

Monitoring the Strength & Power Capabilities

One frame back

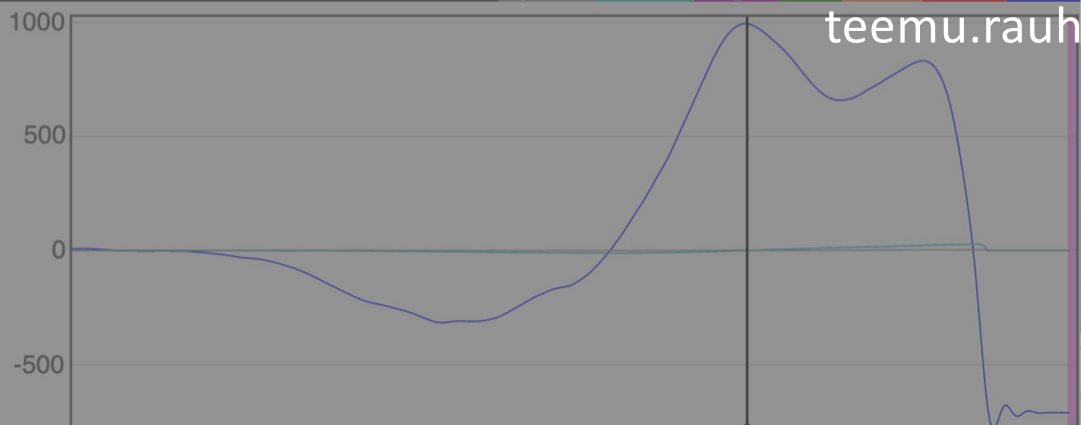
Play

One frame forward

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Part 1

- Principles of the neuromuscular system influencing Strength&Power training

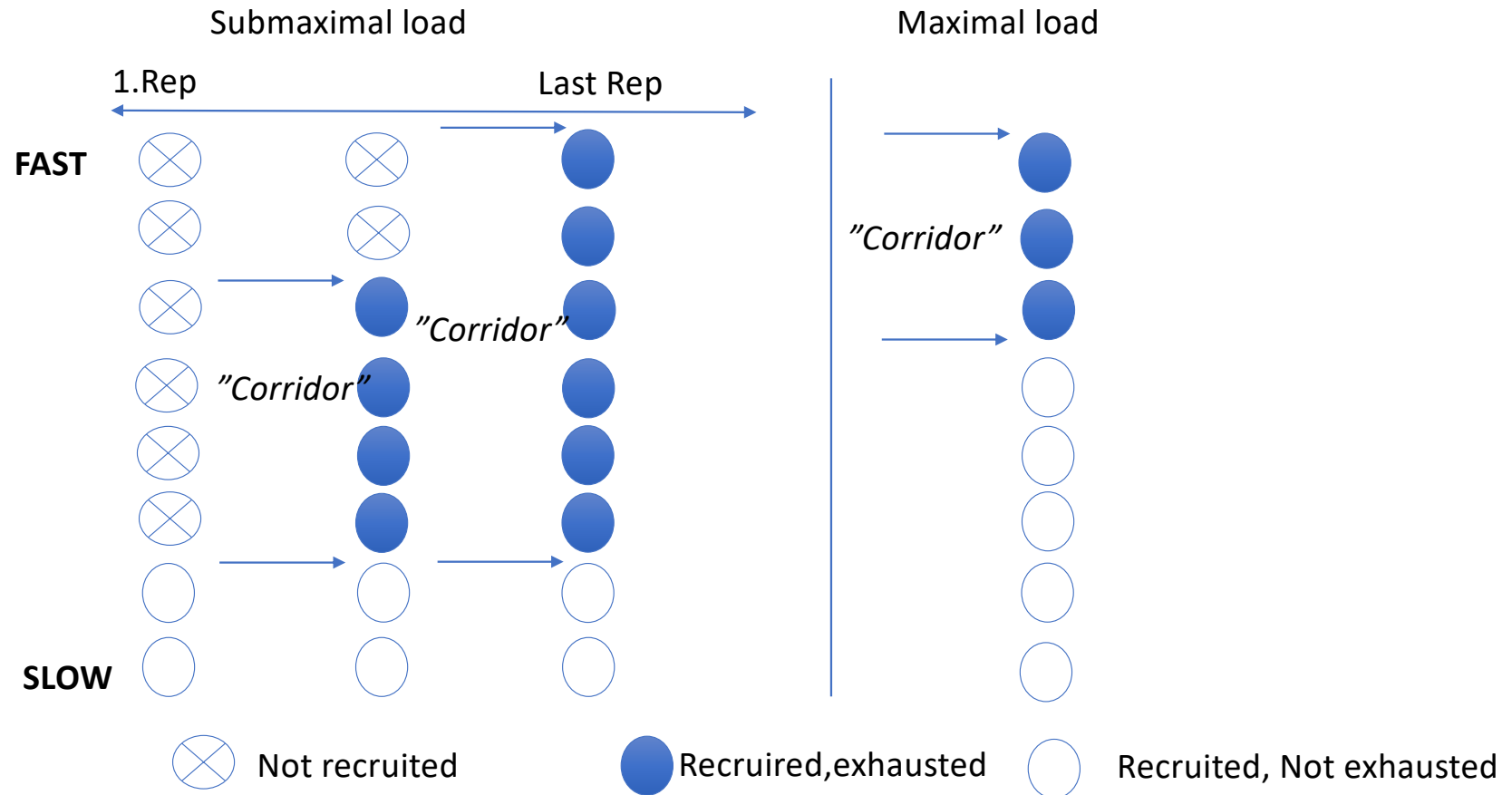
Part 2

- Role of Strength & Power in Sports Performance

Part 3

- Monitoring Strength&Power capabilities at youth and adolescent

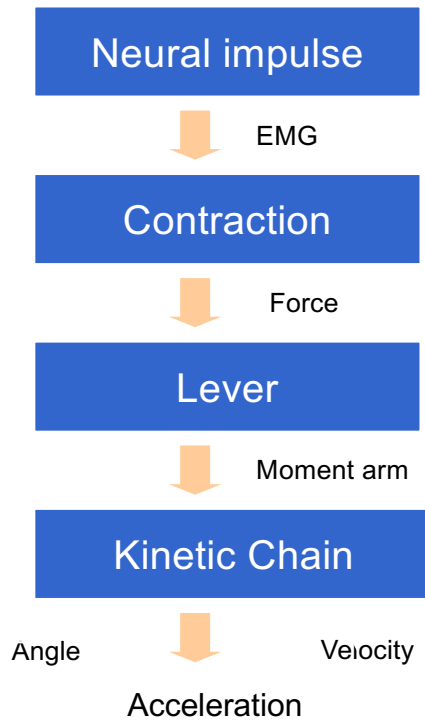
