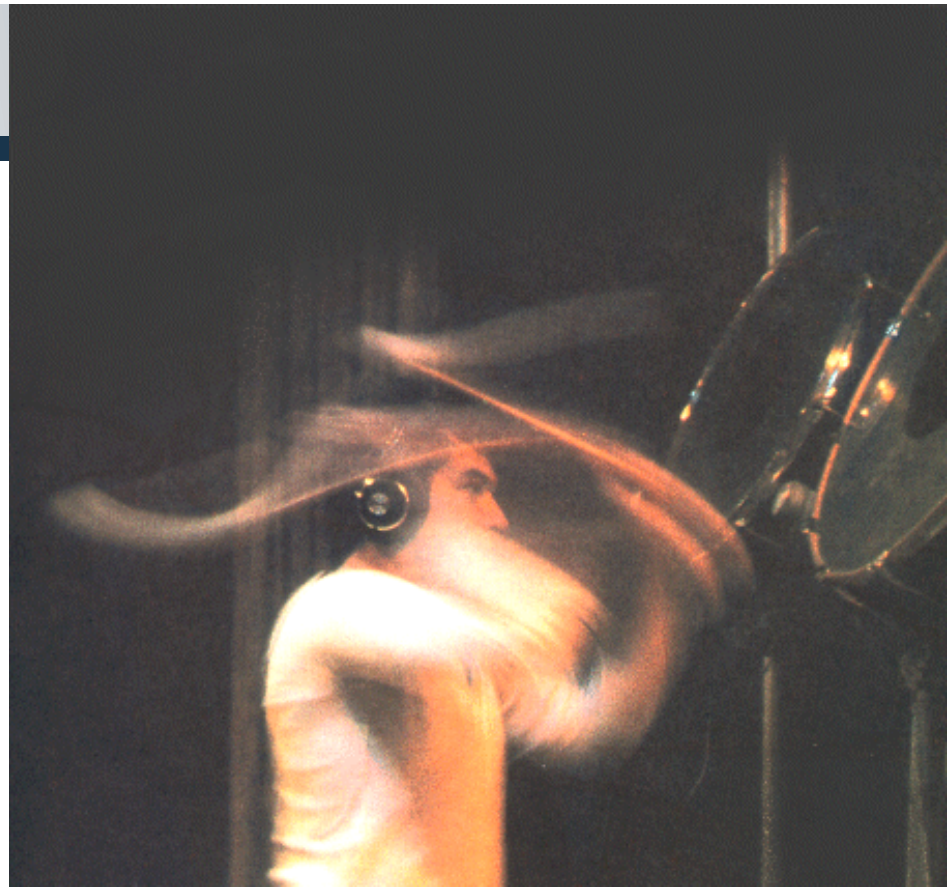
AALBORG UNIVERSITY COPENHAGEN

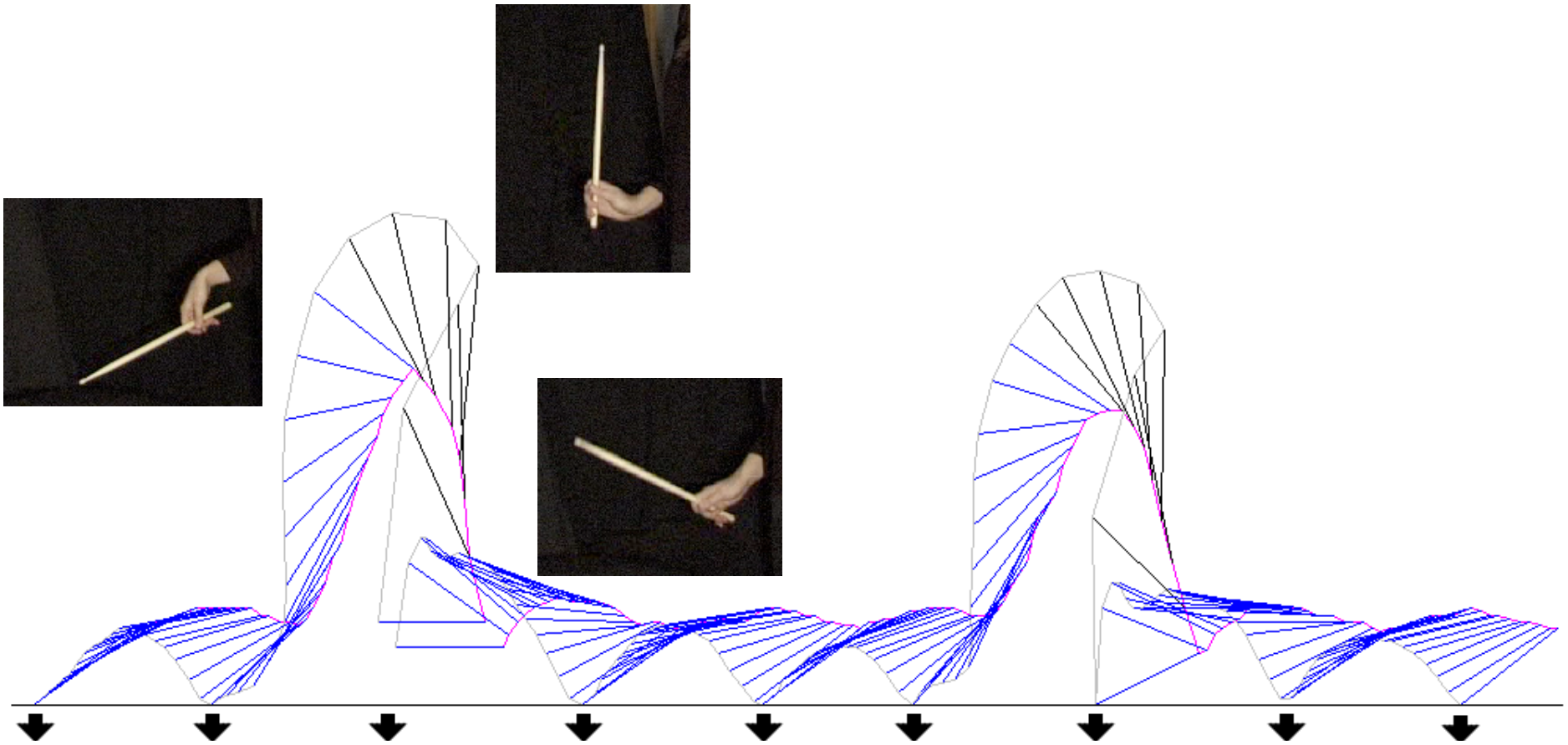
MARIE CURIE ACTIONS



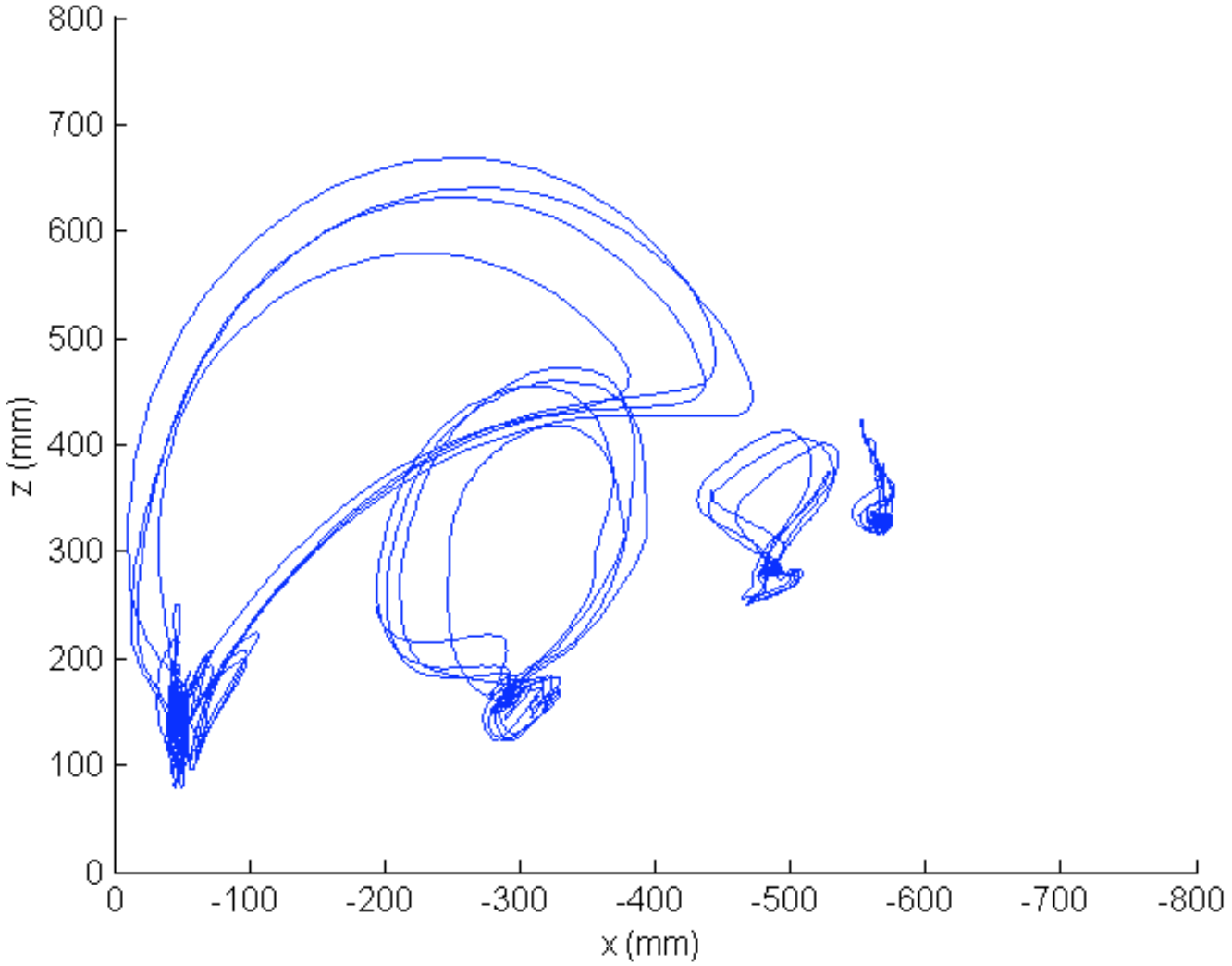
Sofia Dahl

THE STRIKING MOVEMENT:
How do percussionists control timing and dynamic level when drumming?

