

Tennis Europe

Department of Sport Science and Kinesiology

UNIVERSITY of SALZBURG

Speed & Precision of the Groundstrokes in High Performance Tennis



European Coaches Symposium 2008

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The best players in the history of Tennis

THOMAS

??? WHY ???

Muster



**“The biggest achievement of my coach was to let me play the way I was playing.”
(BJÖRN BORG)**



Knudson 1997

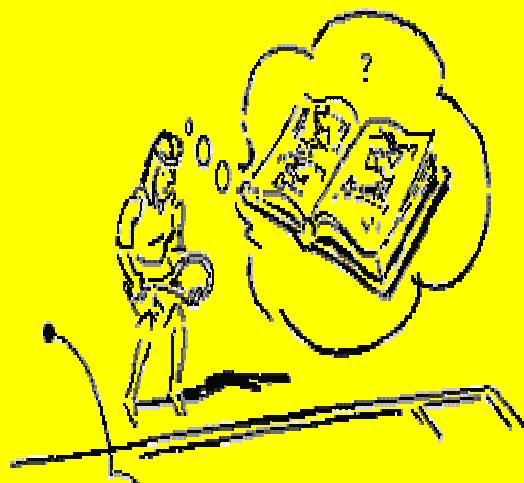


Figure 3 - Too much intervention may cause paralysis by analysis in the athlete.



**Before we can prescribe
the right medicine, we
have to know the illness
first!**



Today's game

Mercedes-Benz

...Play of the week



Today's game

"The player's ability to consistently hit the ball with immense power is a distinguishing feature of the modern game..."

Crespo/Higuera 2001

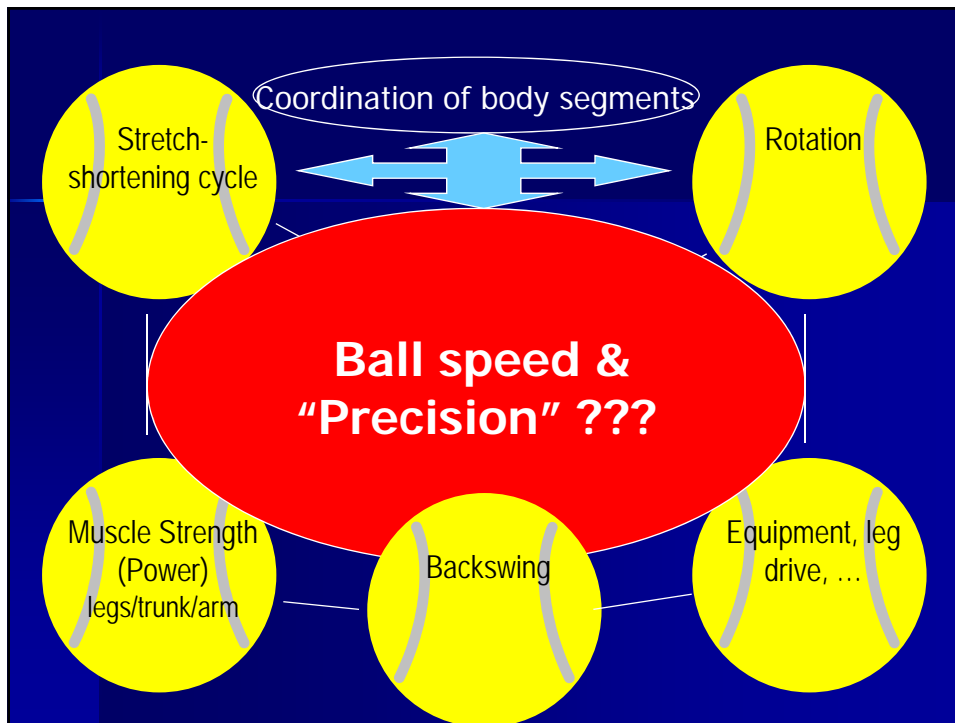


Success in Tennis?

- Success in tennis requires a mix of player talent, good coaching, appropriate equipment, and an understanding of those aspects of sport science pertinent to the game.

