, which are invisible source for computer input, can give influence on performers' behaviour and musical output?

- Does any 'happening-like' factors affect to brain waves in notable way? If it is possible to affect, how those elements can be used in multimedia work creation?

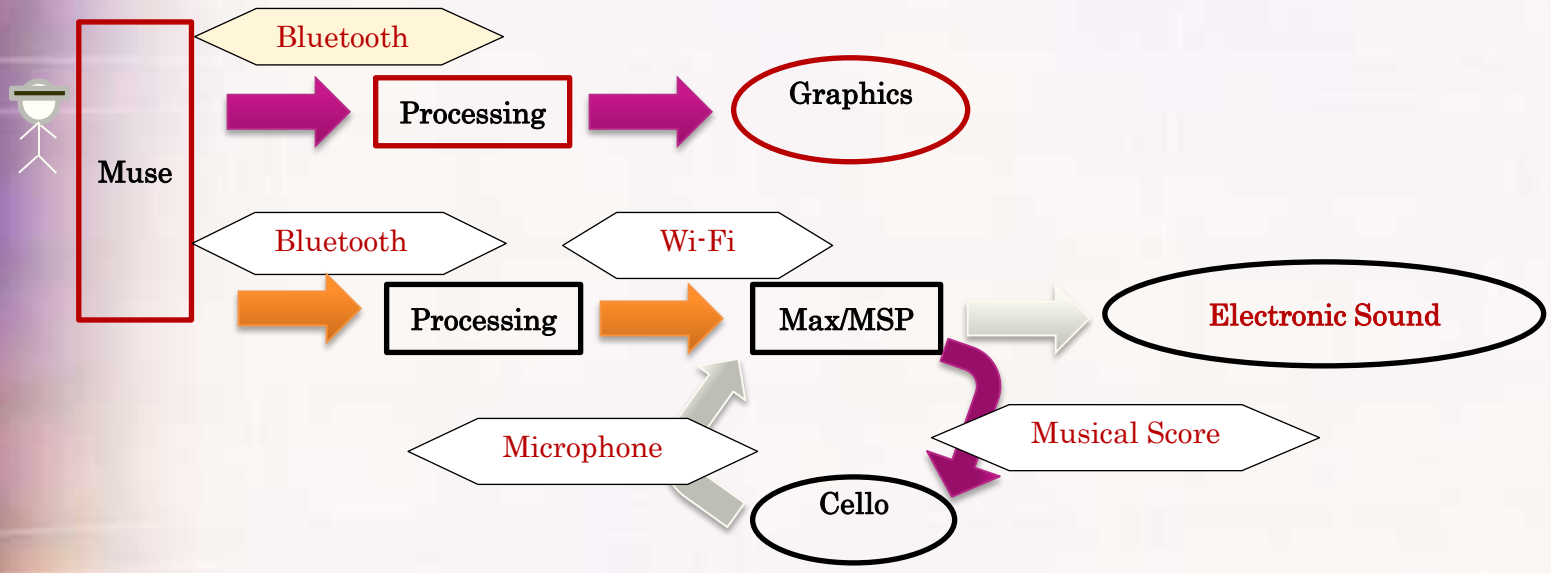
MUSE™

- **MUSE is**
  - **An easy device to measure brain-waves**
  - **Used for meditation like Yoga**

from web site,

- MUSE is the first tool in the world that gives you accurate, real-time feedback on what's happening in your brain when you meditate
- http://www.choosemuse.com/

System diagram for performance



- Processing receives signals of brain-waves through MUSE and visualizes them. It also sends interpreted mathematical value to Max/MSP.
- Max/MSP and its library *bach* produce music score for cello in real time.
- Max/MSP is also used for live-electronic sound components.

Performer and Chance Operation

- A performer's brainwaves are used for source of visualization and sonification.

- What do they do? Why?