Stick movements for accented and unaccented drumstrokes

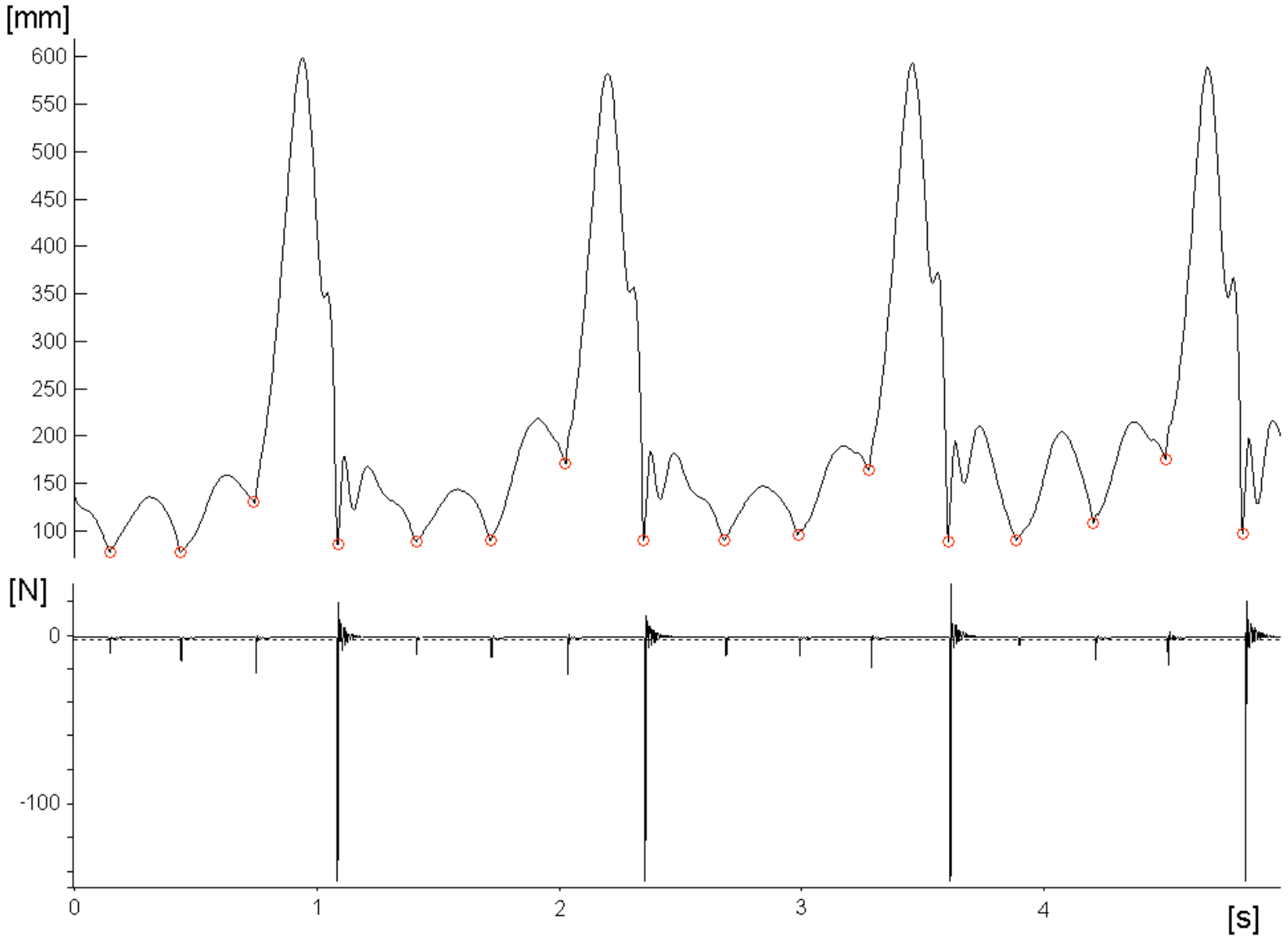


Whole limb motion trajectory



Dahl, 2004

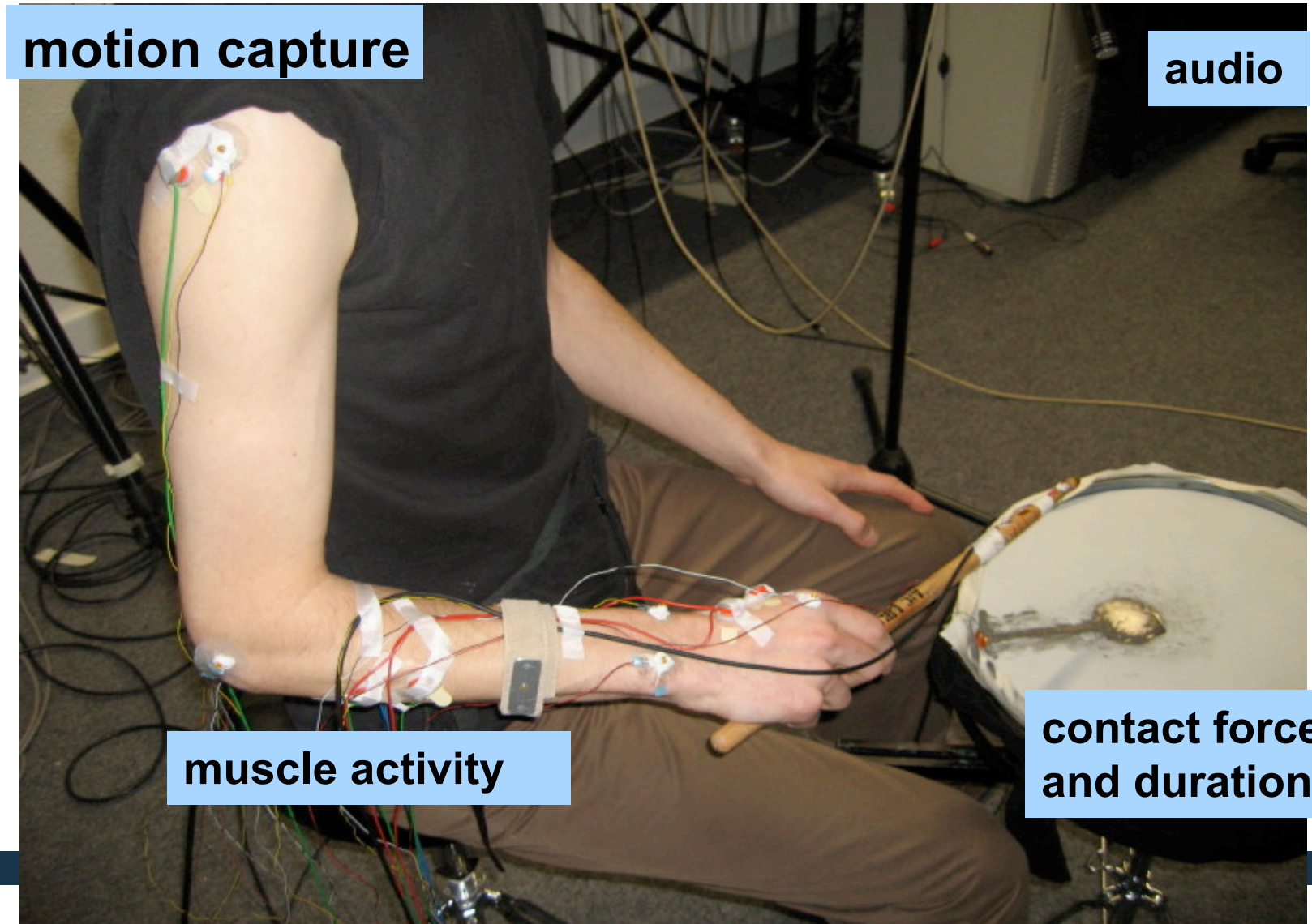
Producing force from acceleration



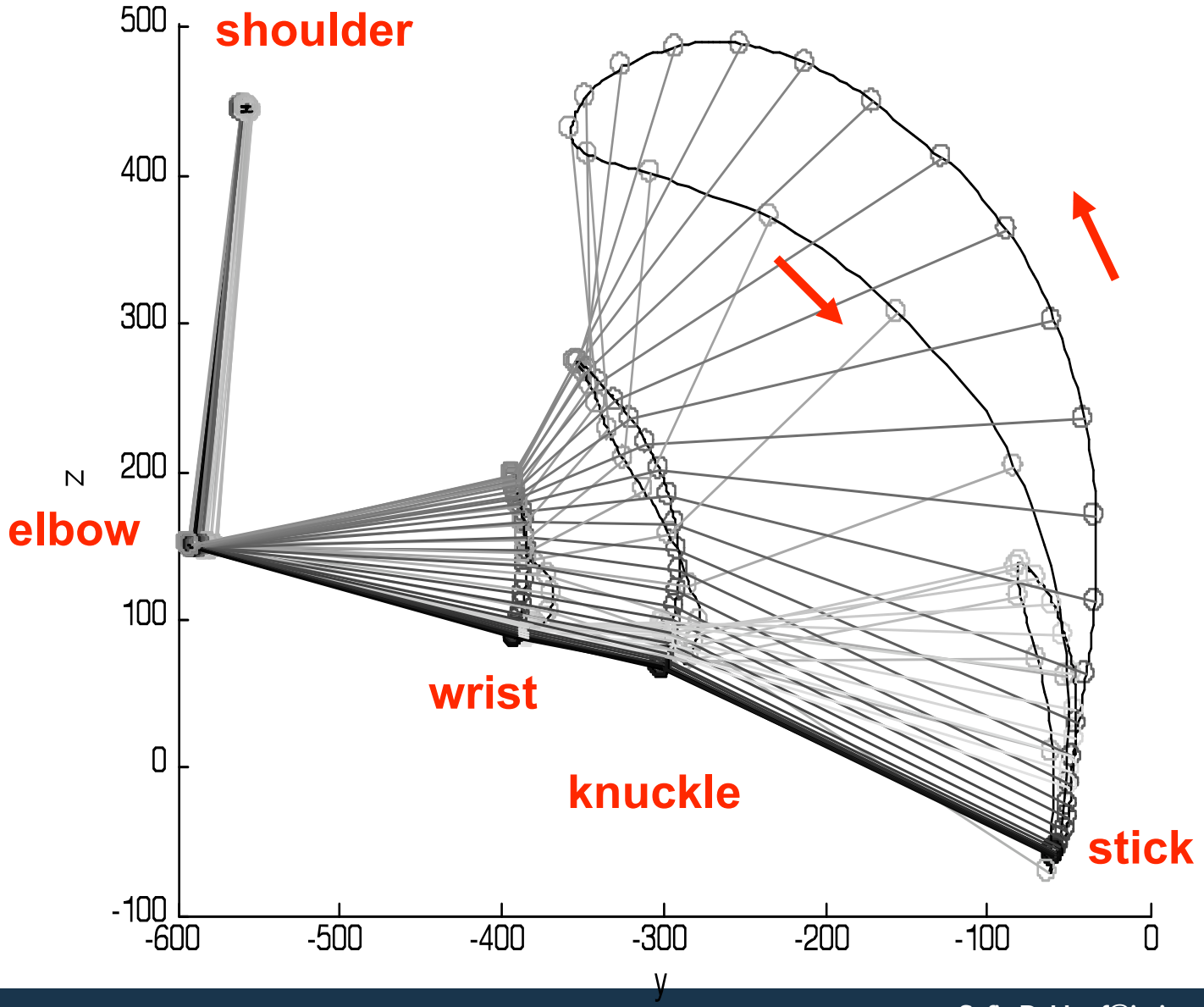
Dealing with the rebound

- The rebound from the surface can be incorporated in, and be an aid for, the preparation for the nextcoming stroke.
- Necessary in order to play some fast patterns (e.g. rolls)
- Strategies like the "Moeller stroke" also utilizes the rebound
- Accelerating the stick over a longer runway makes louder playing possible.