Repetitions with submaximal load



Human Movement

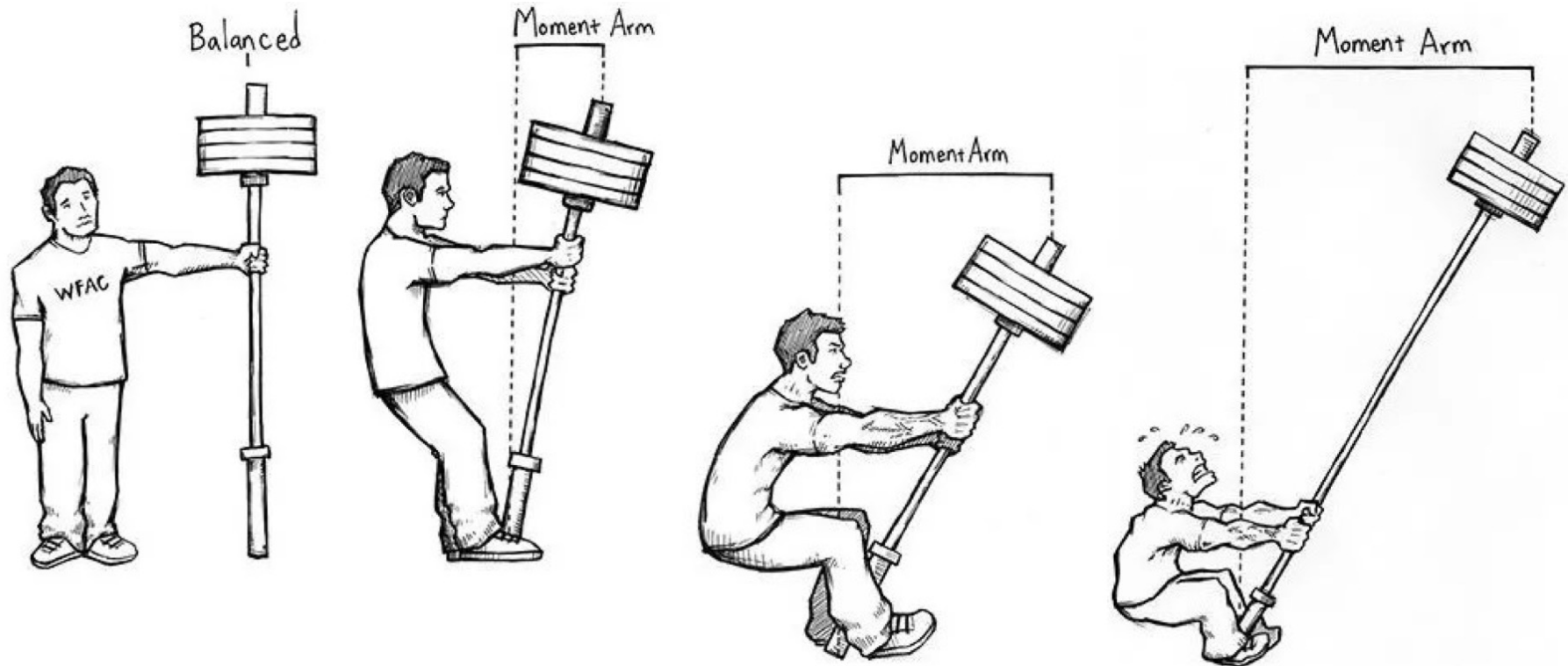
- Several muscle groups
- Complexity

Biomechanical principles of the Force production

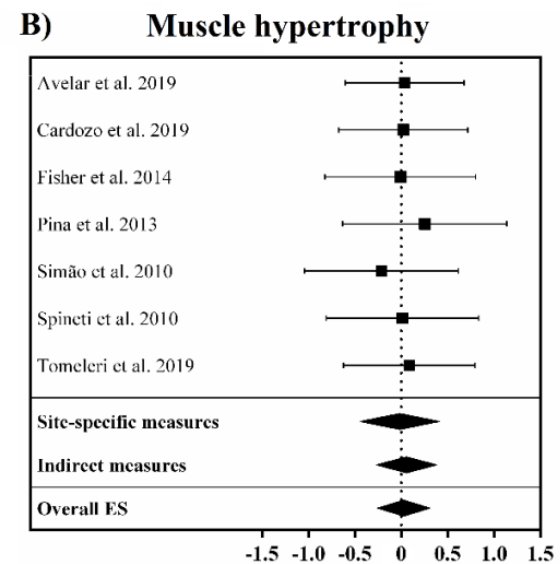
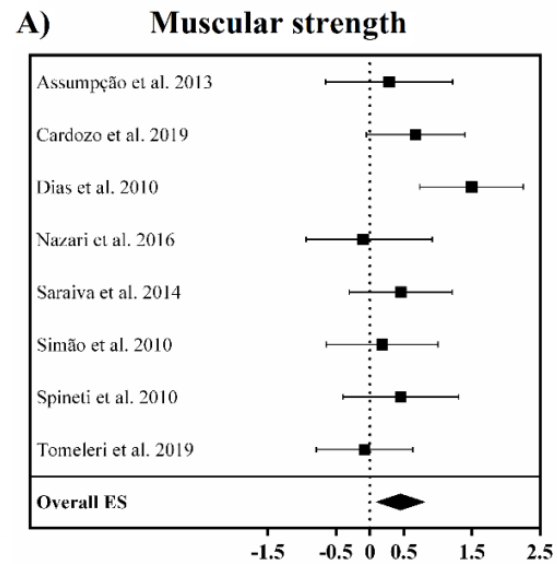


Zajac&Gordon 1989

Moment arm (Potential Energy)



Exercise Order



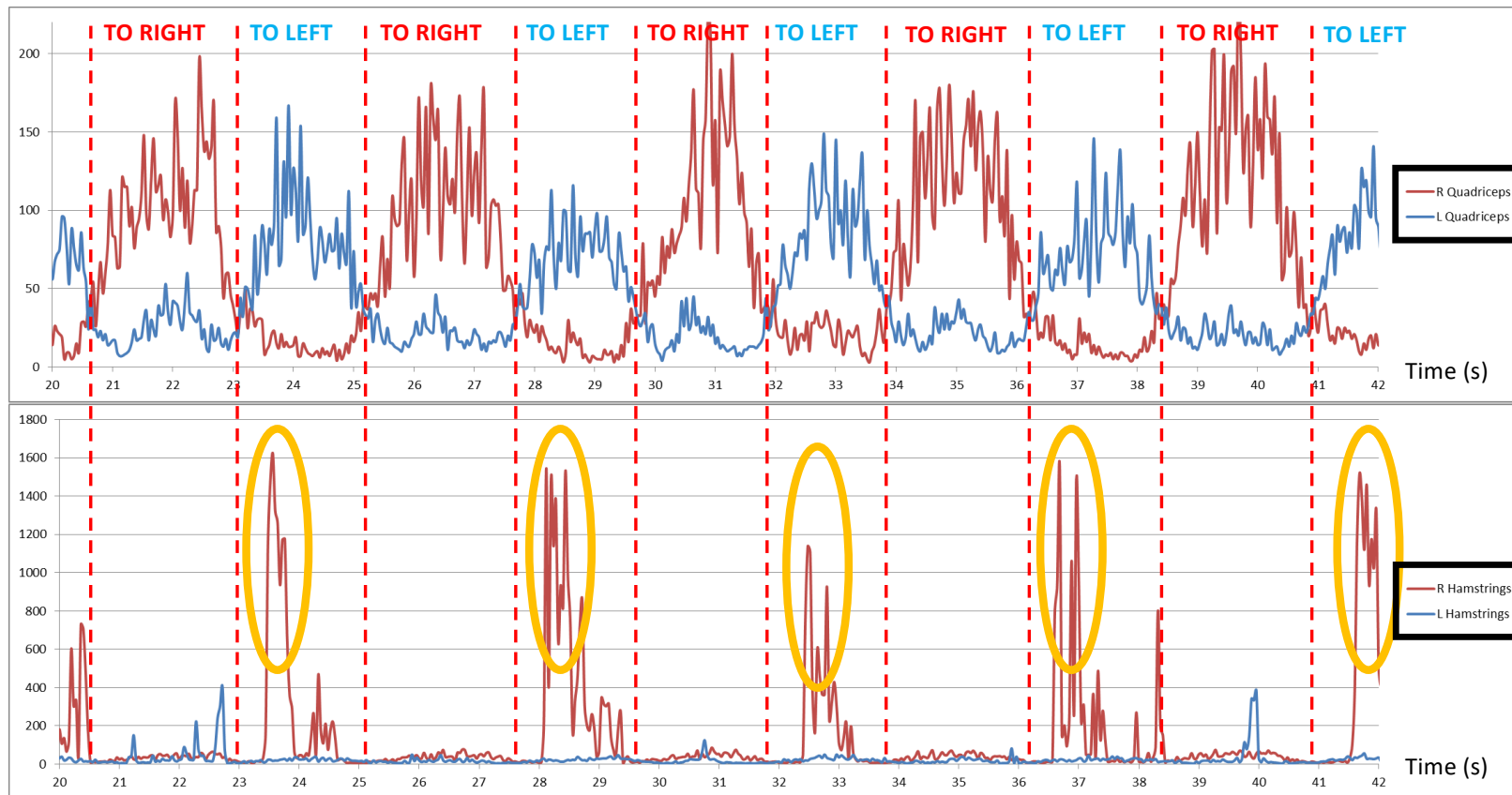
Nunez et. al. 2019

Where to put your main exercises of the workout?