  Performance can include:

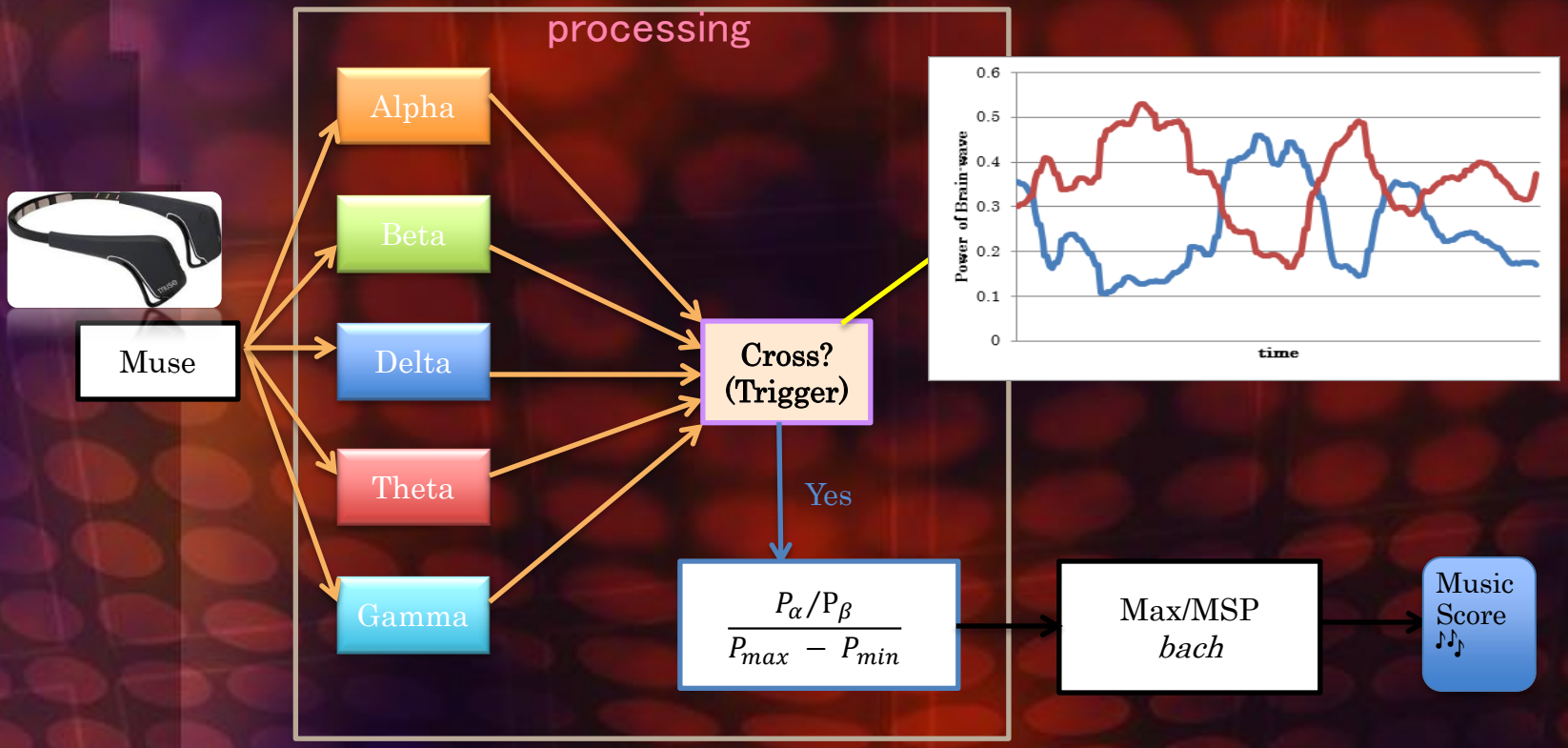
  - Meditation
  - Elements to surprise (?)
  - Elements to concentrate on (?) ... etc.

  Can brainwaves be affected by those elements? How?

