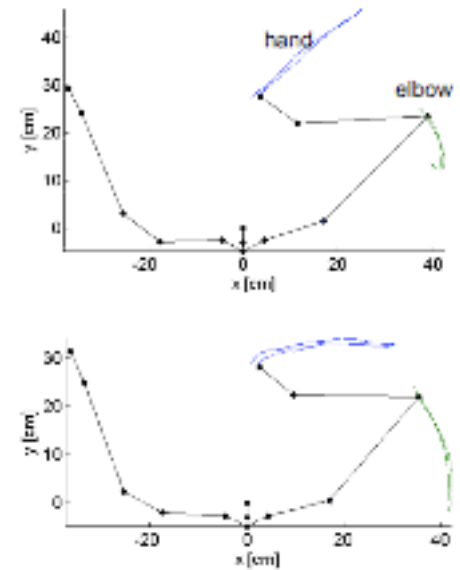
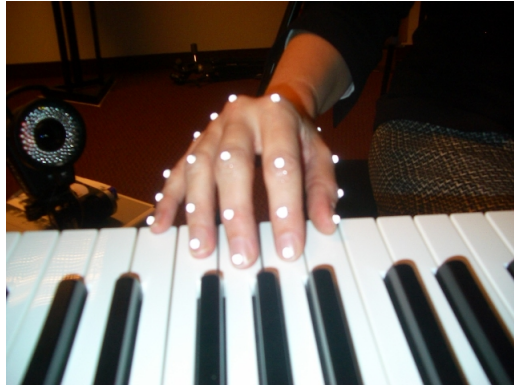


Please download programs

**AudioVideoAnalysis
& VideoAnalysis**
from

[https://www.uio.no/english/research/groups/
fourms/software/](https://www.uio.no/english/research/groups/fourms/software/)



Sofia Dahl

Motion data and analysis



After today you should be able to...

- ...give examples of techniques that can be used to record and analyze movement in music performance.
- ...evaluate pro's and cons of different techniques depending on aim of study and general context.
- ...describe basics on video and how to use it for analysis

How can we measure and describe musicians' movements?

- Measurement technologies
- Descriptions of Movement
 - McNeill – gesture and speech
 - Laban movement analysis
- Tools for annotations and analysis



electromagnetic sensor-based motion capture

(From Jensenius, 2013)

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mechanical

sensor-based motion capture

(From Jensenius, 2013)

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inertial sensor-based motion capture

Surface electromyography

- Muscle activity

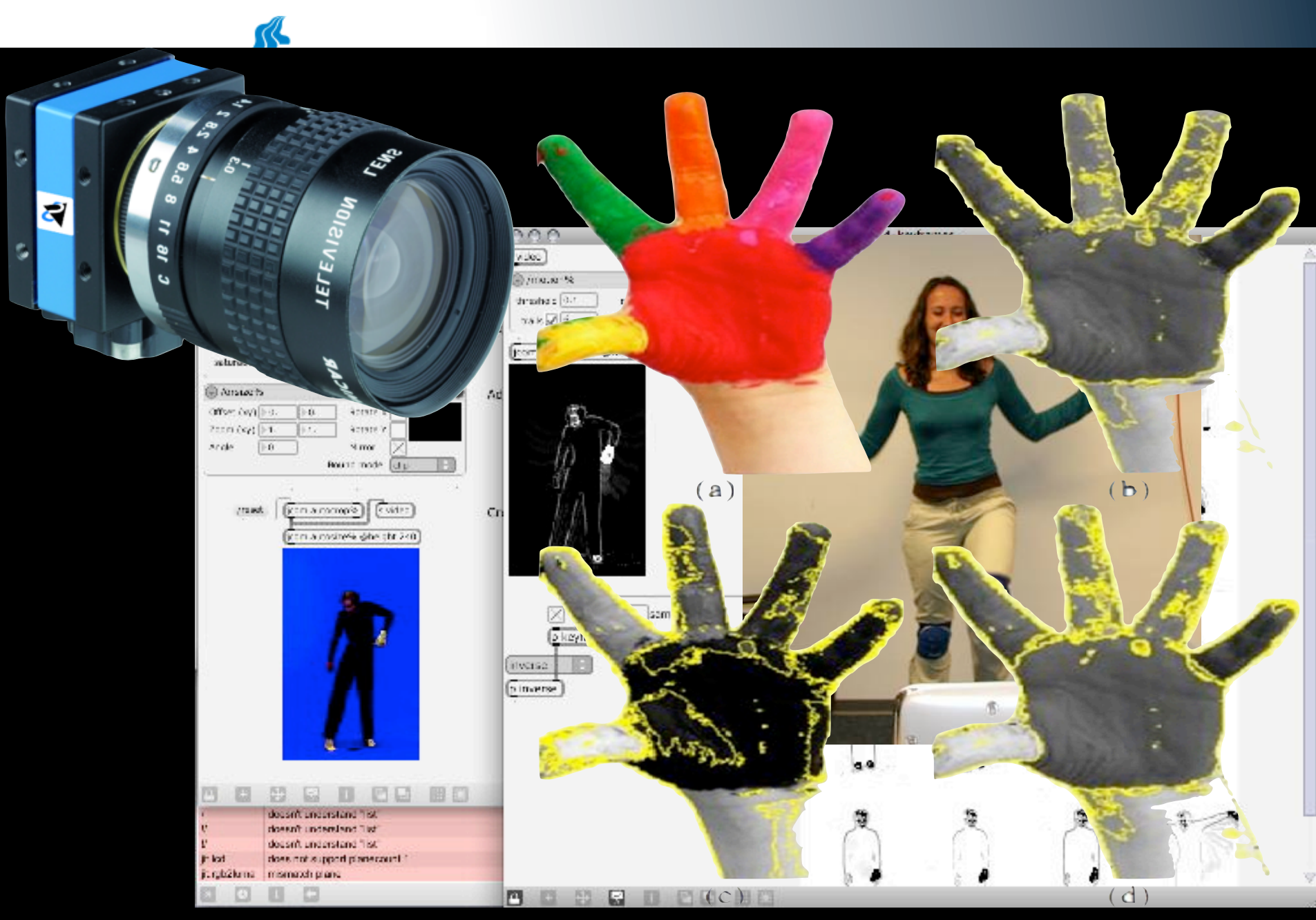




KINECT™

for  XBOX 360.