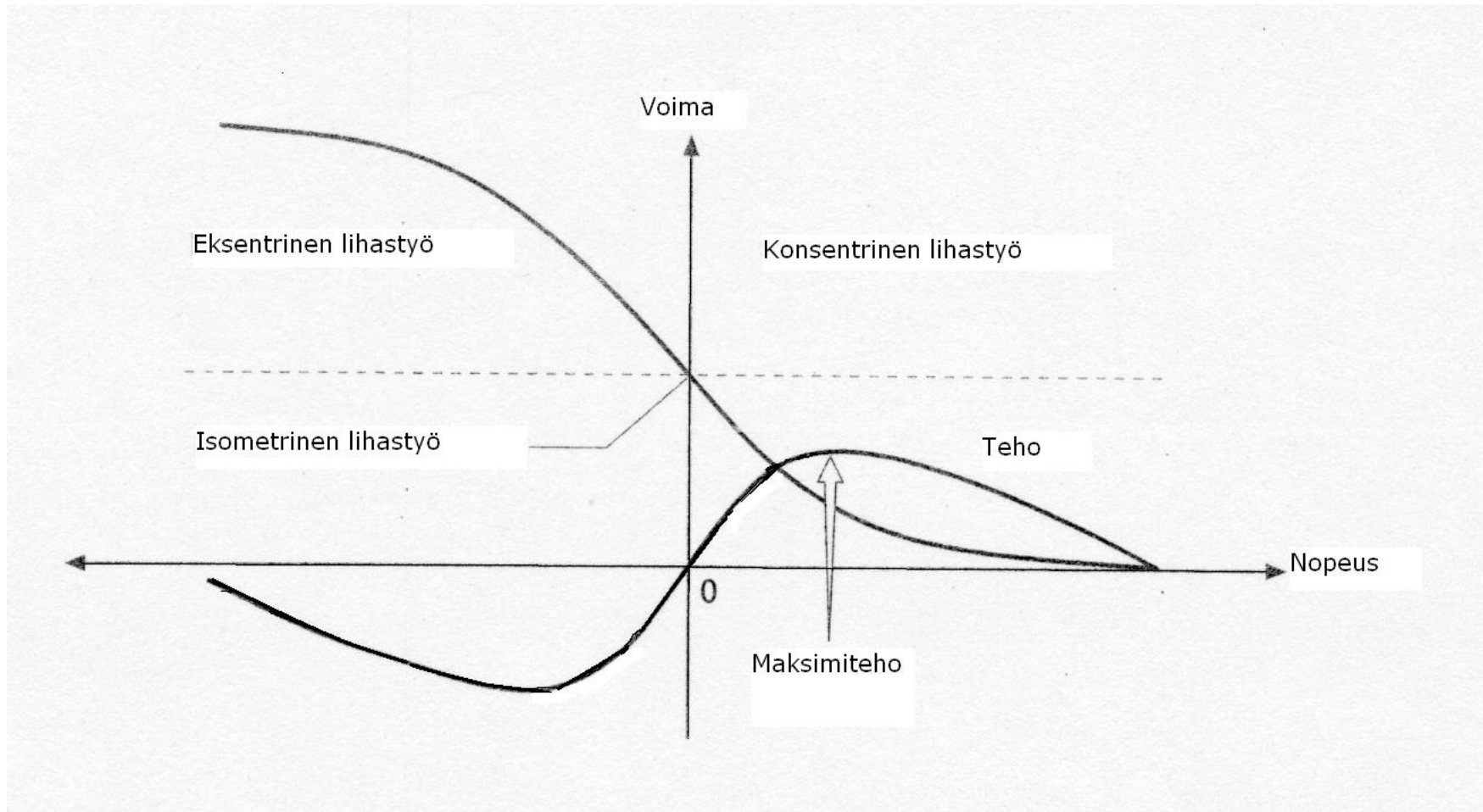
Speedskating - dryland



KALLISTELUT = WEIGHT SHIFTS FROM ONE LEG TO ANOTHER IN LOW POSITION



(Lihastyön teho) Muscle Power



Power- terminological mess...

“anaerobic power”

”maximal explosive power”

”conventional power”

“contractile power”

”explosive strength”

“mechanical power output”

“muscle peak power”



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- **Role of Strenght & Power in Sports Performance**

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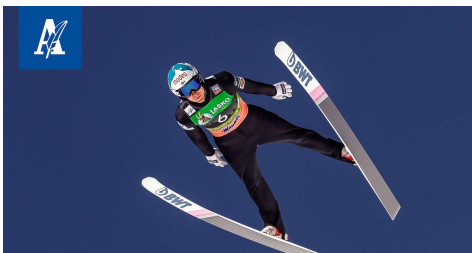
Role of Strength & Power in Sports Performance

- **Key Performance Factors** (Dan Pfaff)
 - *Sports Specific – Athlete Specific*