Methods

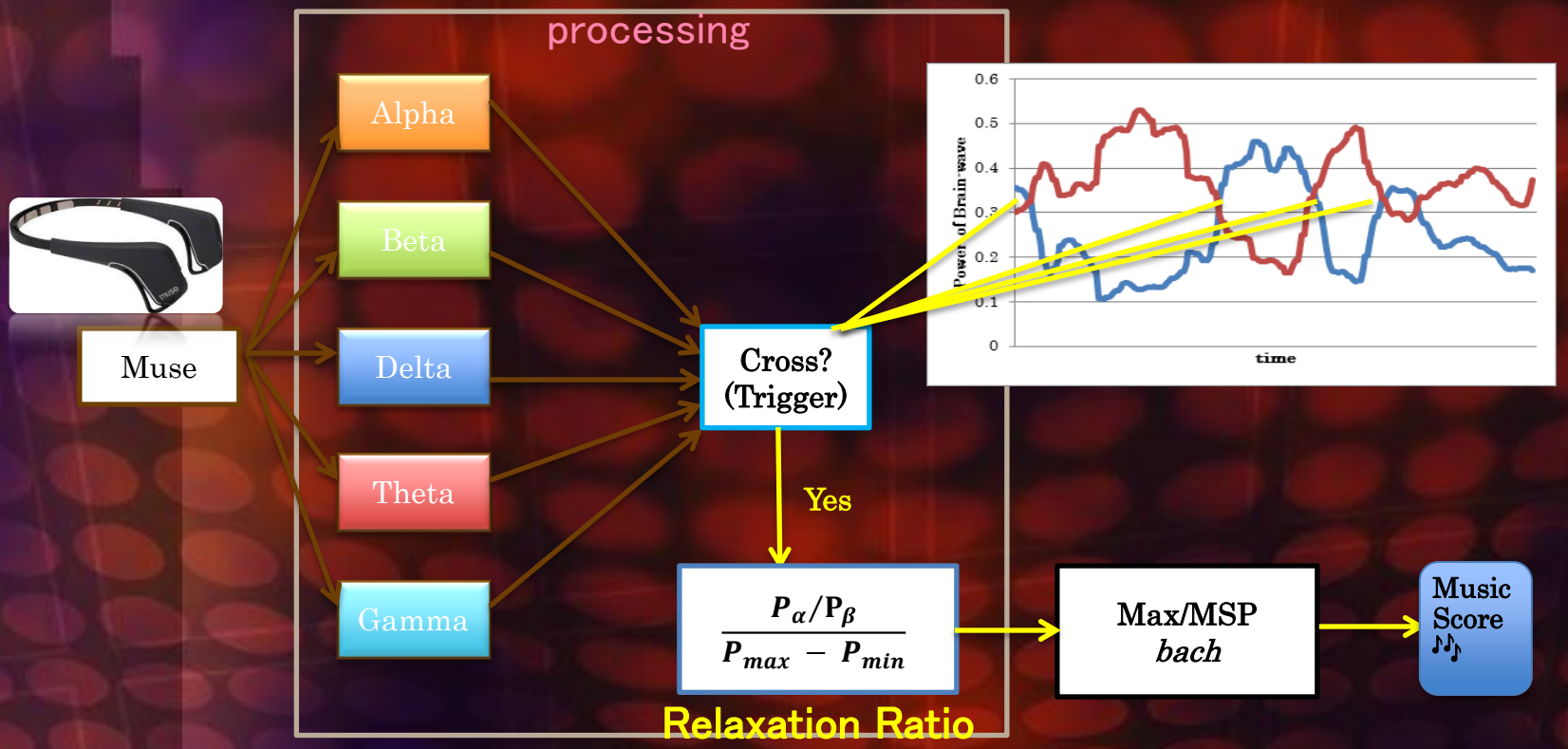
Translation brain-waves into music

- Power of brainwaves is measured at every 20msec.
- Intersections of each wave's power level are used as triggers to send information (values) to Max/MSP.