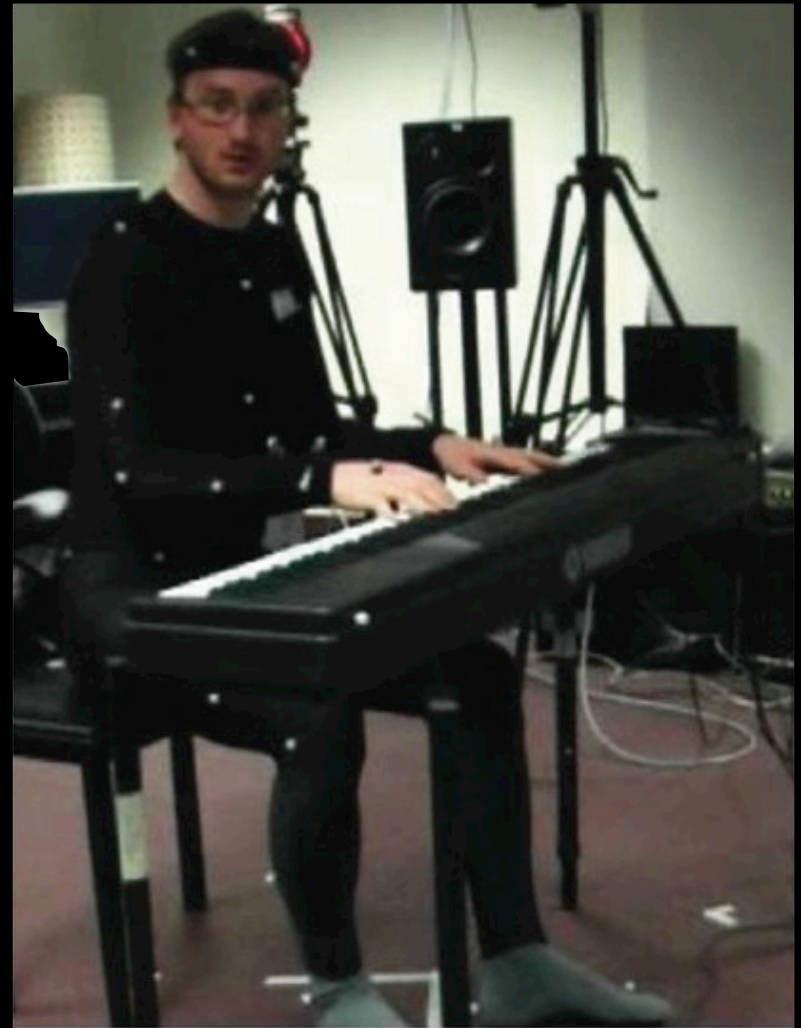
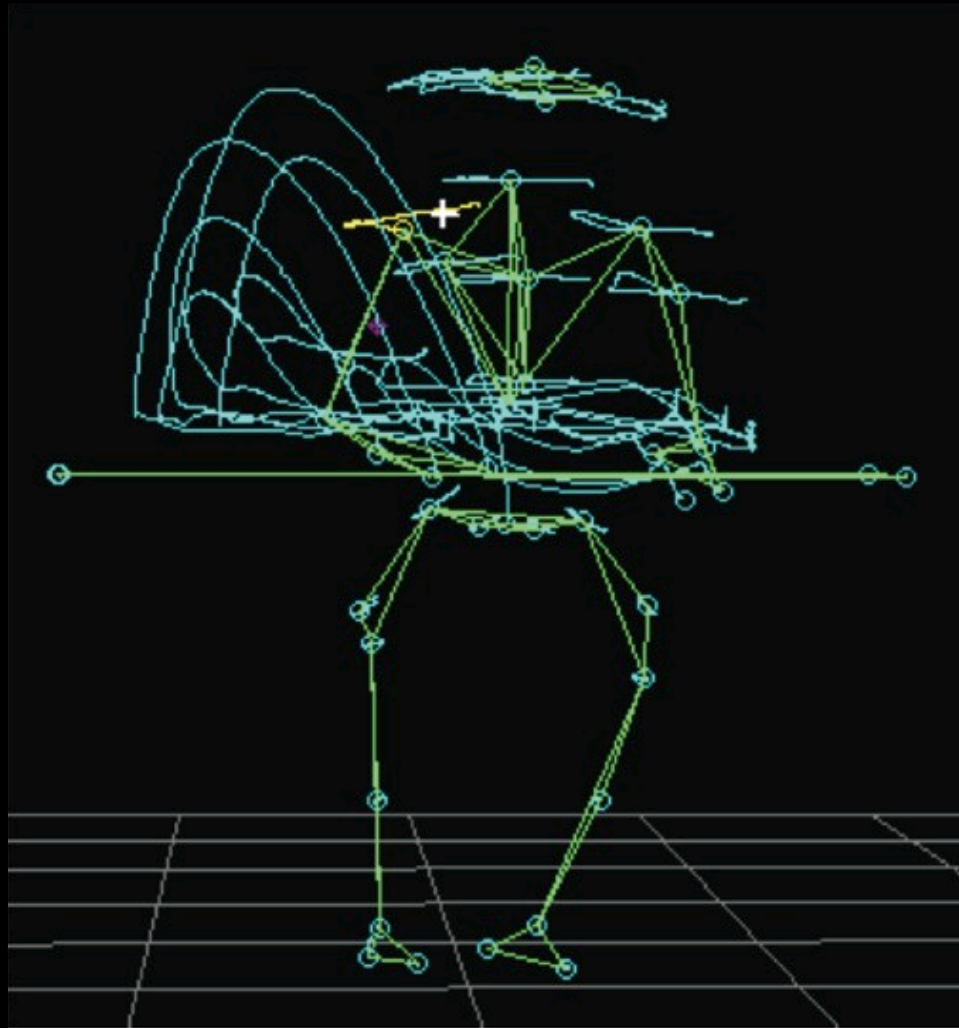




(From Jensenius, 2013)

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optical infrared marker-based motion capture



Optical (visual)



Optical (infrared)



Inertial



Electromagnetic



Mechanical motion capture



Physiological

(From Jensenius, 2013)

	Inertial/ magnetic	Mechanical	Electro- magnetic	Optical (visual)	Optic (infrared)	Physiological
+	- flexible - small	- flexible - small	- resolution - identification - absolute	- flexible - no cables - no markers - accessible	- speed - resolution - # markers	- indirect motion sensing
-	- relative	- relative	- cable - short range	- 2D - speed - resolution - identification	- markers - calibration - identification	- indirect motion sensing

(From Jensenius, 2013)

How can we classify and describe movements?

Repetition: Functional categorization of players' movement gestures

1. Sound-producing gestures:

- Primarily for the production or modification of notes
(Conveying intention and expression through the resulting sound events)

2. Communicative gestures:

- Directly expressing intentions of the performer to observers and co-performers.