Speed

Skill



Endurance

Role of Strength Training in Sport

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graph LR; A[Do you even lift?] --> B[Yes, I do lift]; B --> C[How do I lift];
```

Do you
even lift?

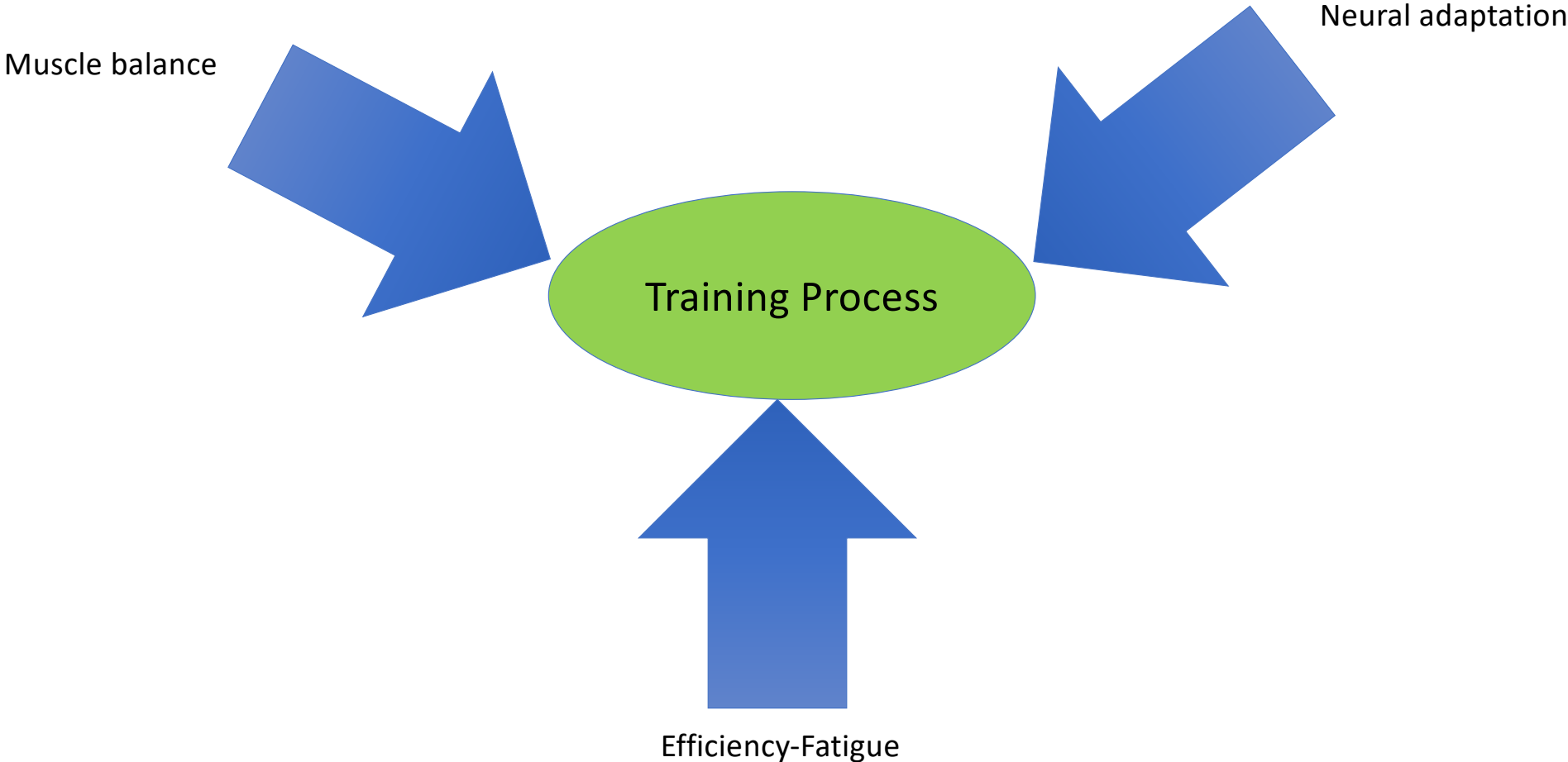
Yes, I do
lift

How do I
lift

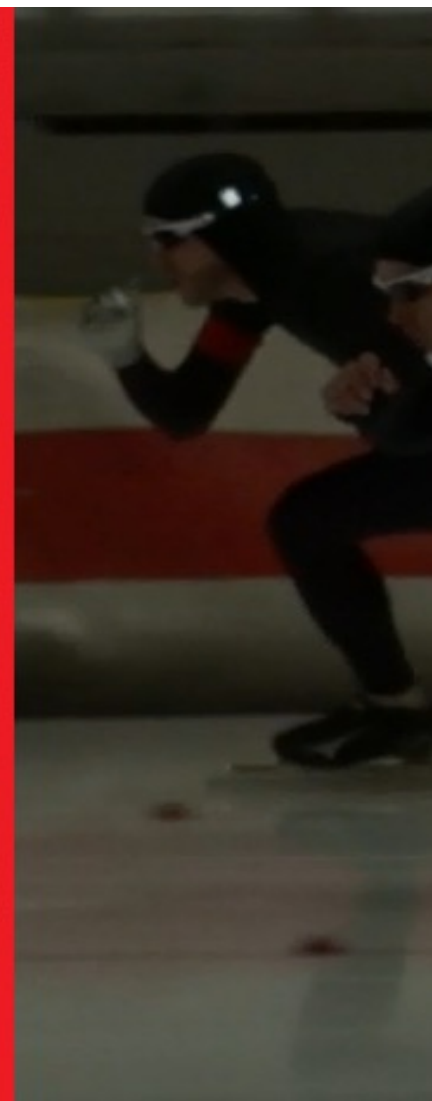
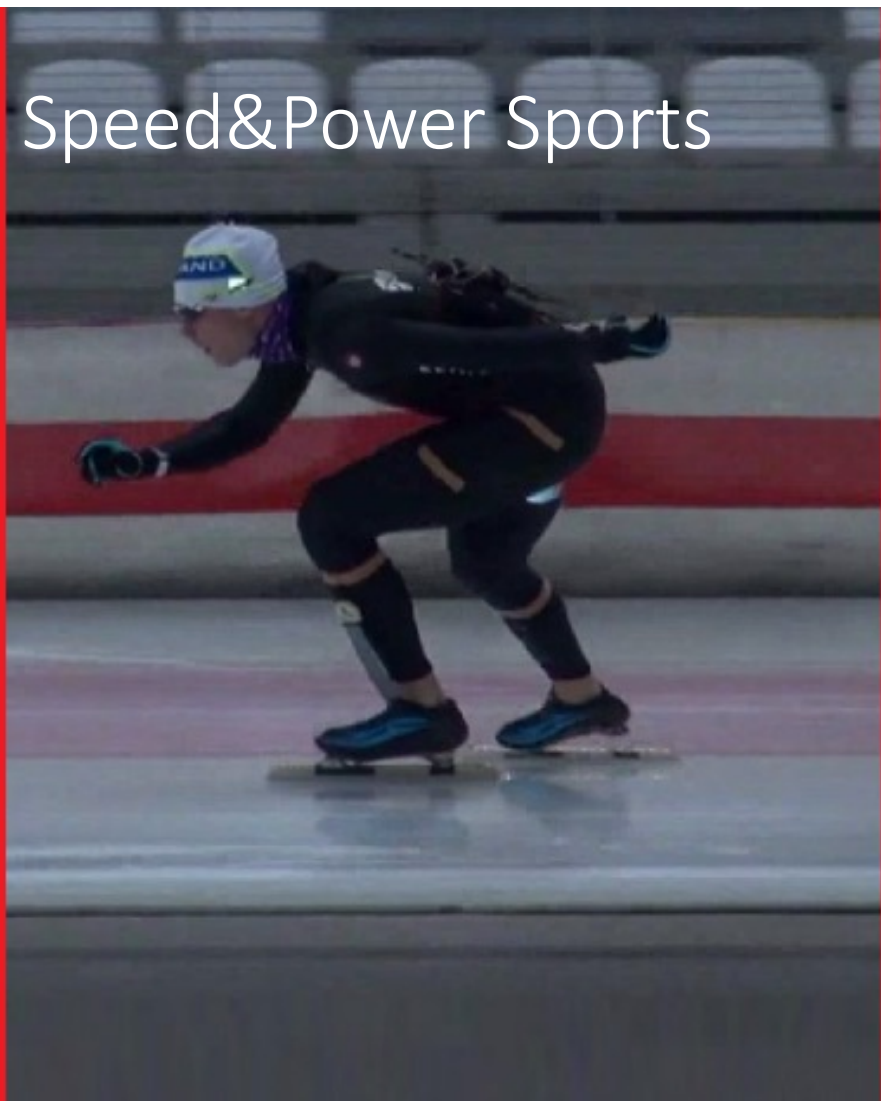
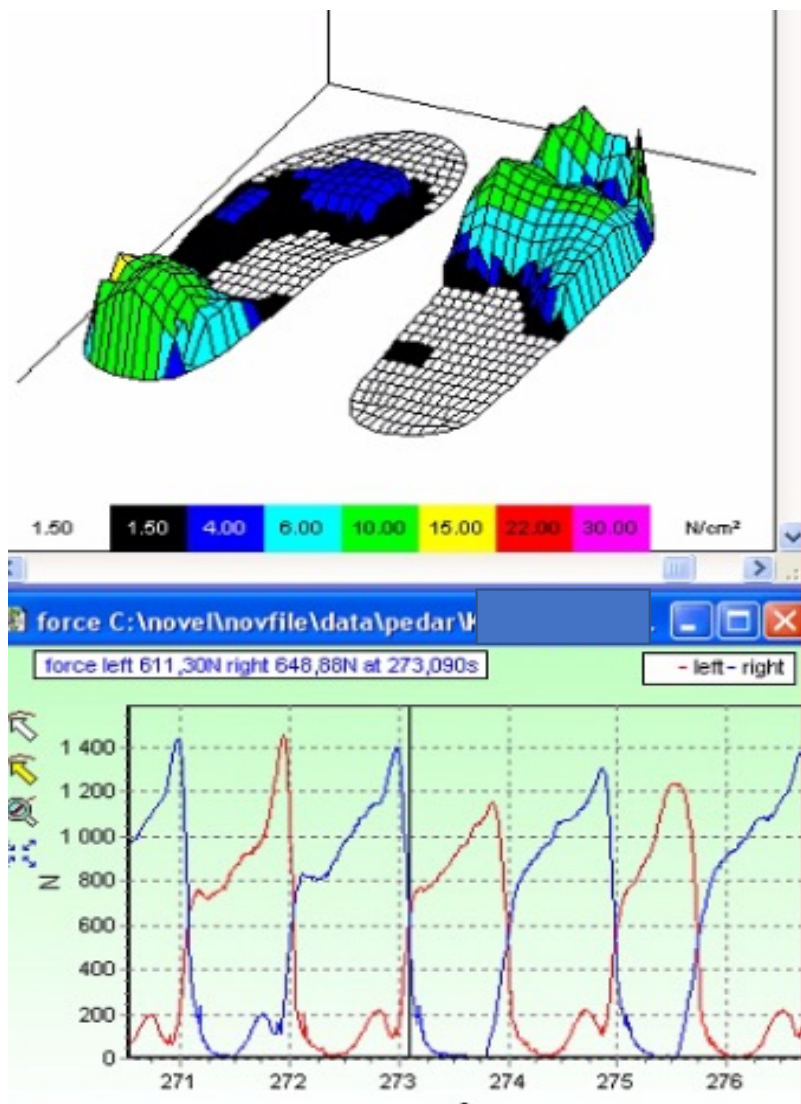
Concurrent training

- If it were just Strength and Power (weightlifting) it would be simple but in most of the sports Strength&Power is only one part of training
- Large training load in endurance sports lead to long term adaptations which are contradictory to the principle of the NMS function

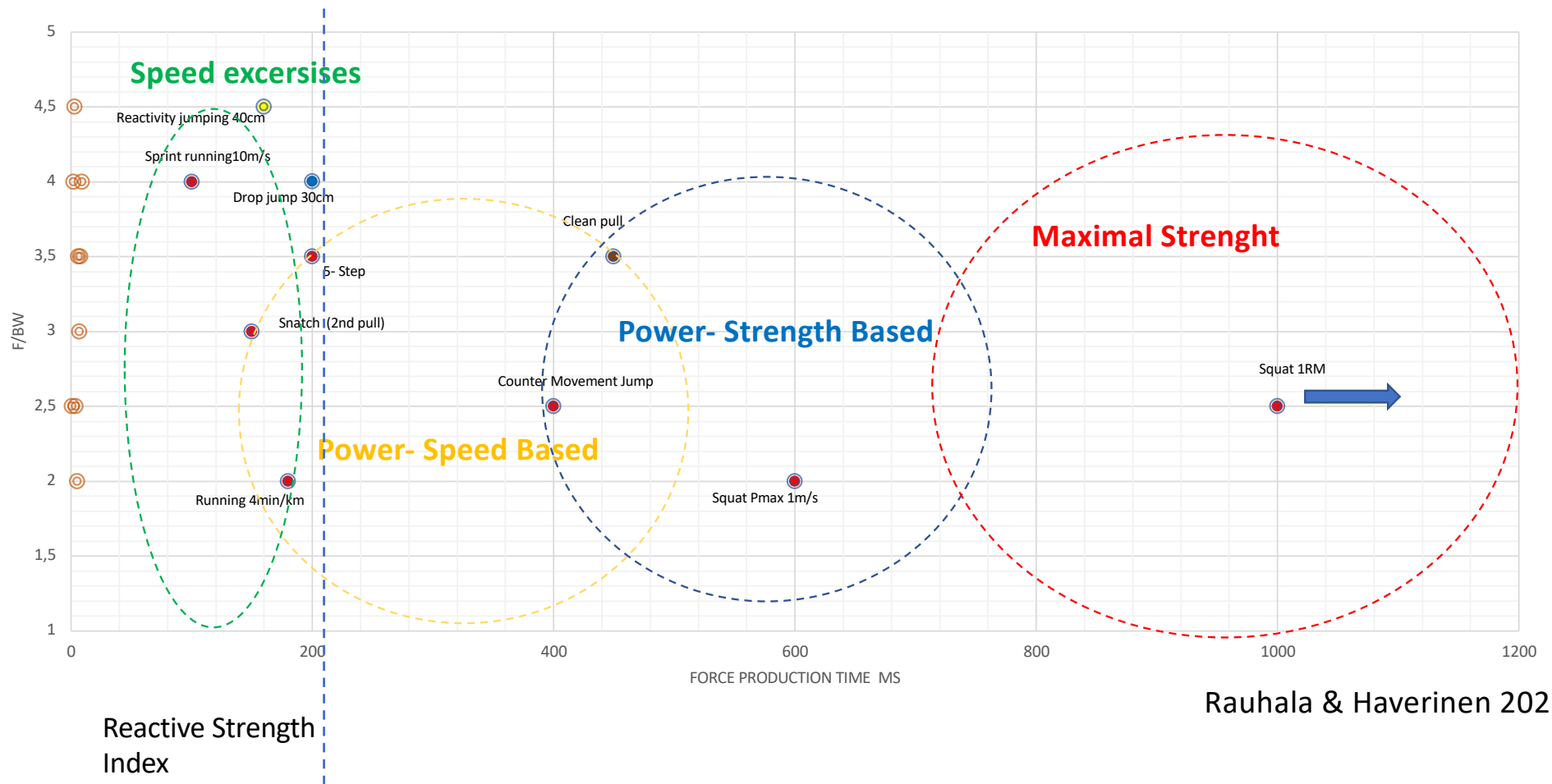
Strength Training in Endurance Sports



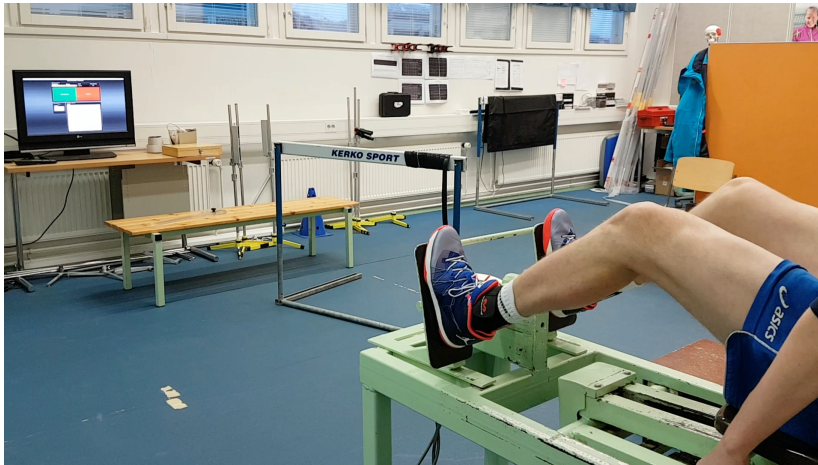
Speed & Power Sports



Scaling it



Validity - Reproducibility



RFD?!?



Validity is the extent to which a test measures what it claims to measure