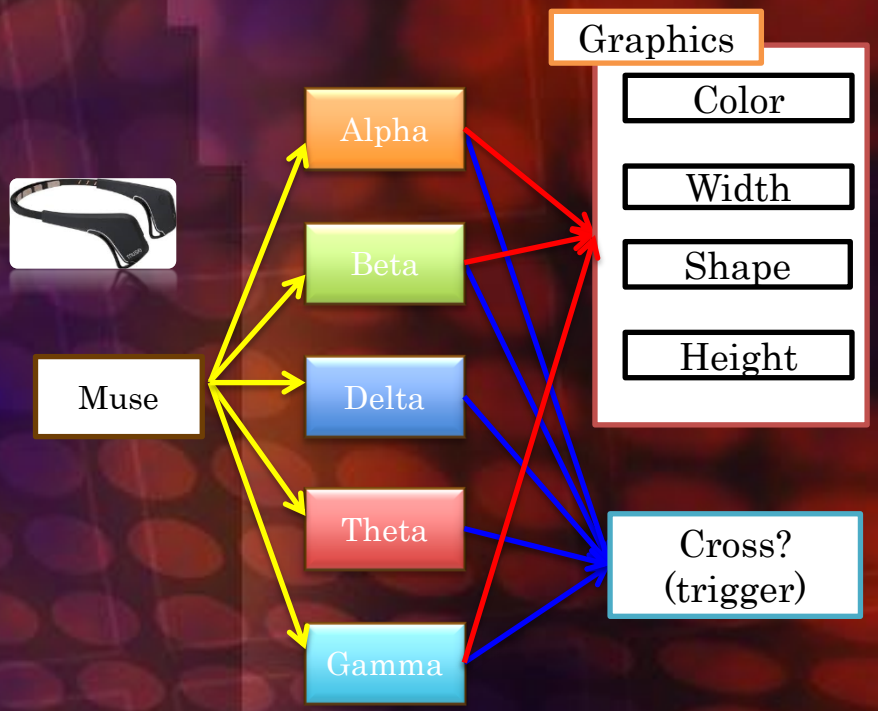
Brainwaves to be interpreted

- Power levels of α and β are used for **Relaxation Ratio.**
- **Relaxation Ratio** is calculated in Processing and when the α and β waves intersect, the levels of Relaxation Ration are sent to Max/MSP
- Max/MSP interprets received values and generate music score with *bach*.



Visualization of brain wave

- Intersections of each power level are used as triggers to generate fireworks.
- Rules for explosions of fireworks are shown in the table. (We use only α, β and γ)



Input parameters for fireworks

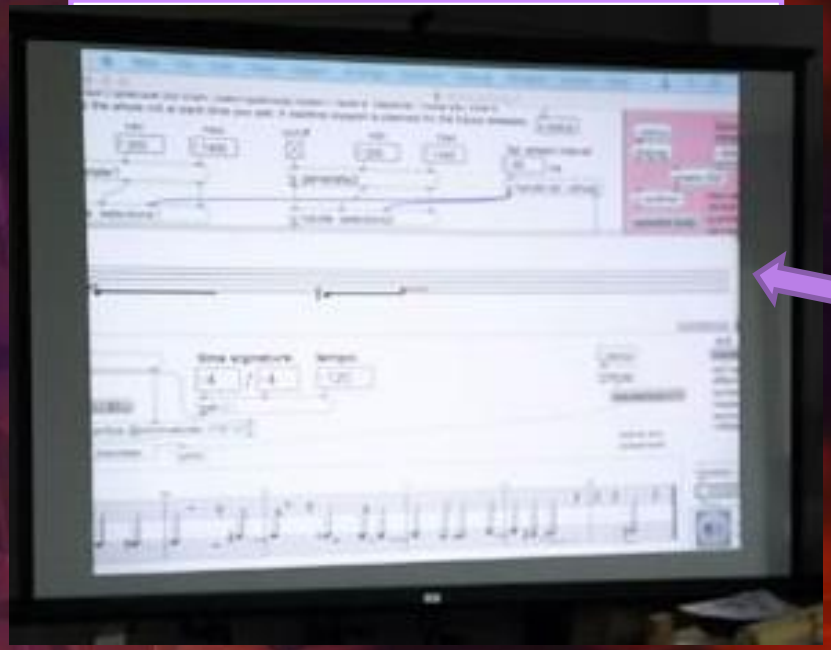
	α	β	γ
Color (RGB)	Green (0..255)	Blue (0..255)	Red (0..255)
Width	strength	strength	
Shape	circle	square	

Relation between fireworks and conditions around a performer

- When a performer feels relaxed or concentrating, green-colour and larger firework are generated.
- When a performer feels tense, afraid or agitated, fireworks are illustrated in purple and red.
- Width and height of fireworks depend on the power of brain-waves.

Improvisation by cello

- The *Bach* allows to generate notes in real time on Max/MSP.
- A Cellist improvises.



Improvisation

Live-electronic of cello sound

- In this composition live-electronic part is performed in extemporize way, according to the cello sound as well as the surrounding conditions created by other performers.

- For live electronics computer feeds cello sound as its input source, employing audio signal processing technology, and output sound is modified characteristics of original cello sound to observe how performers' behaviour can be changed by those "response" from a computer..

Performance (Rehearsal)

THANK YOU FOR YOUR ATTENTION