3. Sound-facilitating gestures

- Movements not directly related to, but *supporting* the production of notes,

4. Sound-accompanying gestures

- Movements not involved in sound production but follow the music or made in the response to sound.

(See Godøy & Leman, 2009)

Repetition: Space

- ACTION space
- Where in the space do different types of movements occur?



Ancillary,
sound-accompanying,
and communicative

Sound-producing

Sound-modifying

Examples from classifying gestures in speech

McNeill: “Kendon’s Continuum”

Gesticulation => Speech Linked => Pantomime => Emblems => Sign Language

—————→
Increase in how movements show language properties

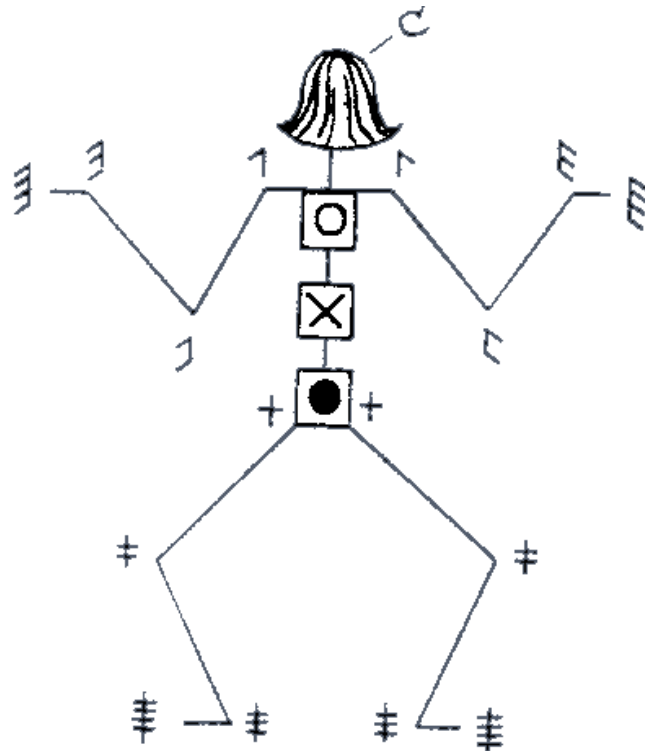
—————→
DECREASE in being obligatory accompaniment to speech

Example, what kind of category is this?

http://www.youtube.com/watch?v=kS21T_p0pNA

Laban Notation

- Rudolf Laban (1879-1958)

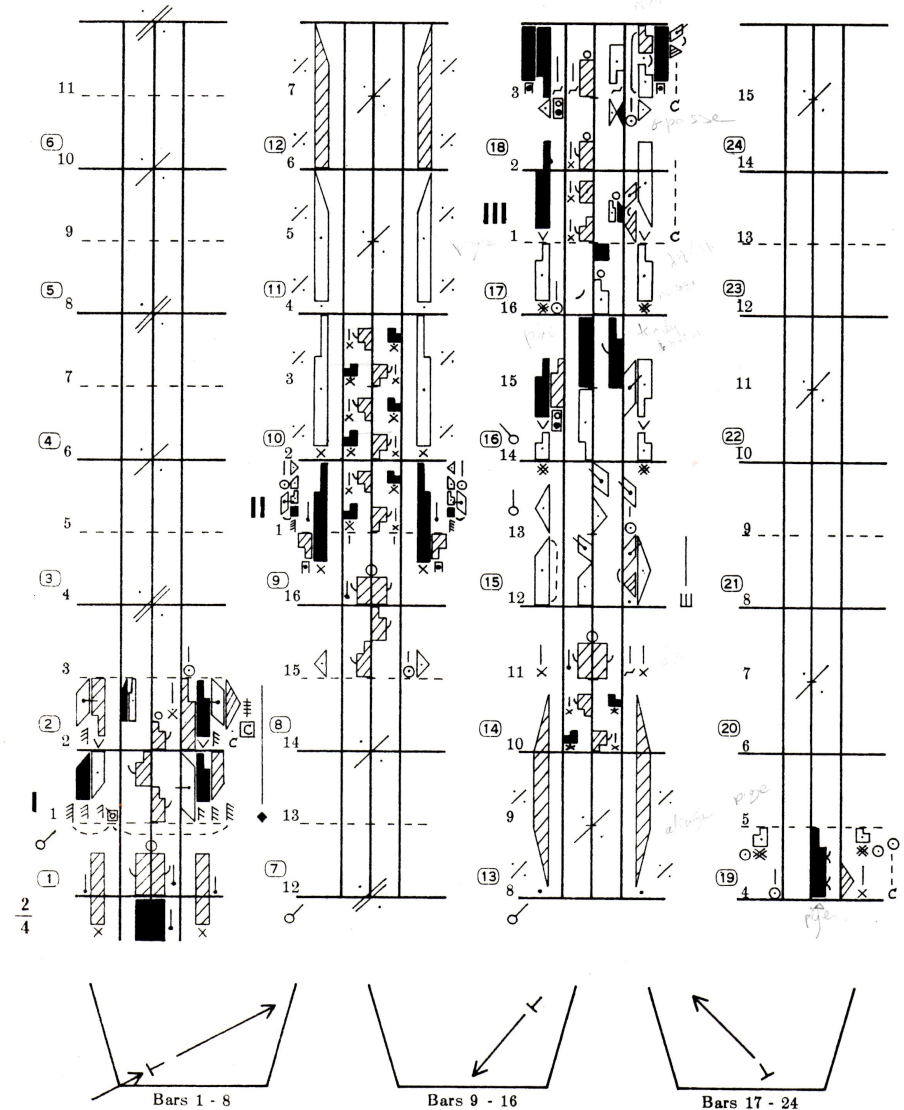


Six Fairy Variations

Variation 3 - FALLING CRUMBS

Prologue, Sleeping Beauty

Choreography by M. Petipa, reconstructed by Mary Skeaping
Labanotation by Ann Hutchinson