- ...but if the next stroke is to be softly played the rebound may need to be controlled

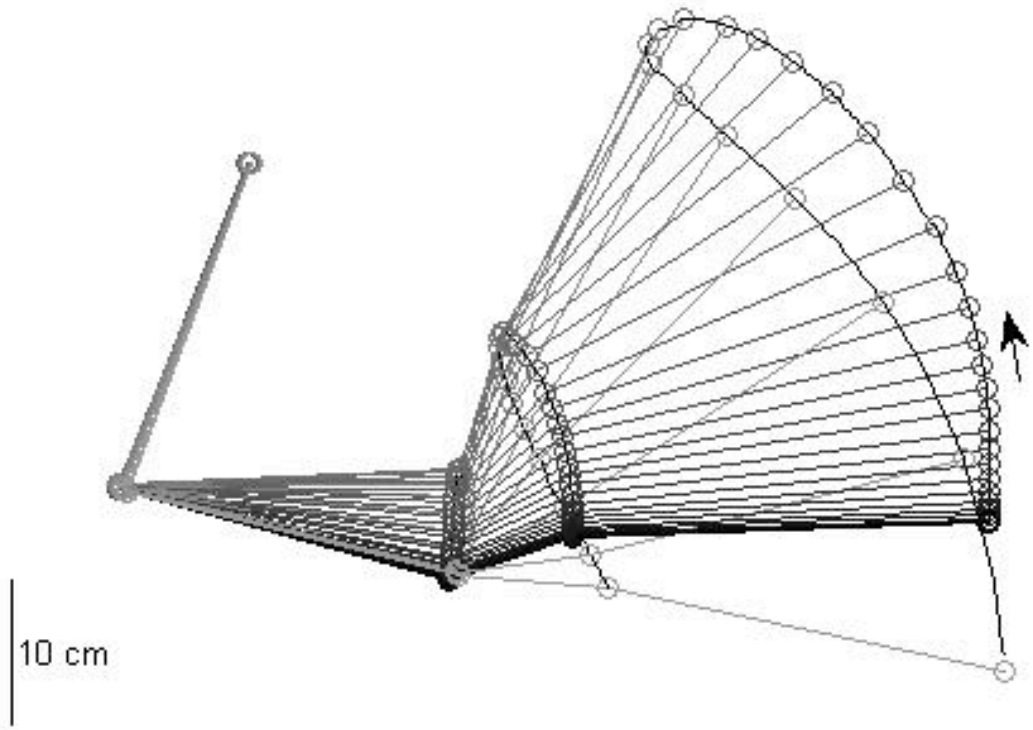
Measuring movement and sound in drumming



Motion capture data for a single *mf* stroke



Single, isolated stroke at mf

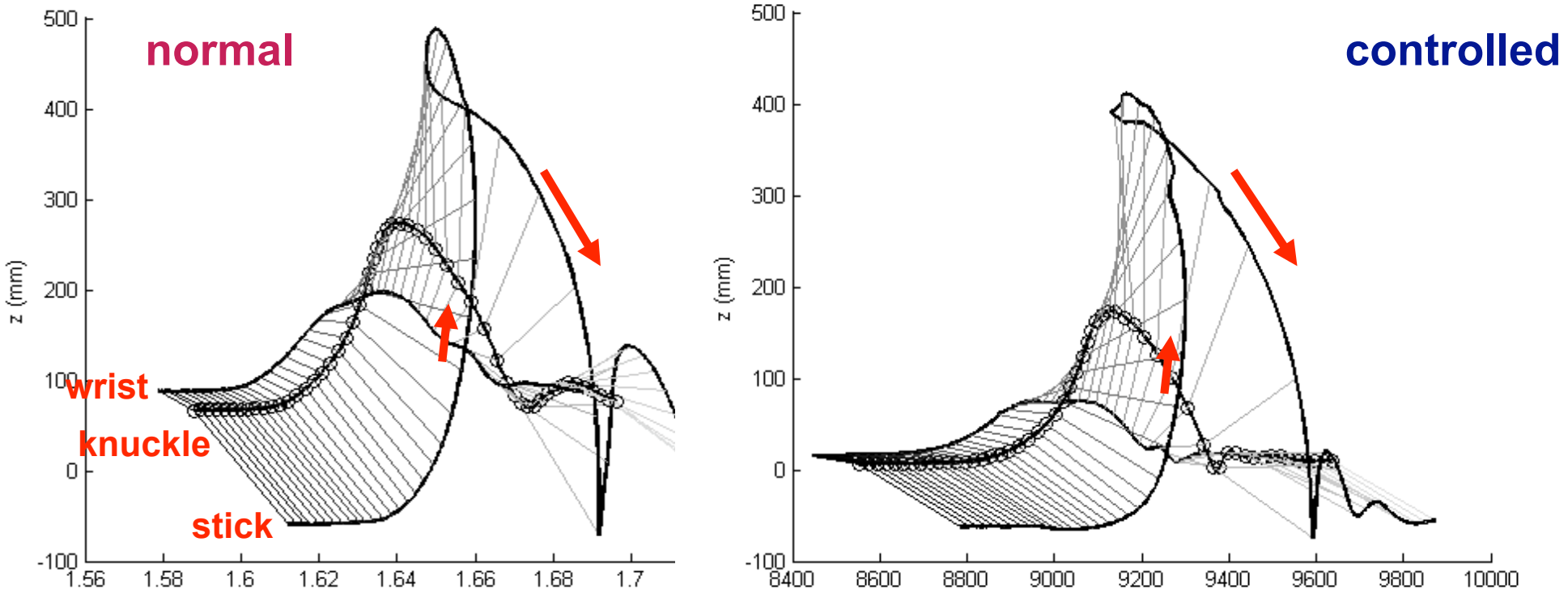


Dahl et al, 2009

How does controlling the rebound affect the sound?

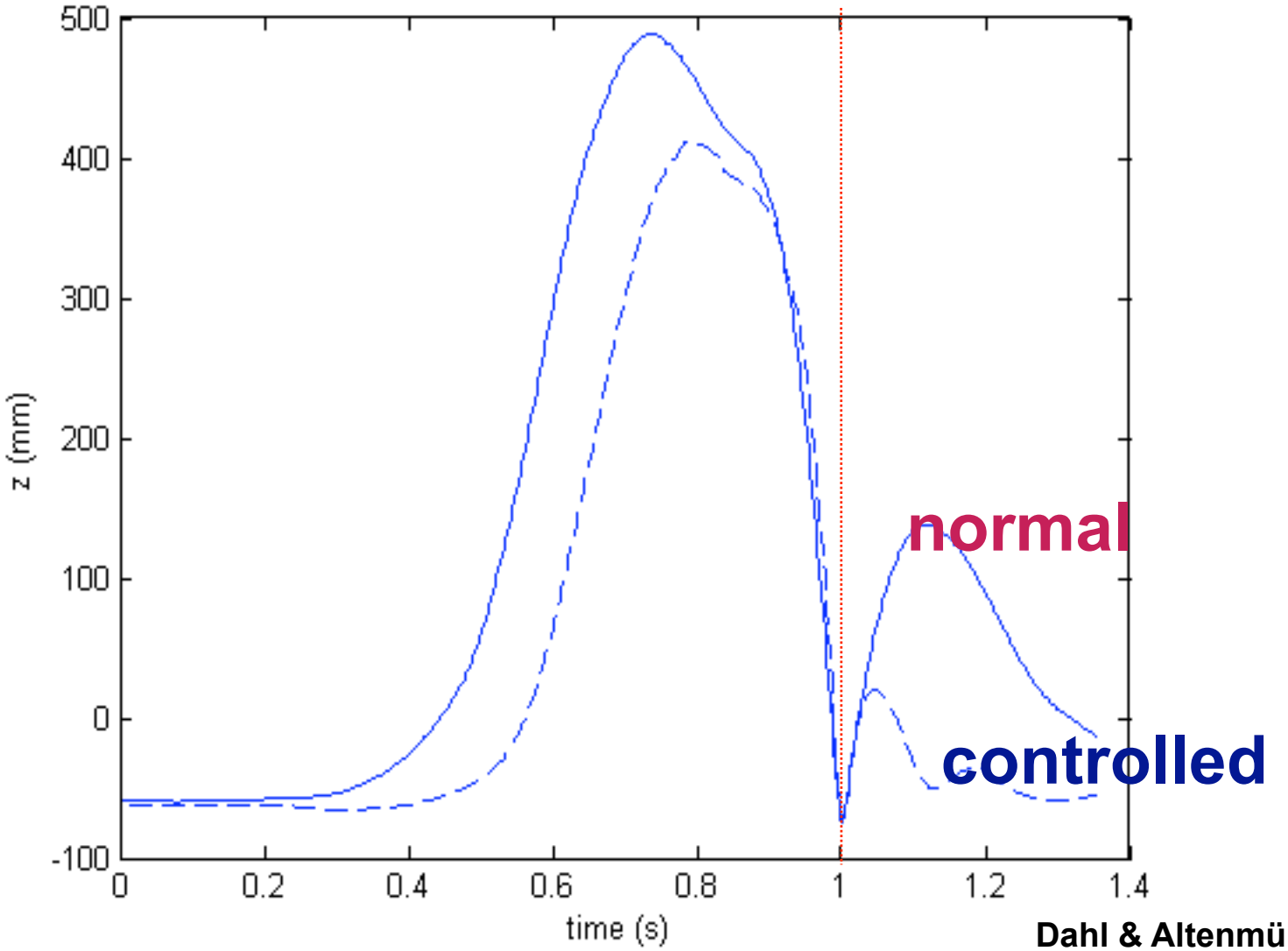
- Separated single *mf* strokes
  - allowed to ring out
- "Normal"
  - play as normal, relaxed, stick free to rebound
- "Controlled"
  - stop stick as close as possible to the drumhead directly after stroke