(ELLIOT, Biomechanics and Tennis, Bjsm, 2006)





Questions

- What distinguishes the professional player from the competitive player?
- Speed + Precision – decisive /key factors?
 - Do prof.players hit harder and/or more precise?
- What are decisive technical or kinematic aspects that make the difference?
- Performance models for coaches ? (stroke improvement in theory and practice)



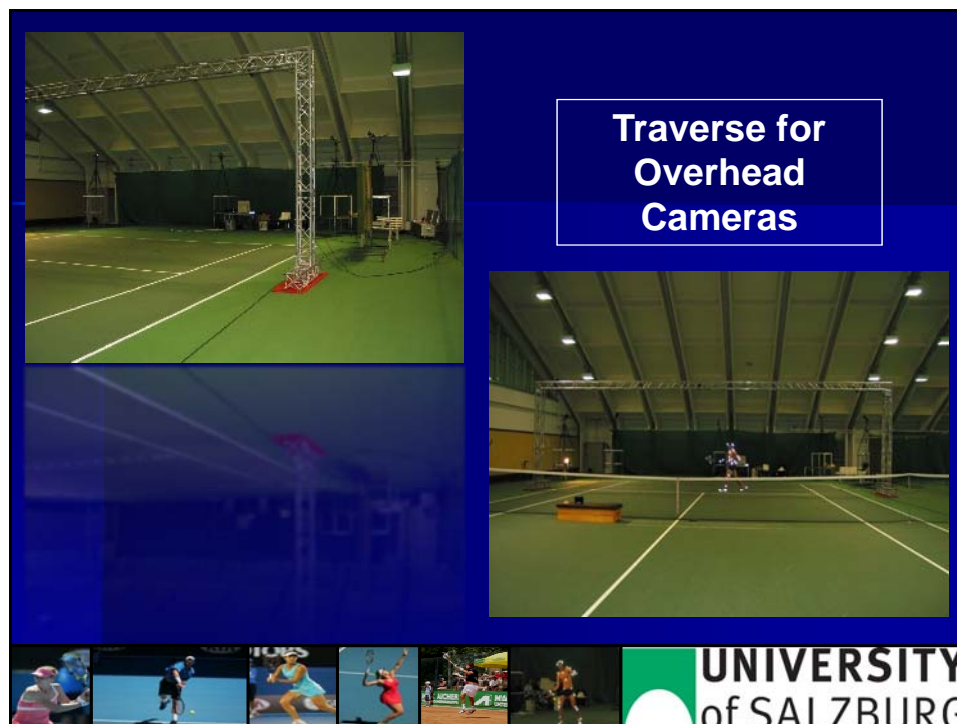
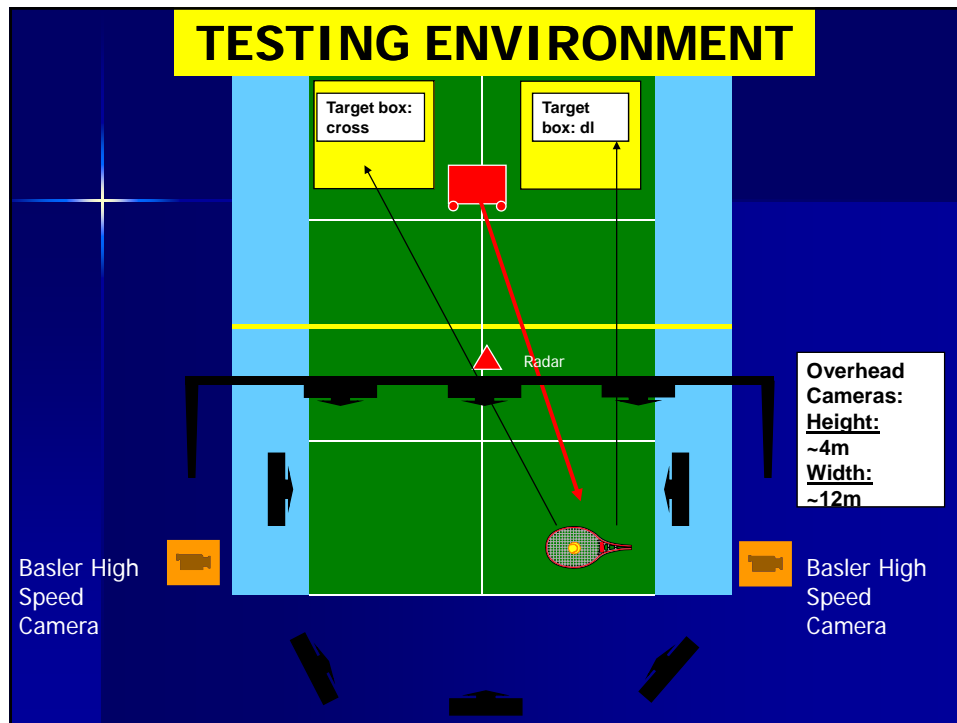