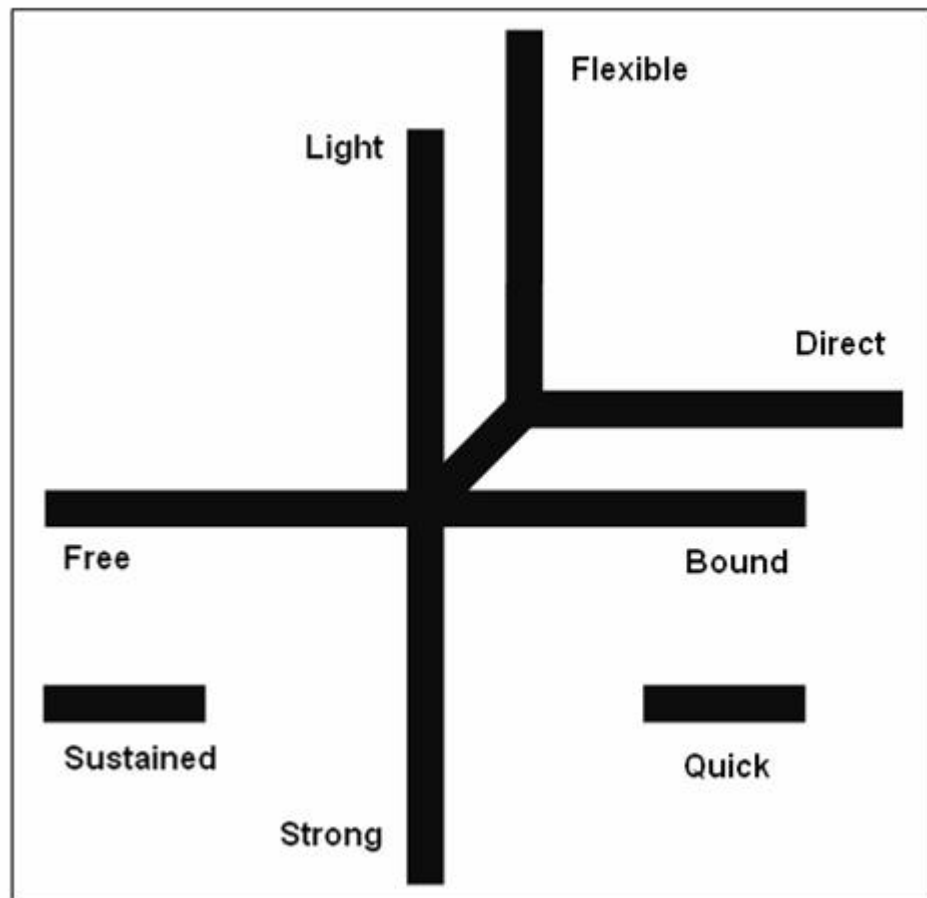
The encircled measure numbers correspond to the numerals in parentheses of the music.

Laban Movement Analysis

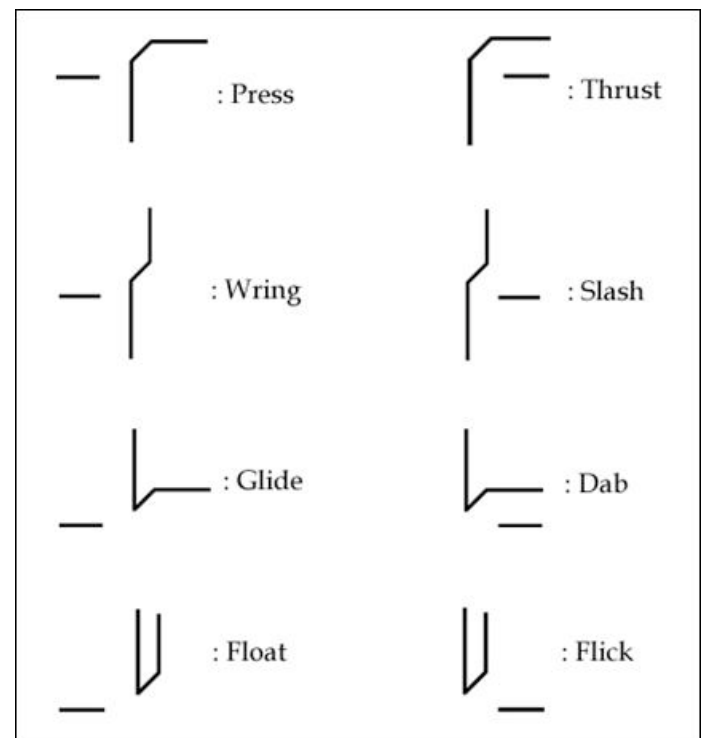
- EFFORT

- Space (Direct ---- Flexible)
- Weight (Light ---- Strong)
- Time (Sustained ---- Quick)
- Flow (Free ---- Bound)

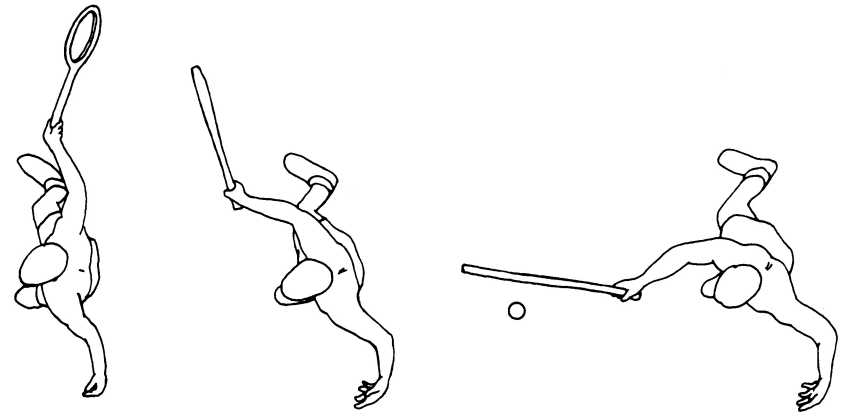
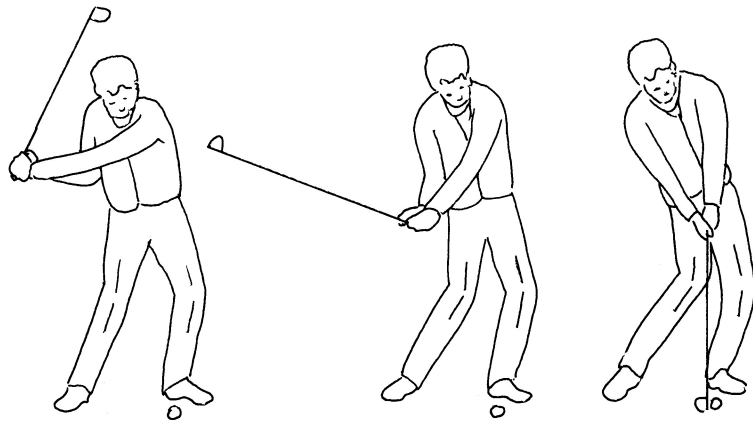
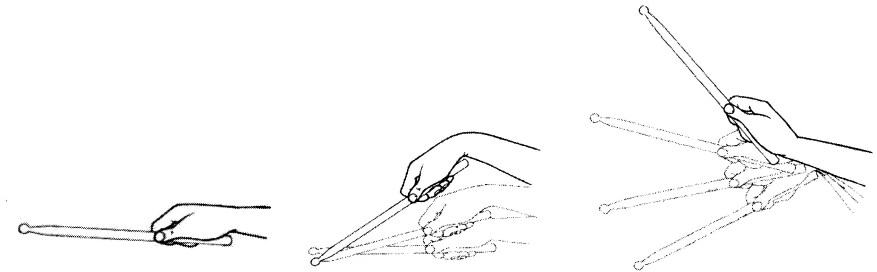
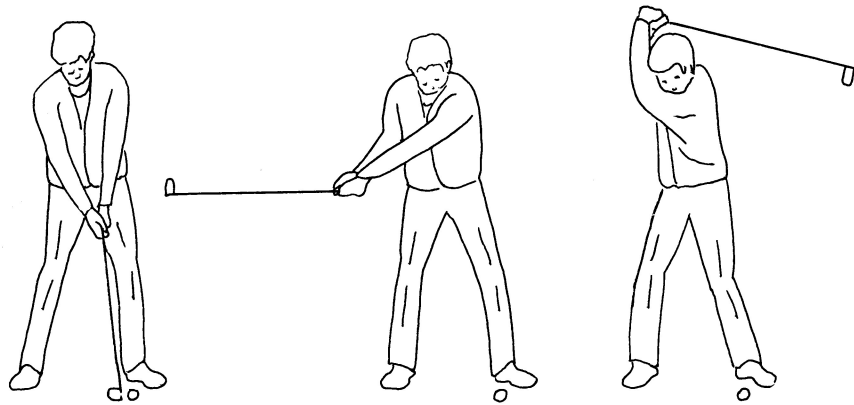
...combinations give rise to different “effort actions”