"Normal" and "Controlled" strokes



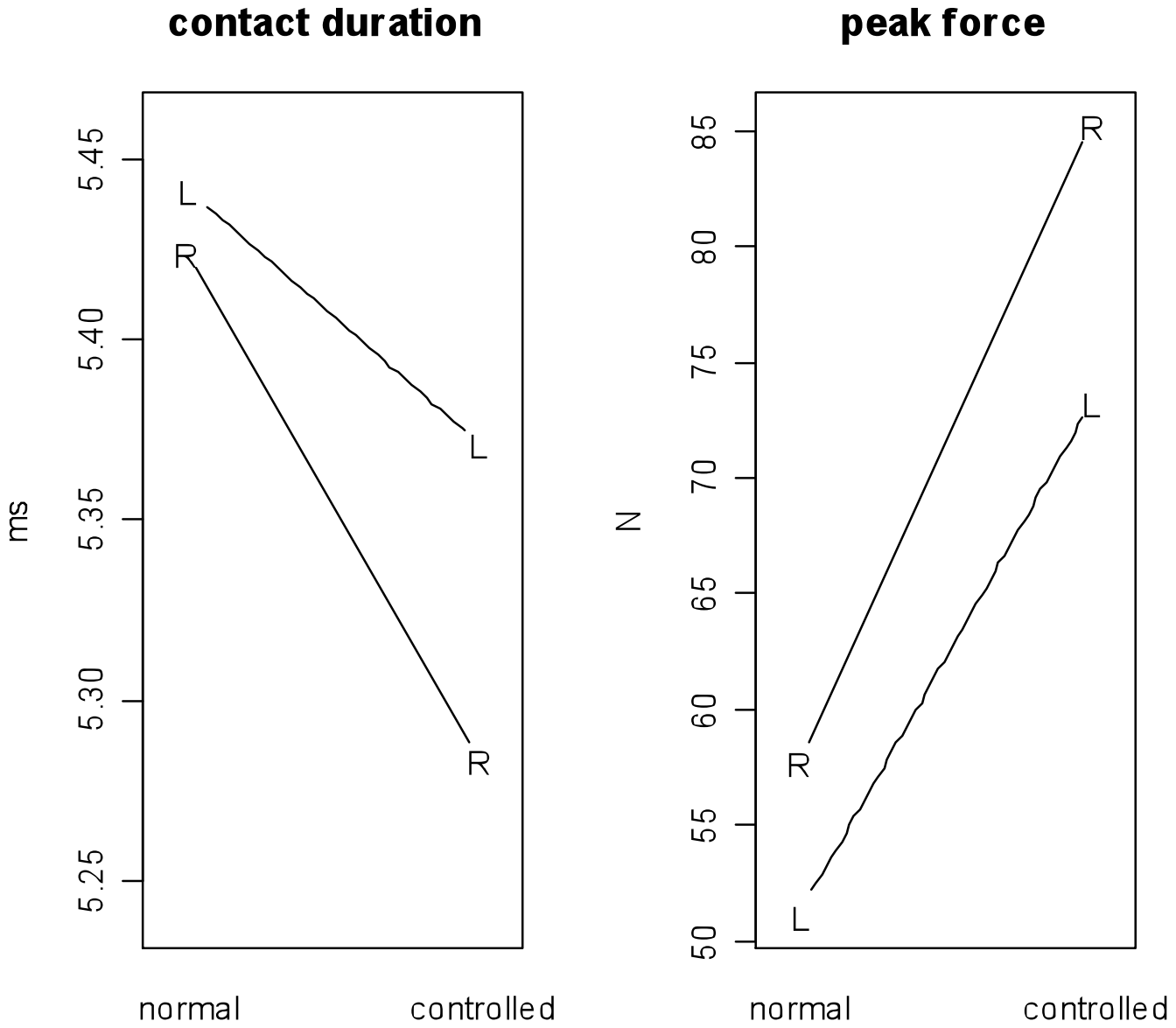
Dahl & Altenmüller, 2008

Vertical displacement of stick marker



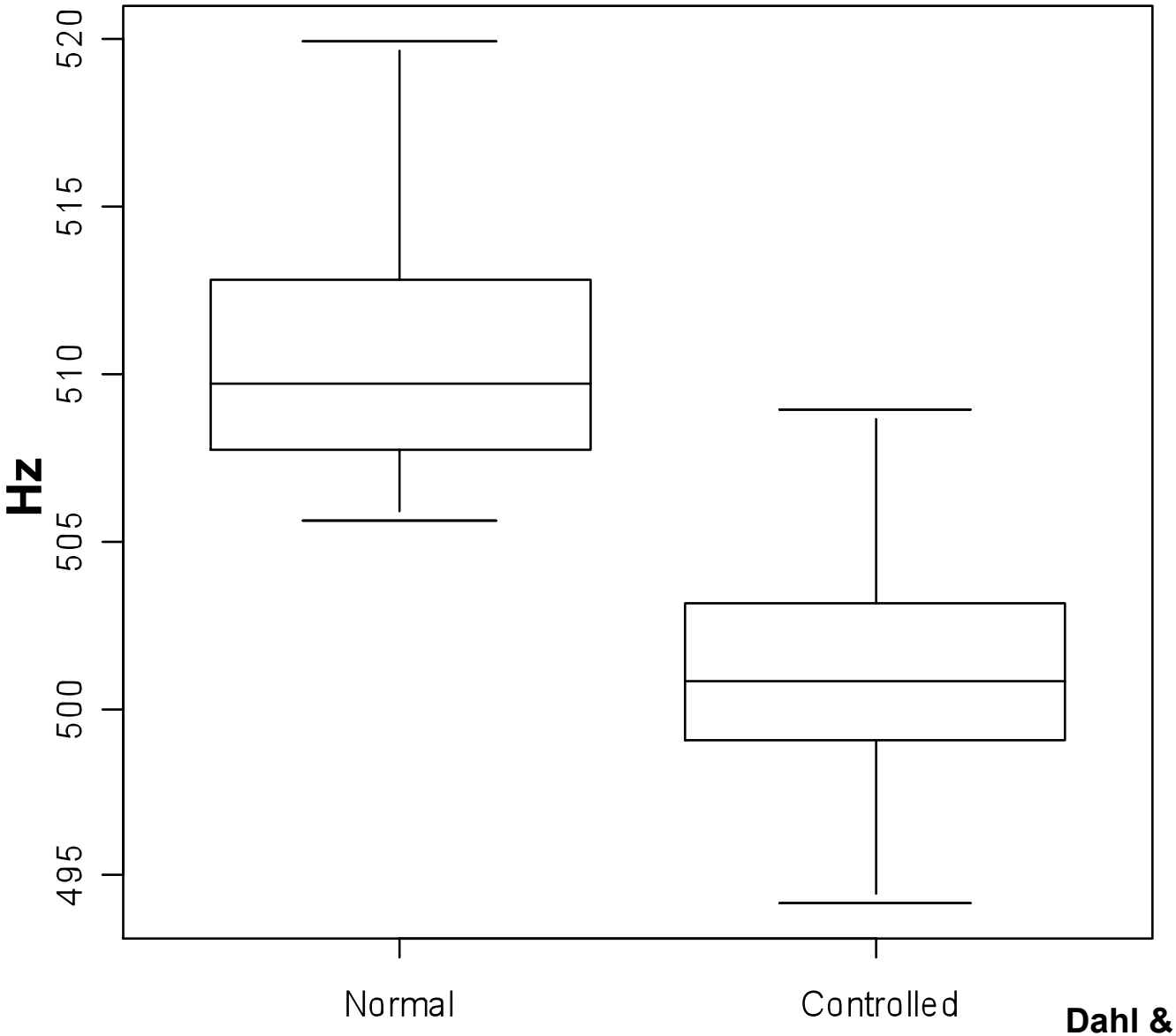
Dahl & Altenmüller, 2008

Contact force and duration



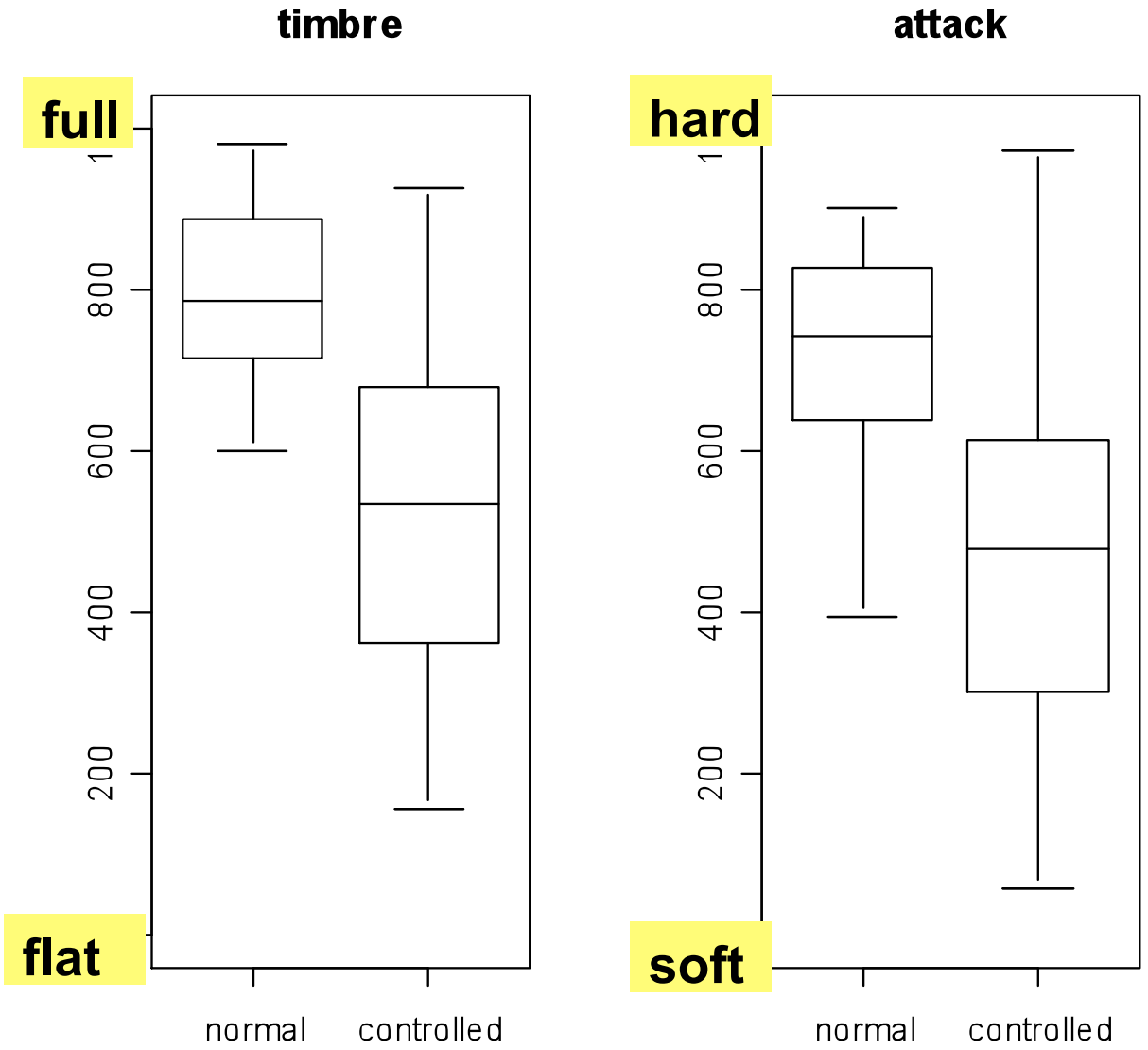
Dahl & Altenmüller, 2008

Spectral centroid (considering 16-1000 Hz)