Reproducibility is the consistency of measurements by different appraisers using the same measuring equipment.



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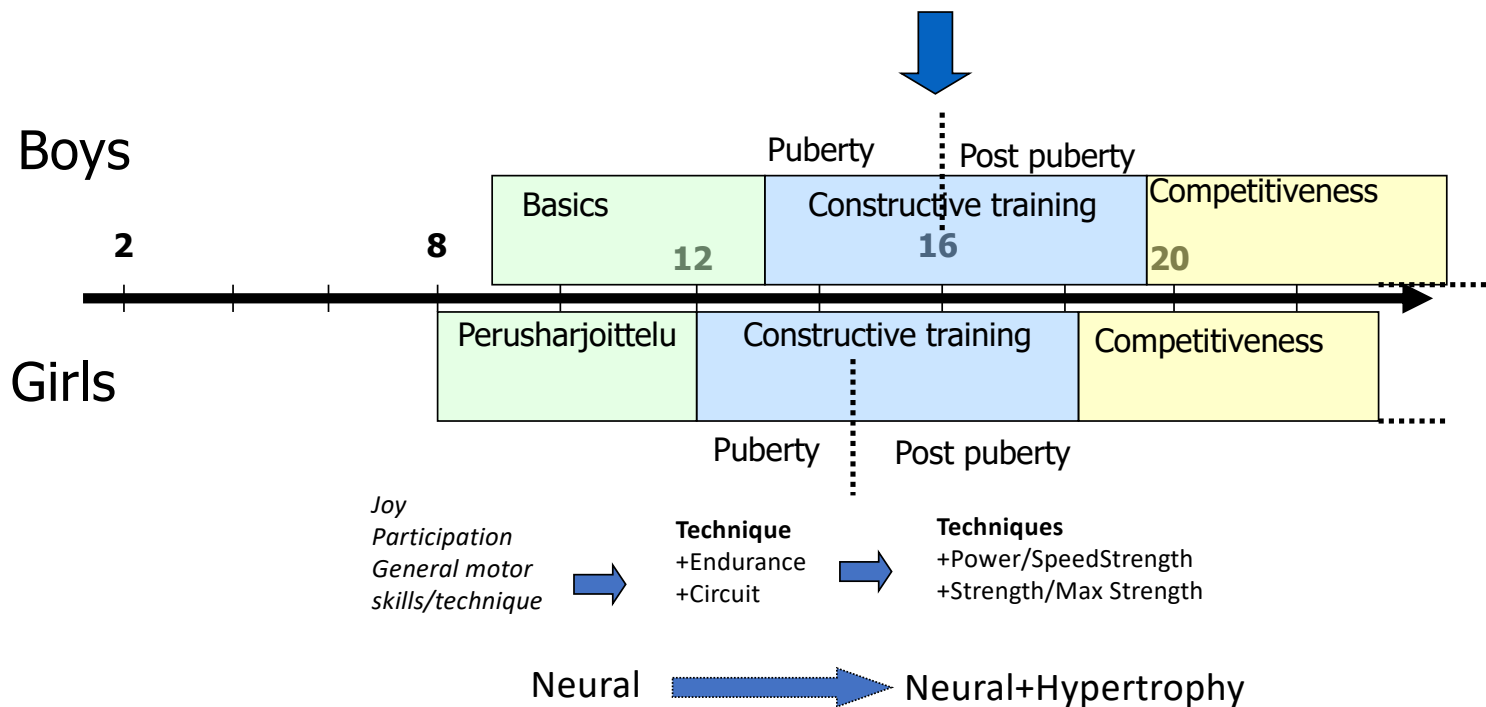
Part 2

- Role of Strenght & Power in Sports Performance

Part 3

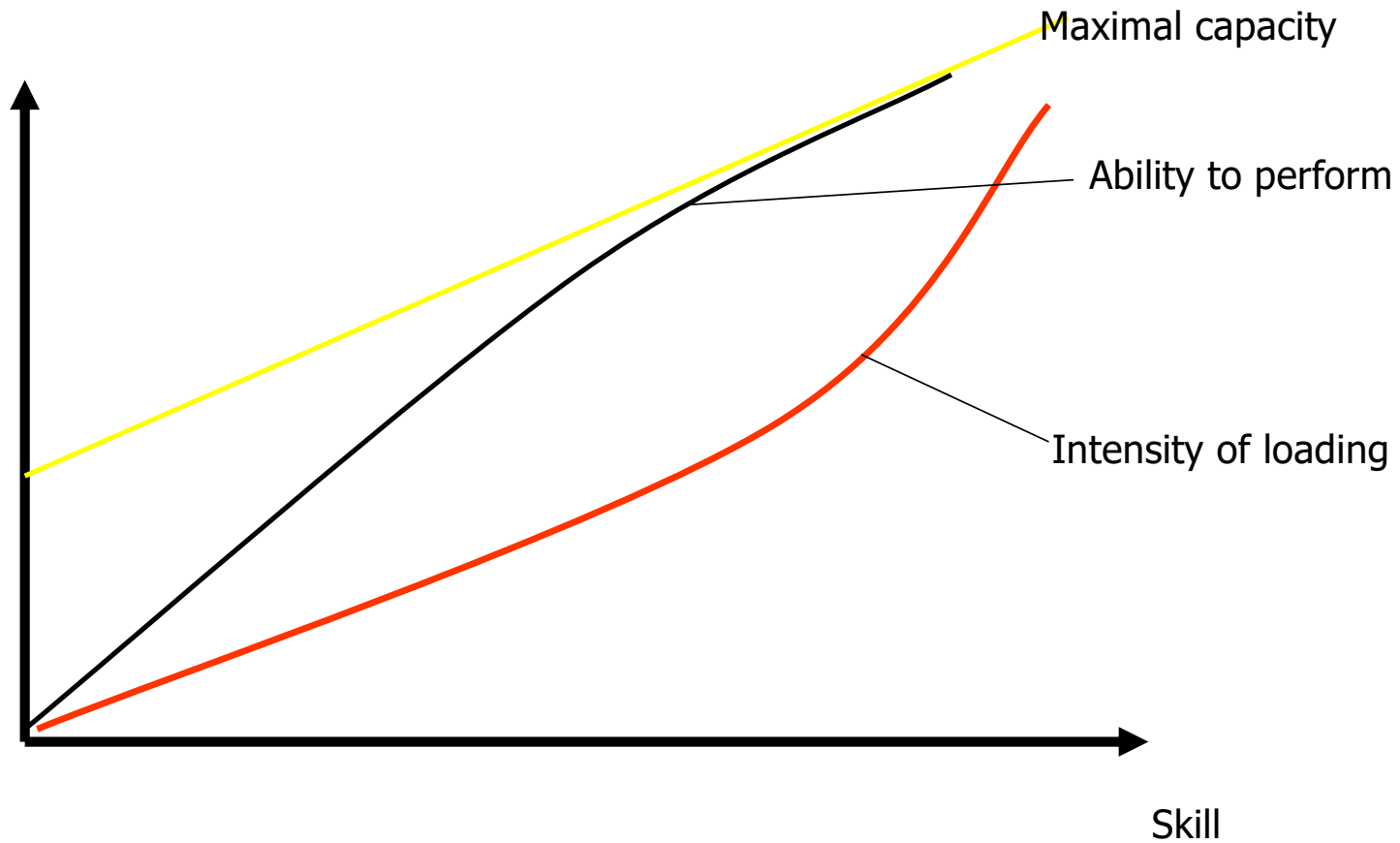
- **Monitoring Strenght&Power capabilities at youth and adolescent**

Long term athletic development




Arbeit E.(1998) NSA 13:4, 21-28, Zatsiorsky 1995

Learning to perform



Verkhoshansky 1998



Maximal Strength

Measuring maximal strength should be measuring maximal strength



Tissues

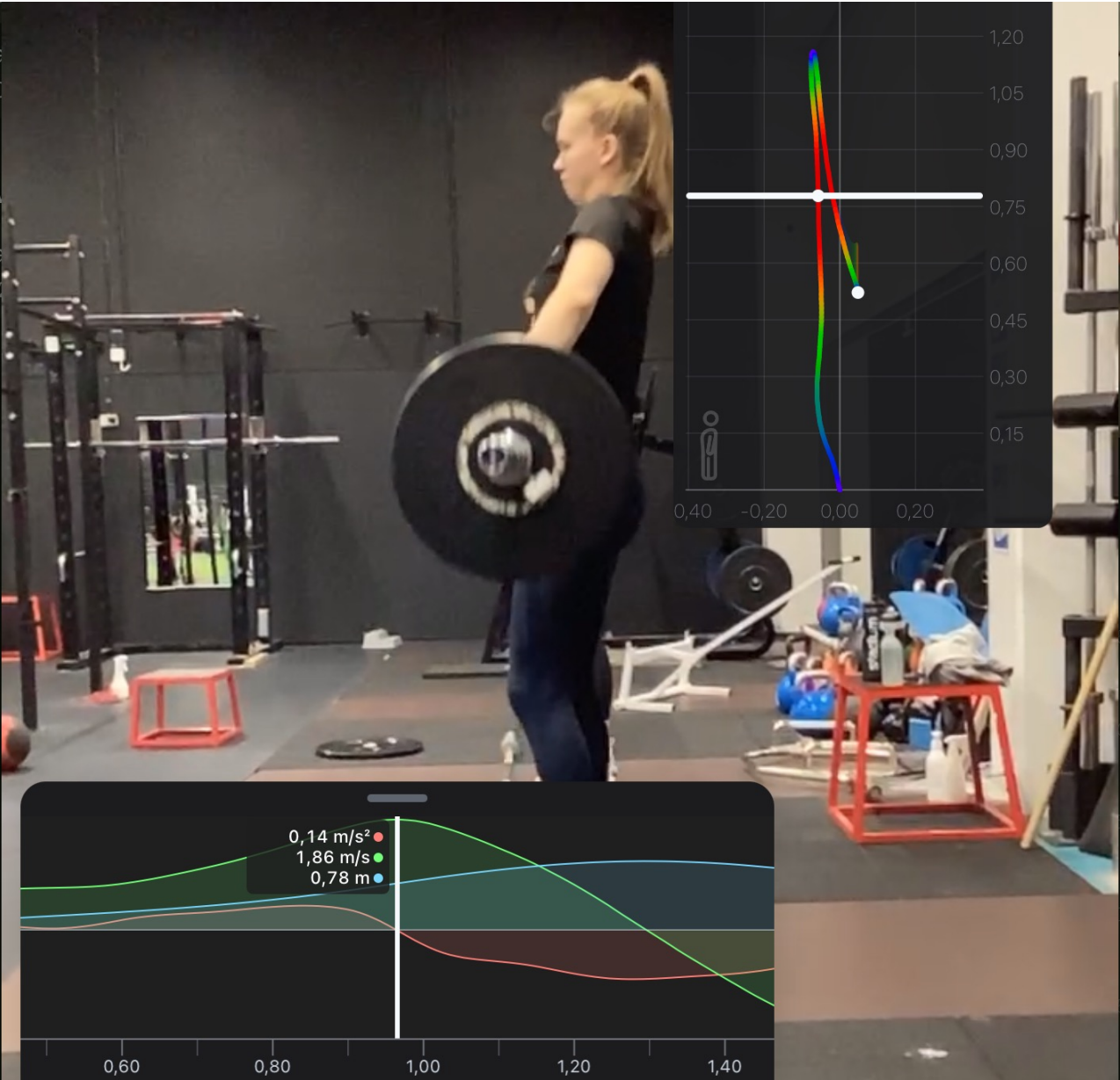
- Measuring maximal strength may be sometimes out of reach with young athletes
 - Repetition methods up to 5-6 RM
 - "3 year rule" with free weights
 - Movement selection (validity)
 - Jumps and Throws reflections (sprints,jumps, medballthrows etc.)
- Overloading issues need to considered