Examples of effort actions used in theatre training
<http://www.youtube.com/watch?v=GrAyNodiXg4>



Time series pictures



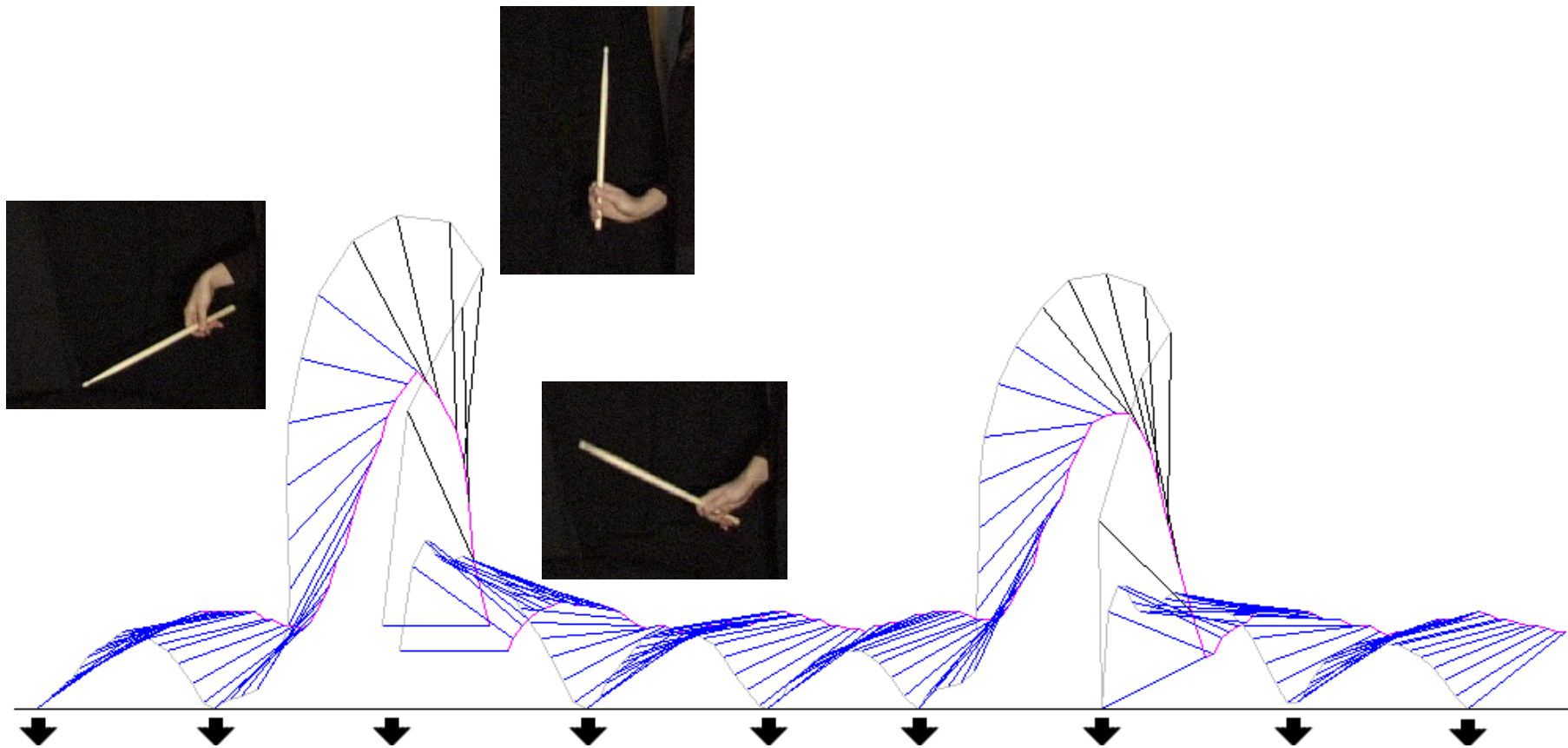
Using images and video to measure