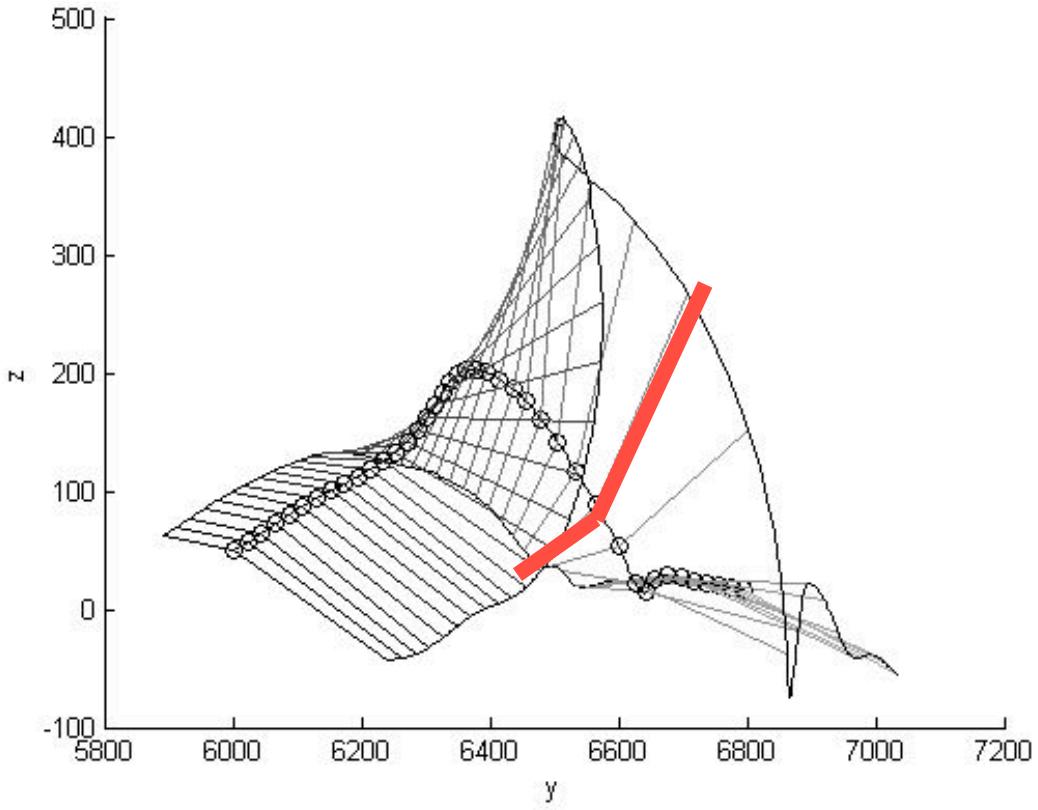
Dahl & Altenmüller, 2008

Ratings for timbre and attack: results

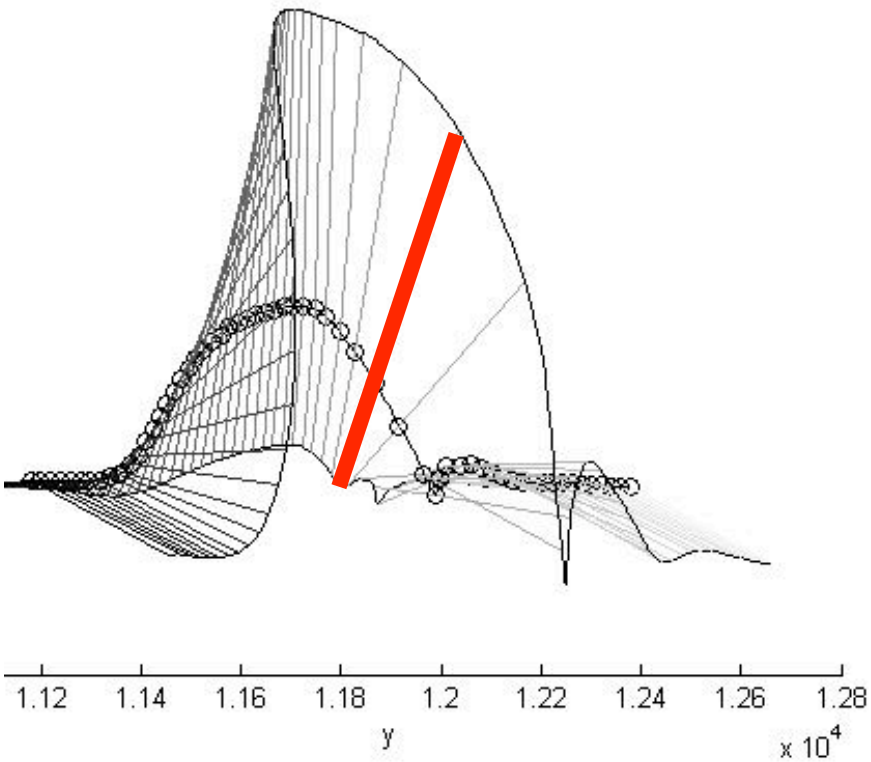


An "appropriate" strategy?

Player 1



Player 2



Musicians' focal dystonia

Defined as (painless) loss of voluntary motor control in highly trained movements (e.g. curling in/ over -extension of fingers).