- Mental preparedness
- Look something for the **core**, will lead you to the ***stabilization***

A person in a white lab coat is using a smartphone to record a person on a treadmill in a laboratory setting. The person on the treadmill is wearing dark shorts and red and black shoes. The background is a blurred laboratory environment with various pieces of equipment.

Measurement technology

- Contact mat, light cells, videocamera...
- 200 fps = 200 Hz +/-5ms
- $gt^2/8$

Integrated sensors



What does the force curve tell?


https://coachtech.fi/player.php?x +
 coachtech.fi/player.php?q=2

mass [kg]		performance		COP [cm]		power [W/kg]				
BW	extra	index		trace I		1/3	max	-200_net	avg Conc.	avg Ecc.
70.64	14.0/42.0	24.1		114.2		12.2	27.3	-15.8	15.9	8.5

mass [kg]		performance		COP [cm]		power [W/kg]				
BW	extra	index		trace I		1/3	max	-200_net	avg Conc.	avg Ecc.
70.69	14.0/42.0	24.7		158.6		13.2	27.5	-15.9	16.5	8.6

jump [cm]		Duration [ms]		Force [N]		Impulse [Ns]		speed [m/s]
height	total	Conc.	Ecc.	Peak	Rel.	Conc.	Ecc.	max
37.8	765	298	468	1093	15.5	192	116	2.77

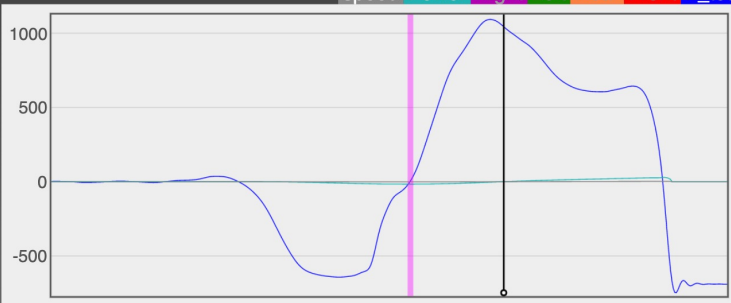
jump [cm]		Duration [ms]		Force [N]		Impulse [Ns]		speed [m/s]
height	total	Conc.	Ecc.	Peak	Rel.	Conc.	Ecc.	max
38.4	718	280	438	1227	17.4	194	120	2.80




0.64

One frame back | Play both | One frame forward

Speed: 0.1x | 0.2 | 1x

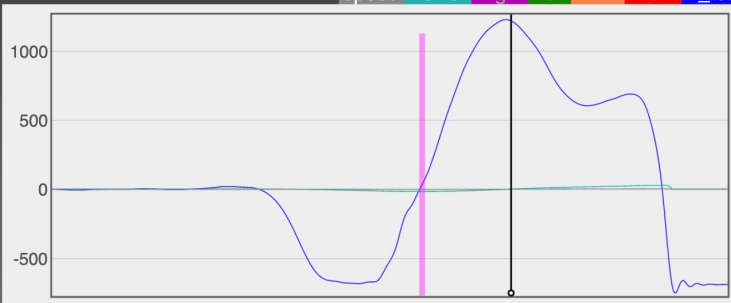




0.65

One frame back | Play both | One frame forward

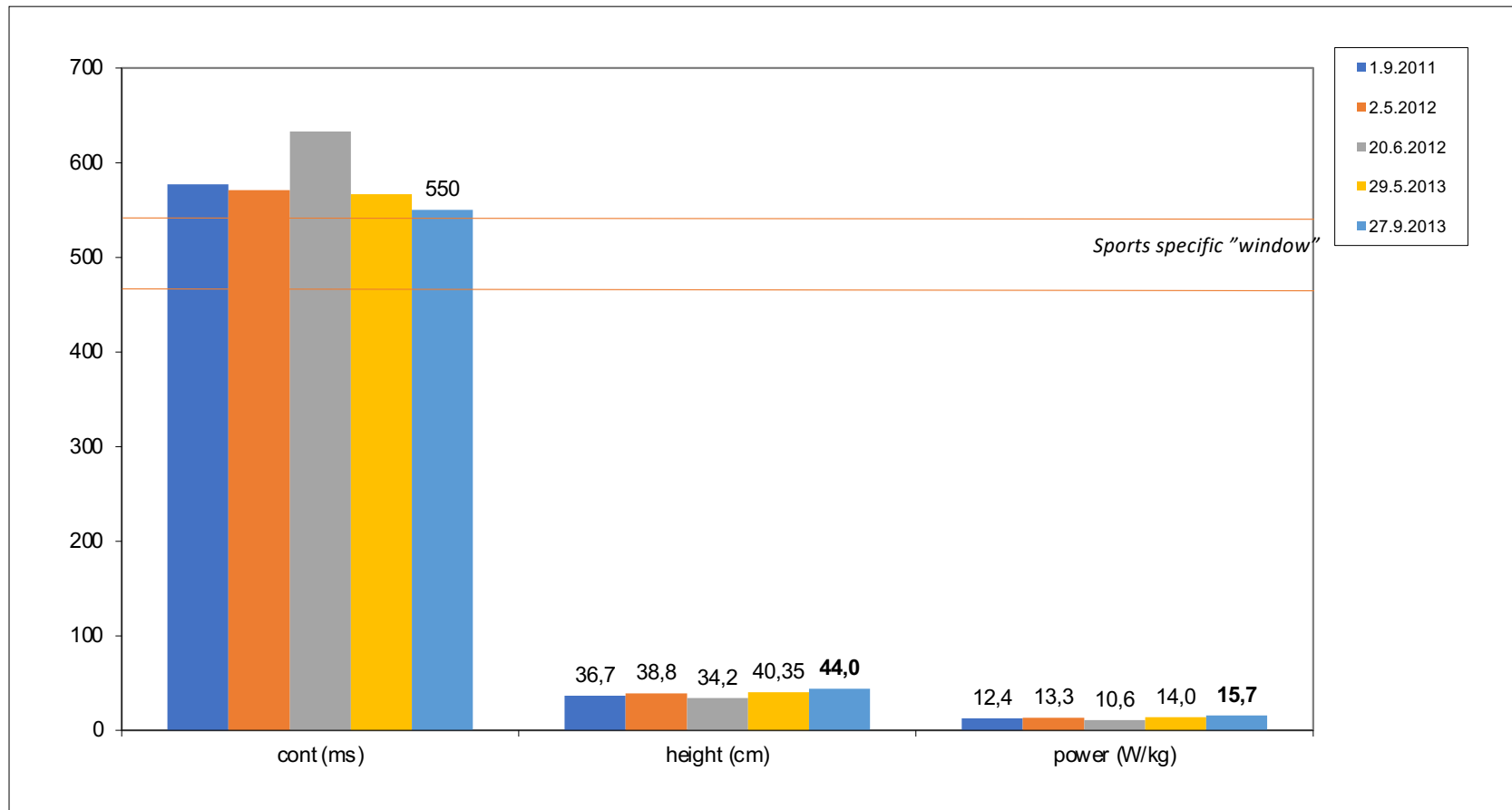
Speed: 0.1x | 0.2 | 1x



Sports specificity



Results – Training process

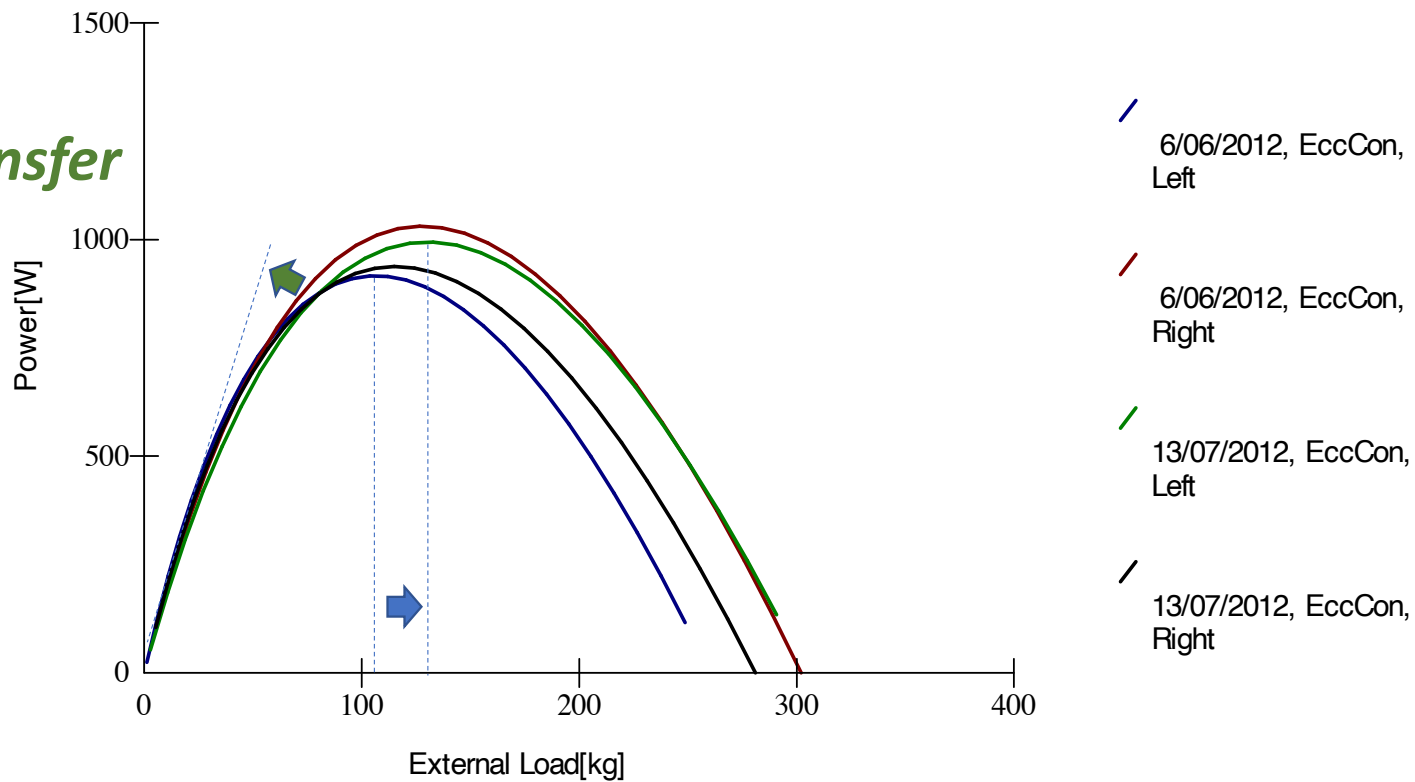


1 Leg Squat

1jalan kyykky

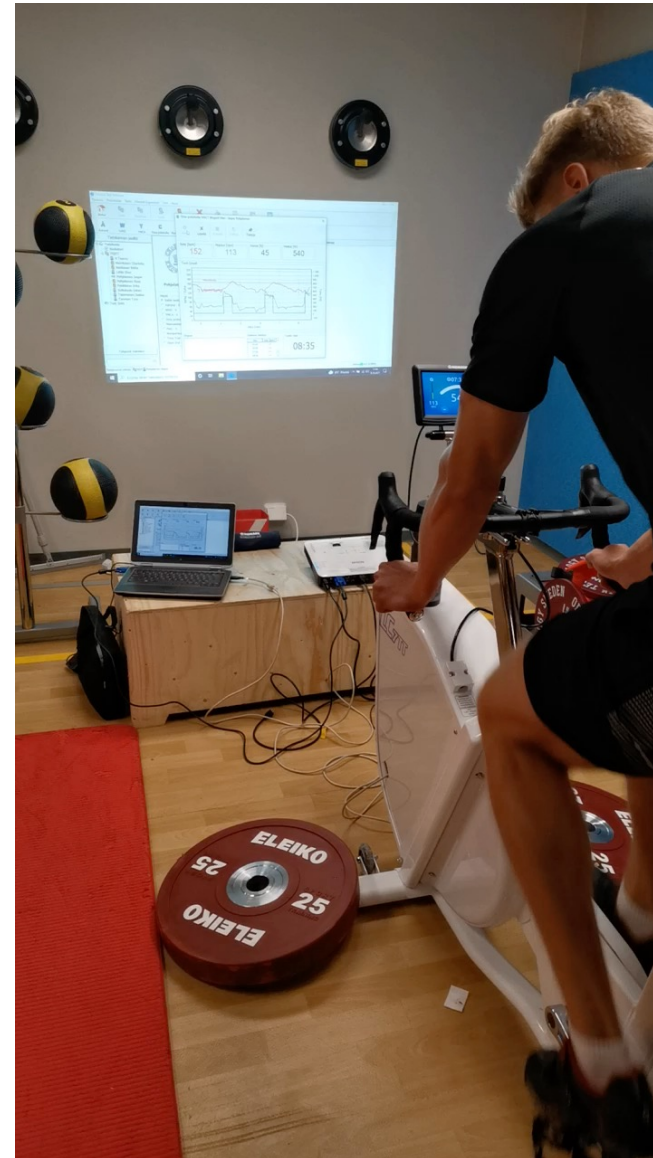
Strength Transfer

Speed Transfer



Speed endurance continuum

- Linear **Speed** 20-30 m
- Repeated Sprint Ability
- Change of Direction (caution with reproducibility!!)
- Speed Endurance
 - Loading Intensity
 - Work time
 - Recovery
 - Loading mode of work
 - Lactate profiling



How to create value for information?

- If it's laboratory or on field measurement -> do **NOT** value the information you get from the measurements
- Respecting principles of **validity, reproducibility and consistency DOES**
 - **Timing of monitoring annual cycle, mesocycle**
 - **Preparedness, level of fatigue**
 - **Monitoring gives you reliable information also on an overreaching state**
 - **Measuring recovery state is ONLY possible measuring PERFORMANCE**

Summary

- There's **NO** difference in **measuring** Strength&Power
- Young athletes ability to perform maximally is still at the developmental phase
- Big individual variation in biological and mental processes
- Need to consider the loading, means of exercise, movements
- Power and speed strength can sometimes replace maximal strength measurements

<https://www.instagram.com/p/CO0LlcZHuBW/>

Thank you!