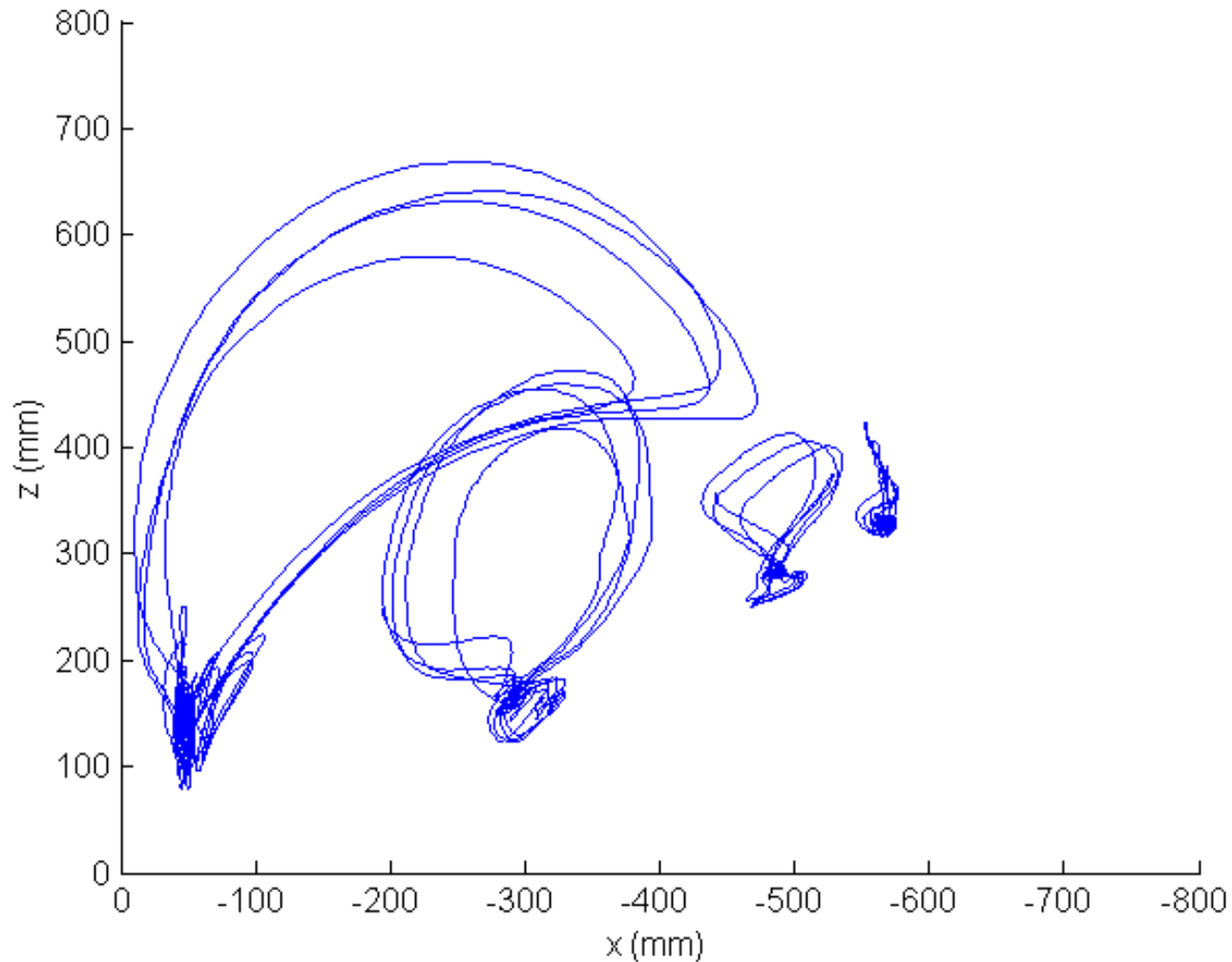
(From Jensenius, 2013)

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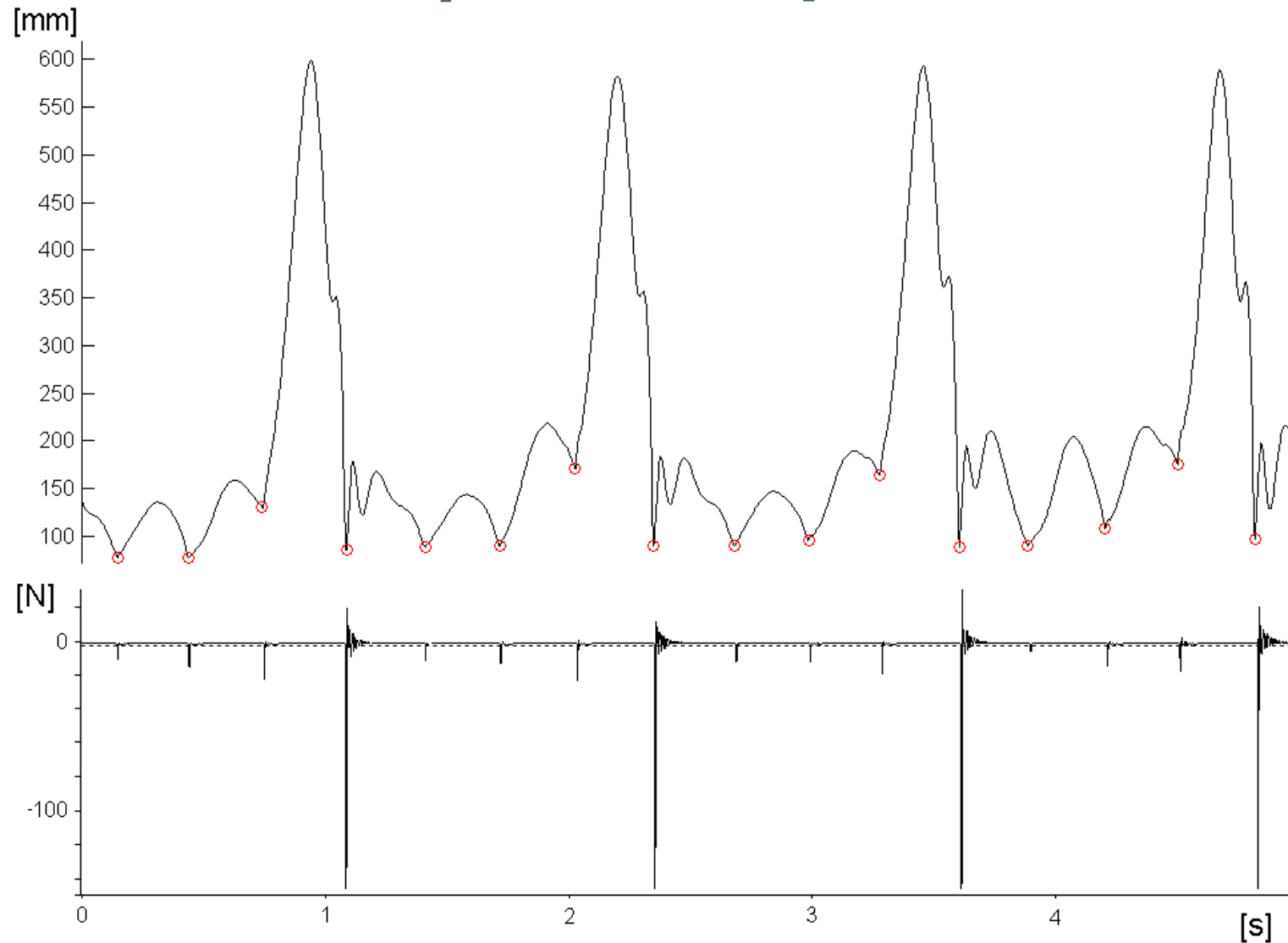
Video footage in front of measuring grid