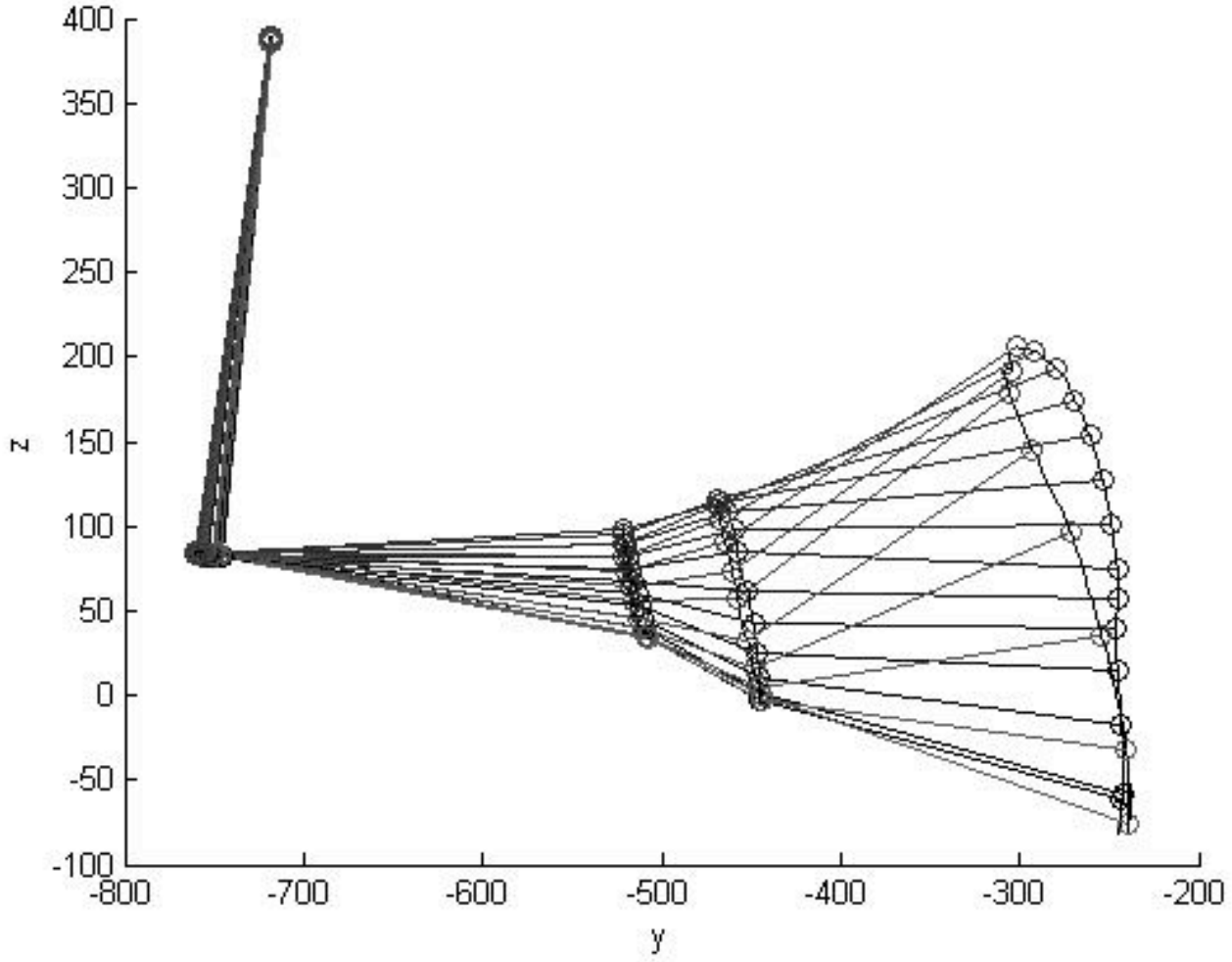
Neurological disorder

Task-specific

(Altenmüller, Hand Clin., 2003)

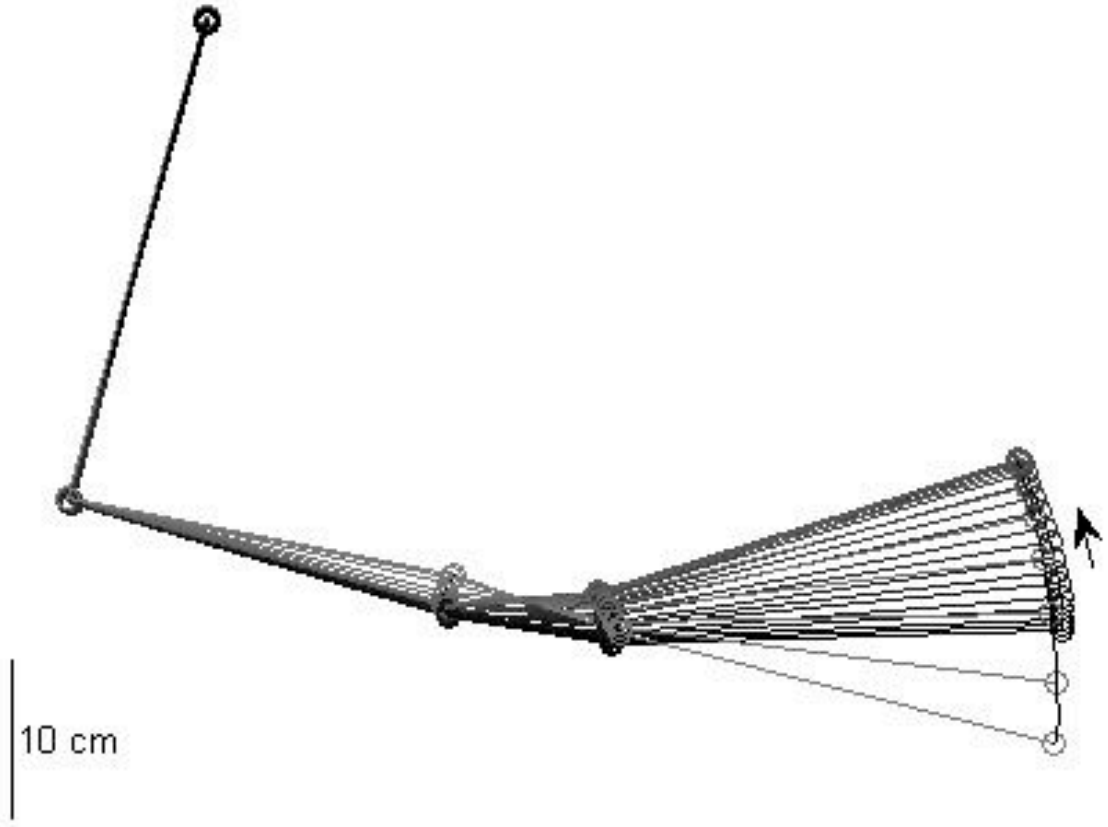
General movement patterns: healthy player

Part1: Left, 120 bpm, mf

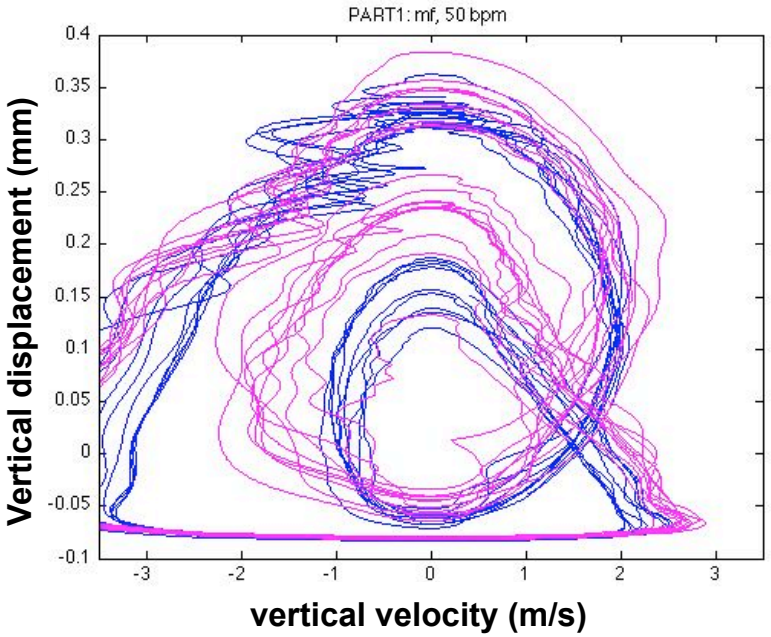


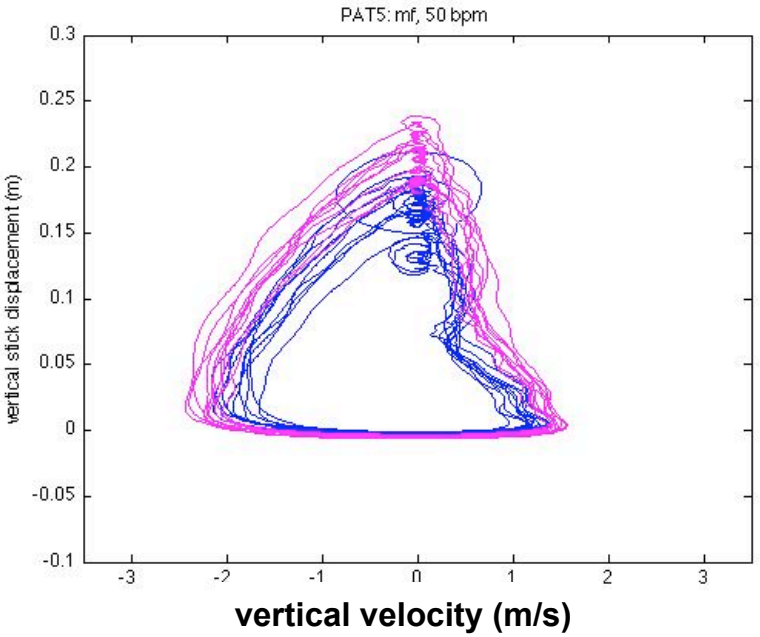
General movement patterns: dystonic patient