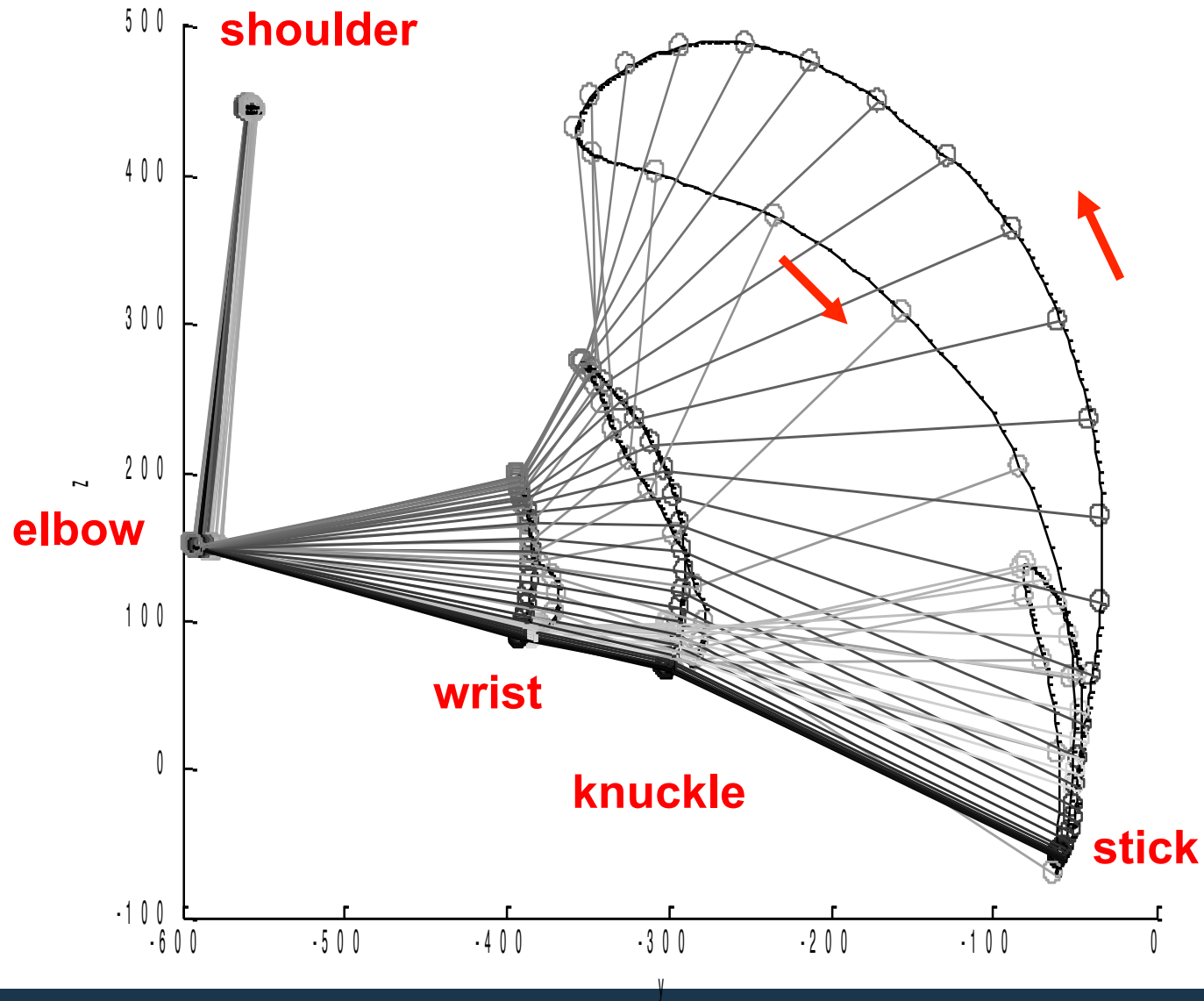
Motion capture data Whole limb motion trajectory



Vertical component only



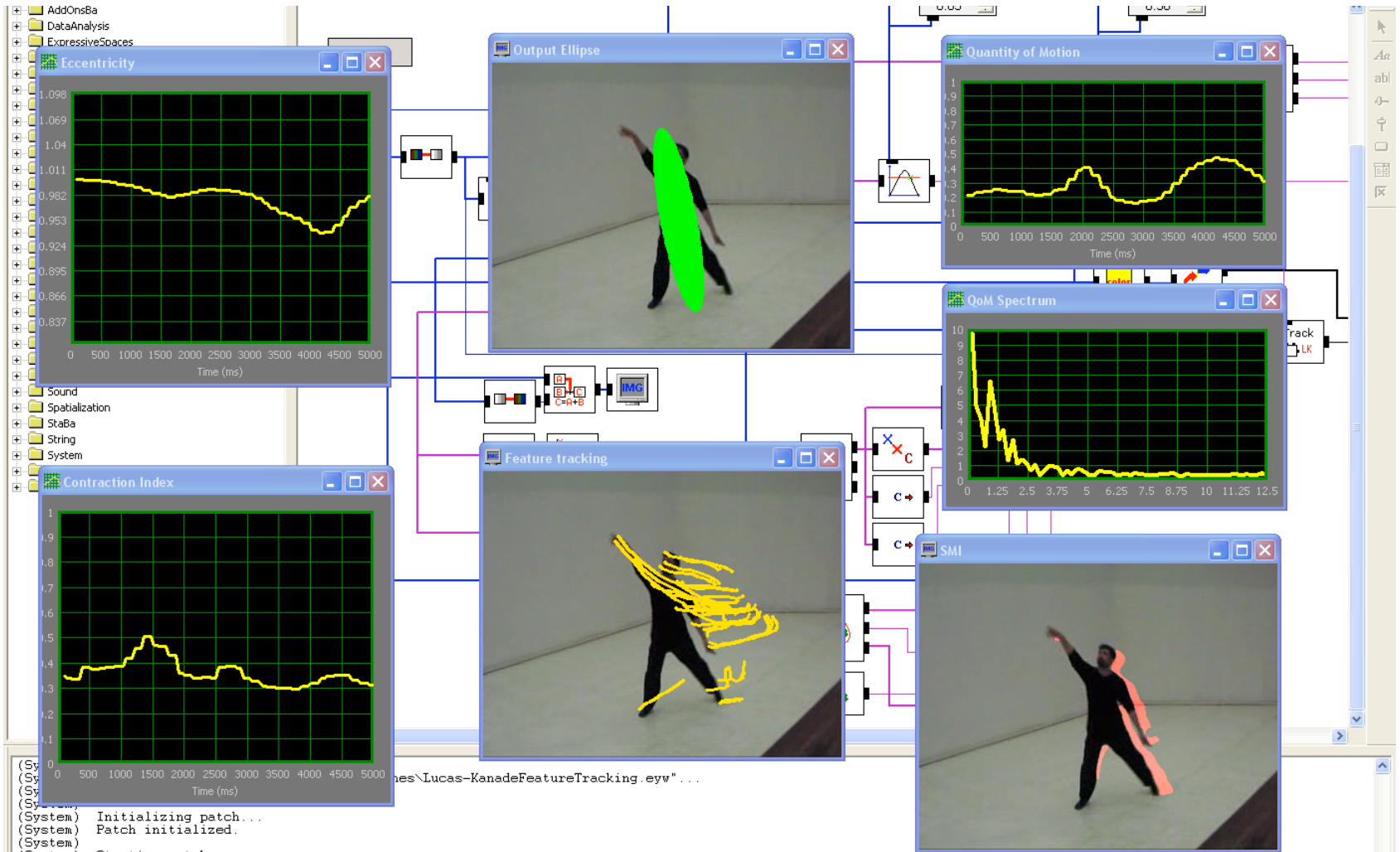
Motion capture data for a single *mf* stroke