Pat5: Left, 120 bpm, mf



Comparing left and right – phase plots

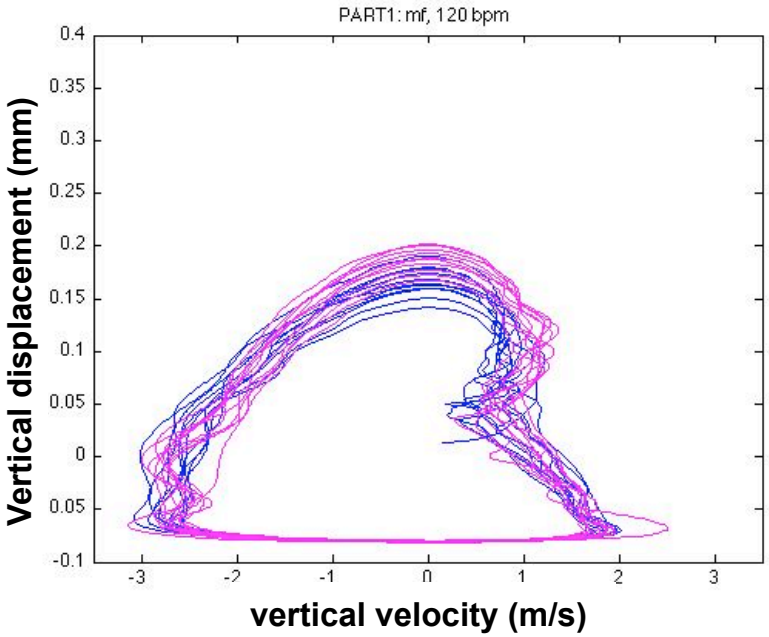


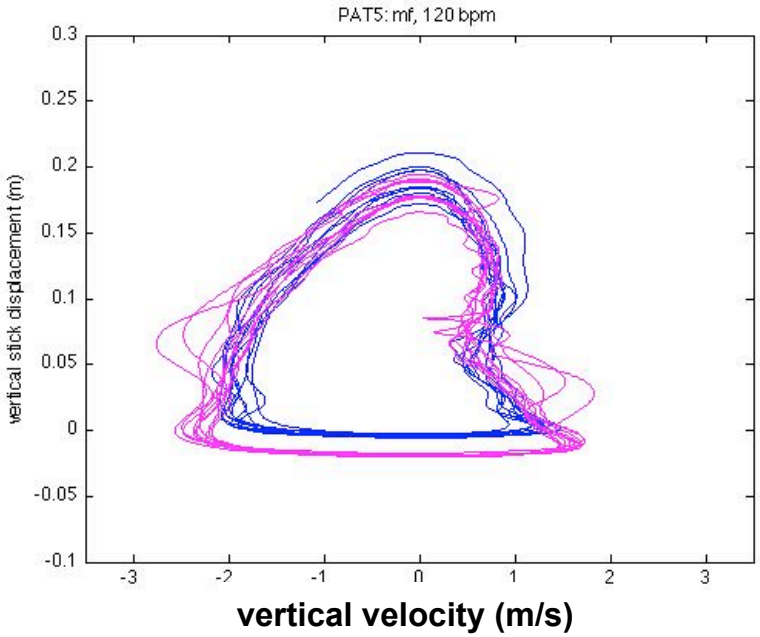


healthy
50 bpm
mf

dystonic
50 bpm
mf

Comparing left and right – phase plots

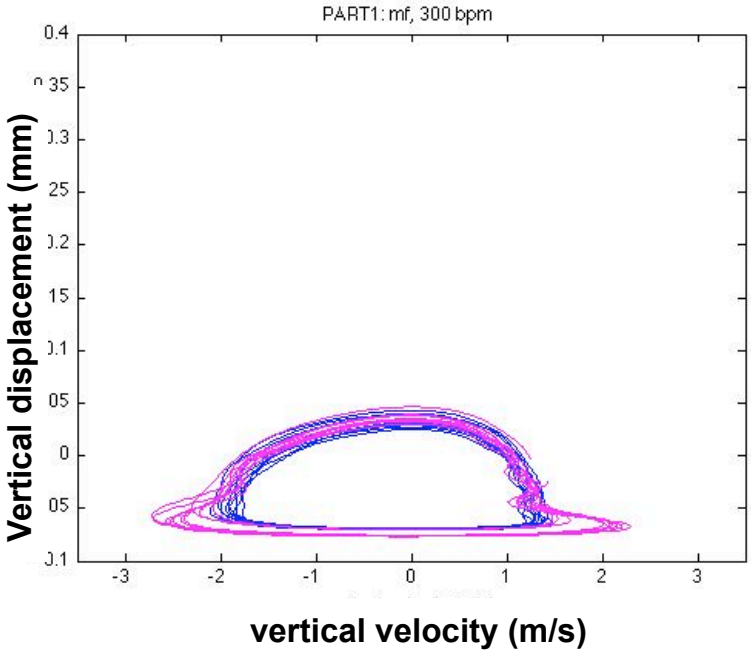


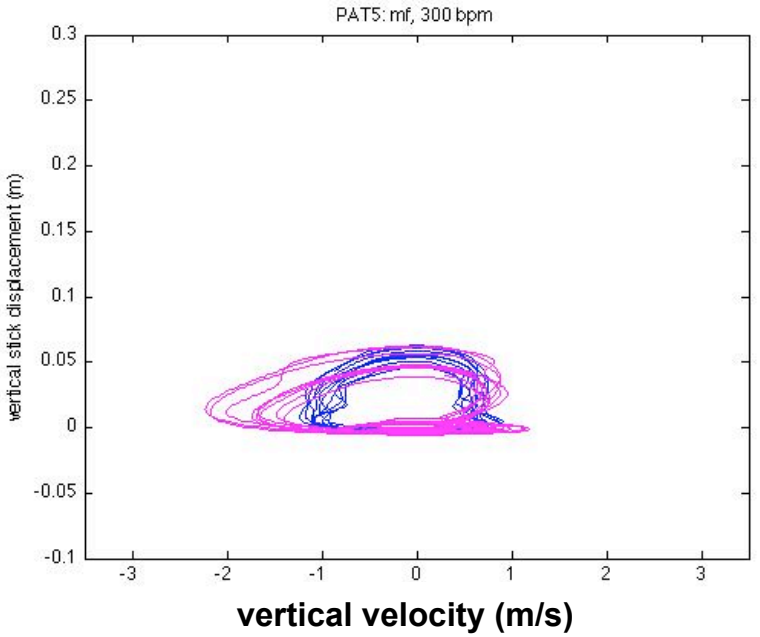


healthy
120 bpm
mf

dystonic
120 bpm
mf

Comparing left and right – phase plots

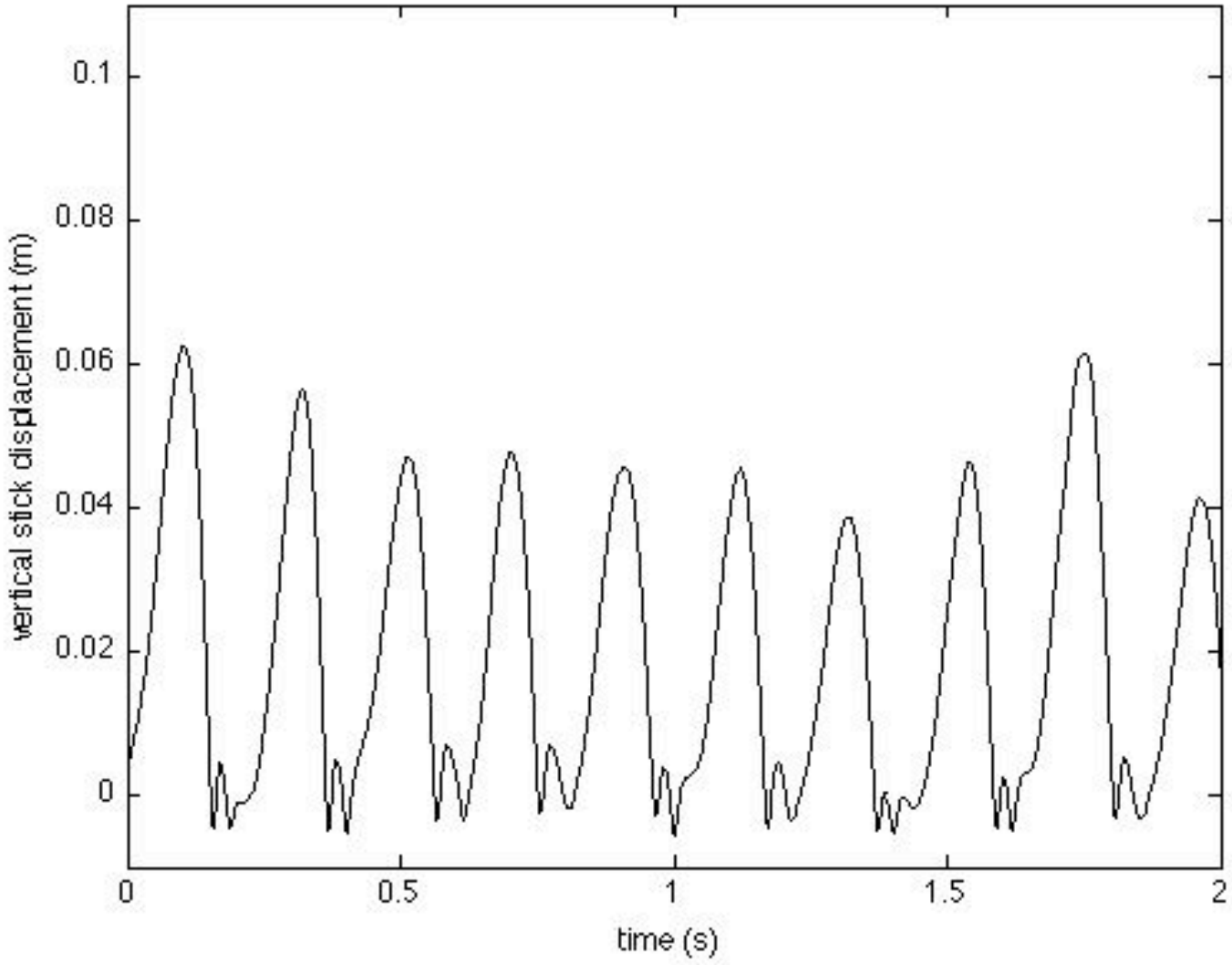




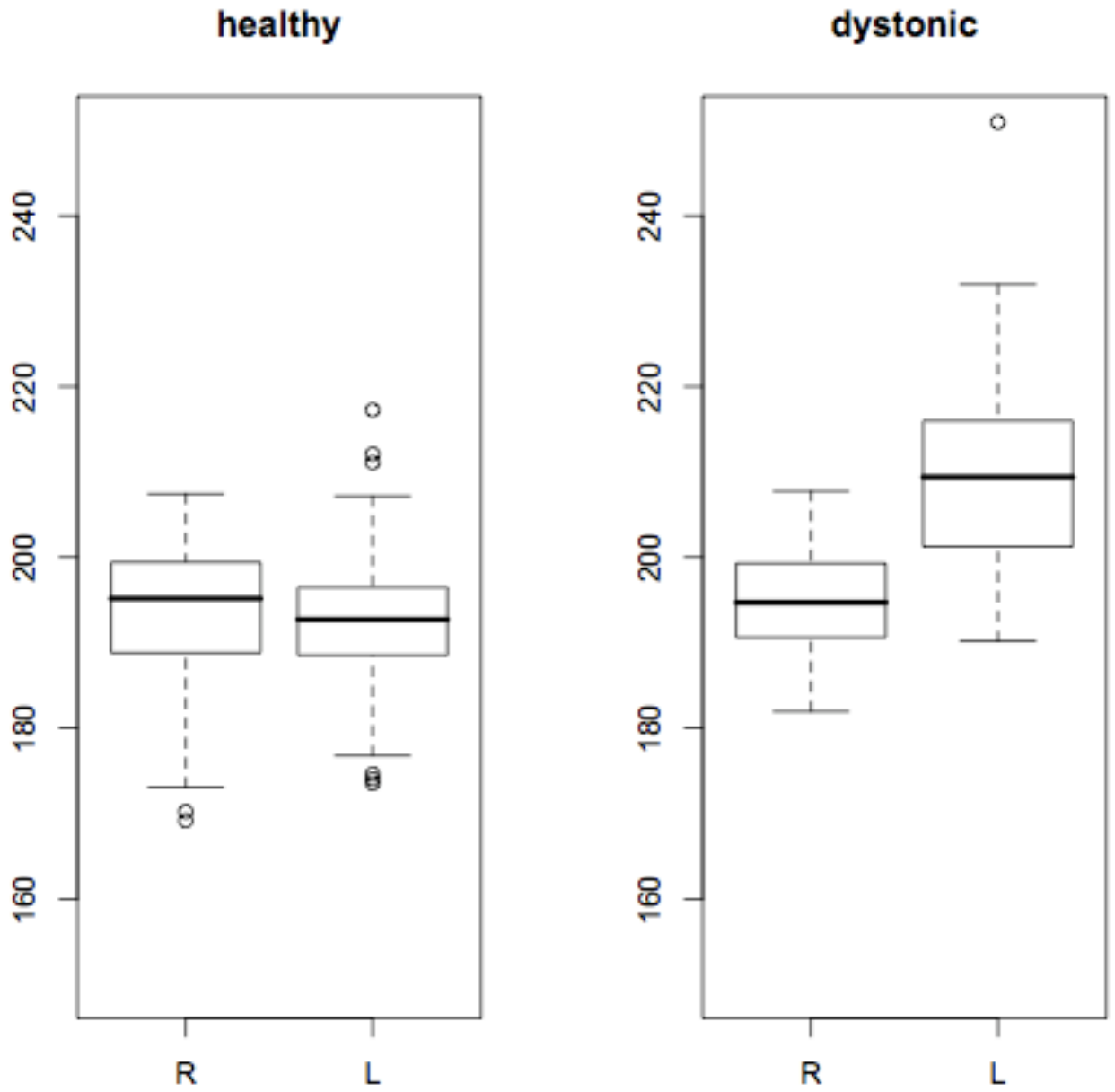
healthy
300 bpm
mf

dystonic
300 bpm
mf

Comparing left and right – phase plots

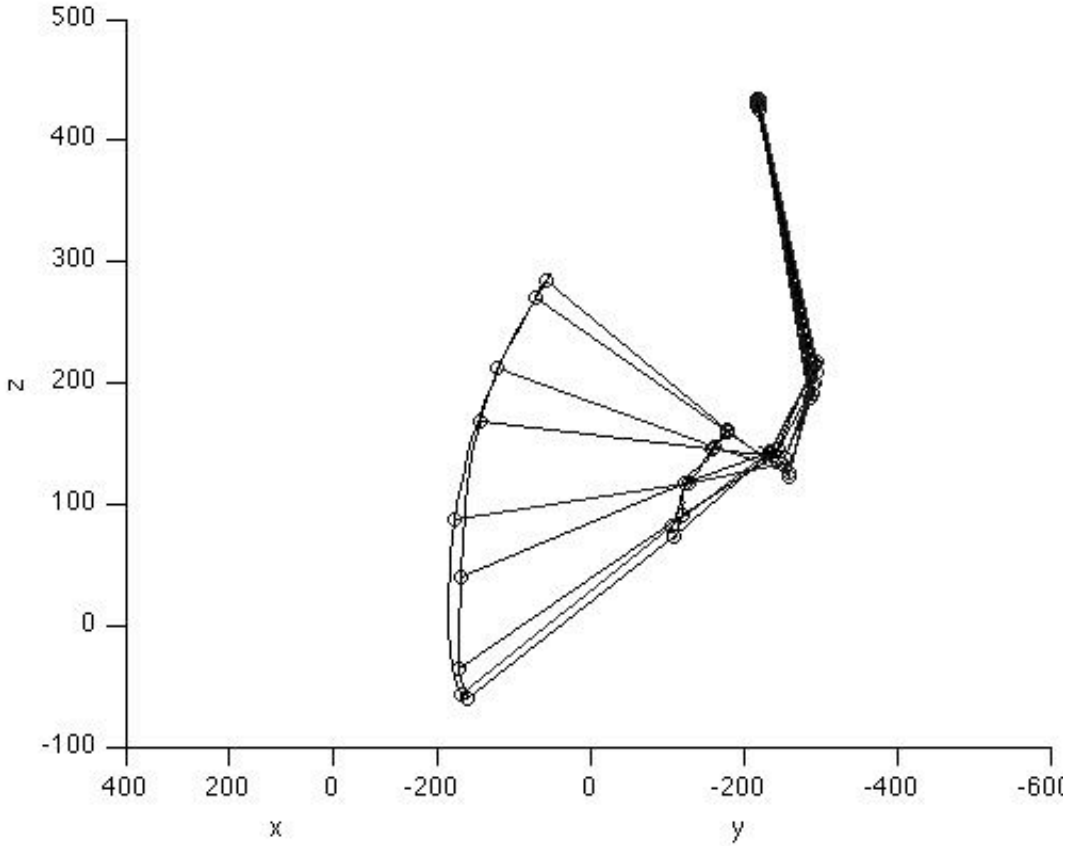