Tools for movement analysis (music applications)

- Video annotations
 - Anvil <http://www.anvil-software.org/>
 - Video Note Taker <http://videonotetaker.sourceforge.net/>
- EyesWeb
 - http://www.infomus.org/eyesweb_ita.php
- MAX/MSP and Jitter <http://cycling74.com/>
 - Jensenius: Musical Gestures Toolbox, AudioVideoAnalysis and more
 - <https://www.uio.no/english/research/groups/fourms/software/>
- Pure data <http://puredata.info/>
- Open Frameworks <http://www.openframeworks.cc/>
 - open source C++ toolkit
- Matlab

Eyesweb



Short on Video format

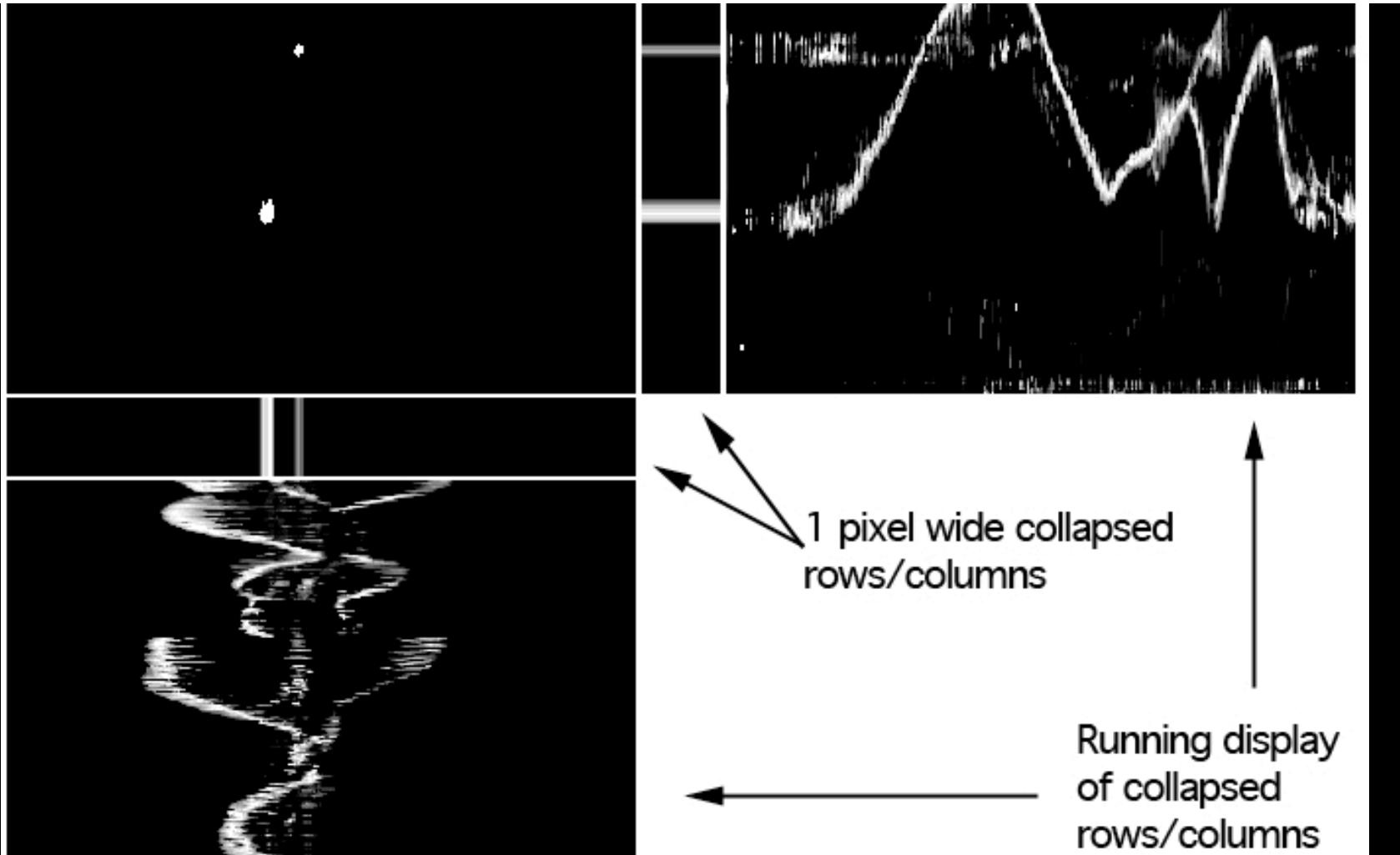
What is

- Pixel?
- Frame rate?
- Channel?

Image subtraction

- The difference between frames can give information about the *change* in the image between frames
=> Information on MOVEMENT

Collapsing the image information



(From Jensenius, 2013)

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