Comparing left – right (120 and 300 bpm)

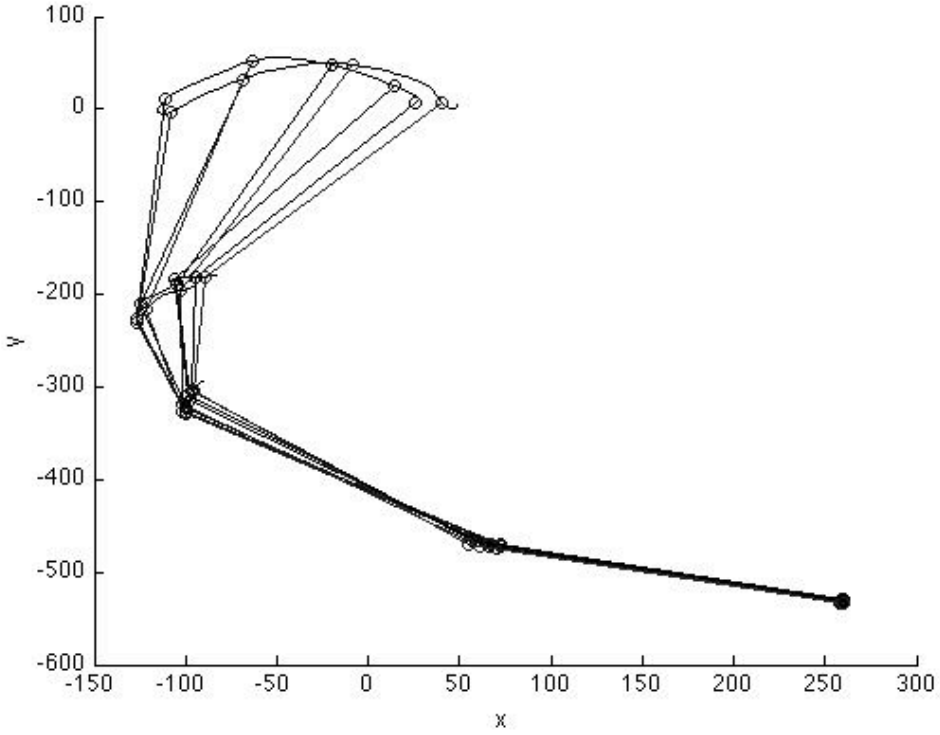


Patient 1, left arm, f, 300 bpm

front view

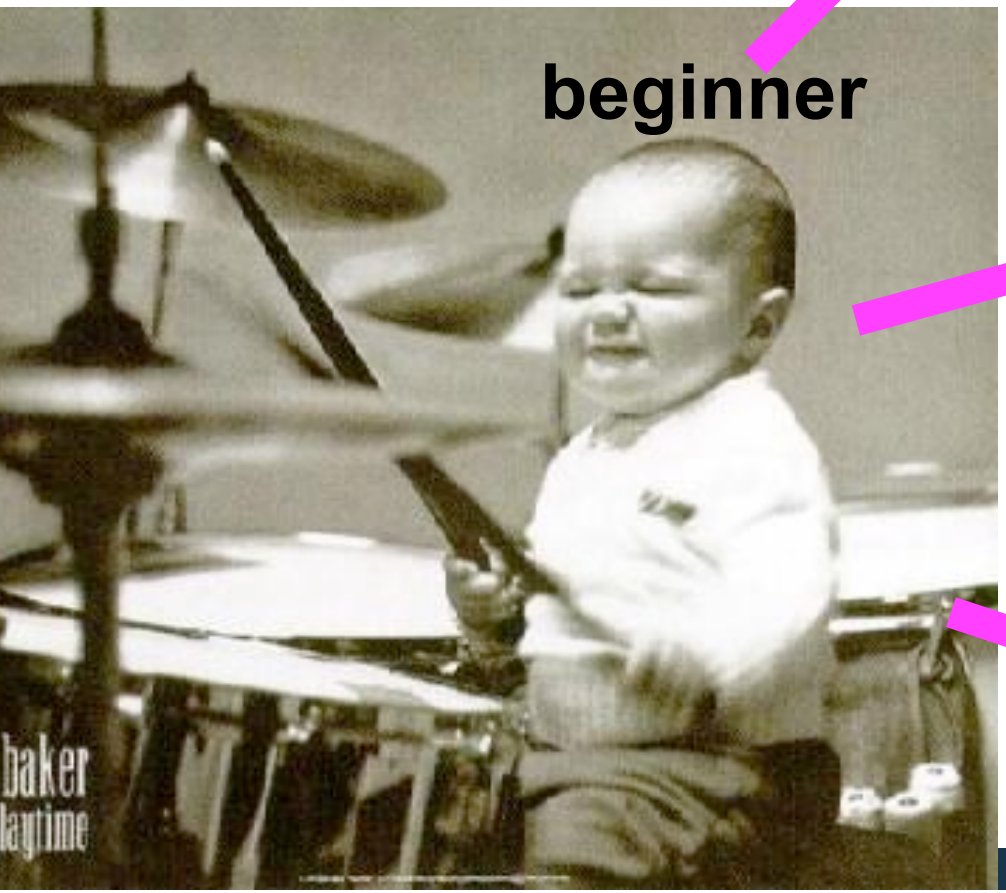


top view



Learning to play

Playing for fun



beginner

Professional

Drop out

MARIE CURIE ACTIONS

Acknowledgements

Project funded by European Commission

Collaborators Eckart Altenmüller, Michael Grossbach, and colleagues at Institute for Musicians' Physiology and Musicians' medicine, Hanover

Hochschule für Musik und Theater Hannover

Thanks to all our participants playing and participating in the listening tests.

Thank you!