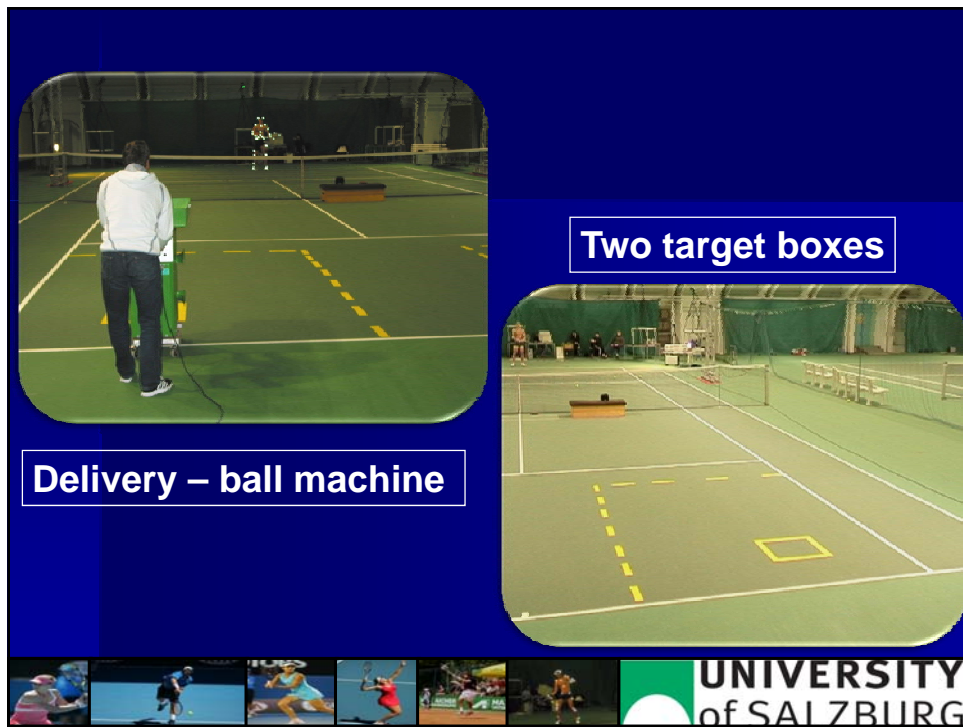
Methods

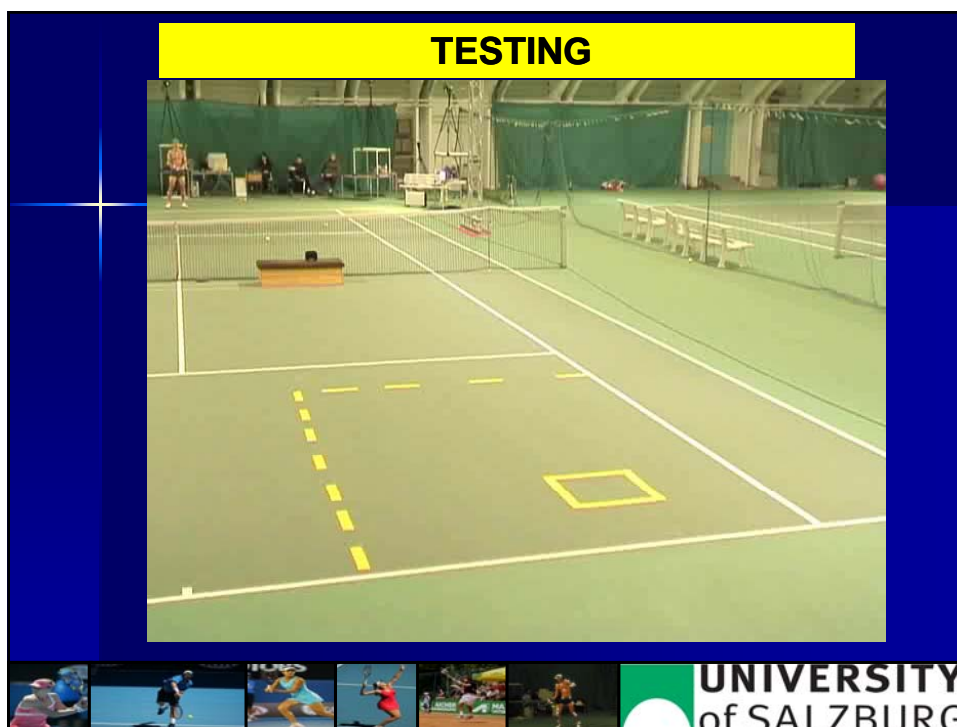
- Subjects: 17 (8 active/former professional players and 9 competitive youth/high performance players)
- Age: 16-27

Test design

- Test-Task: FH/BH crosscourt/down the line (as fast & precise as possible to target area); 4 series a 20 balls
- Data capture: Vicon motion analysis system, 8 infrared cameras, 400Hz; (recording 43 retro-reflective marker trajectories)
- Basler High Speed Kamera: (impact)
- Radar: ball speed
- Sony DV Camera: Precision



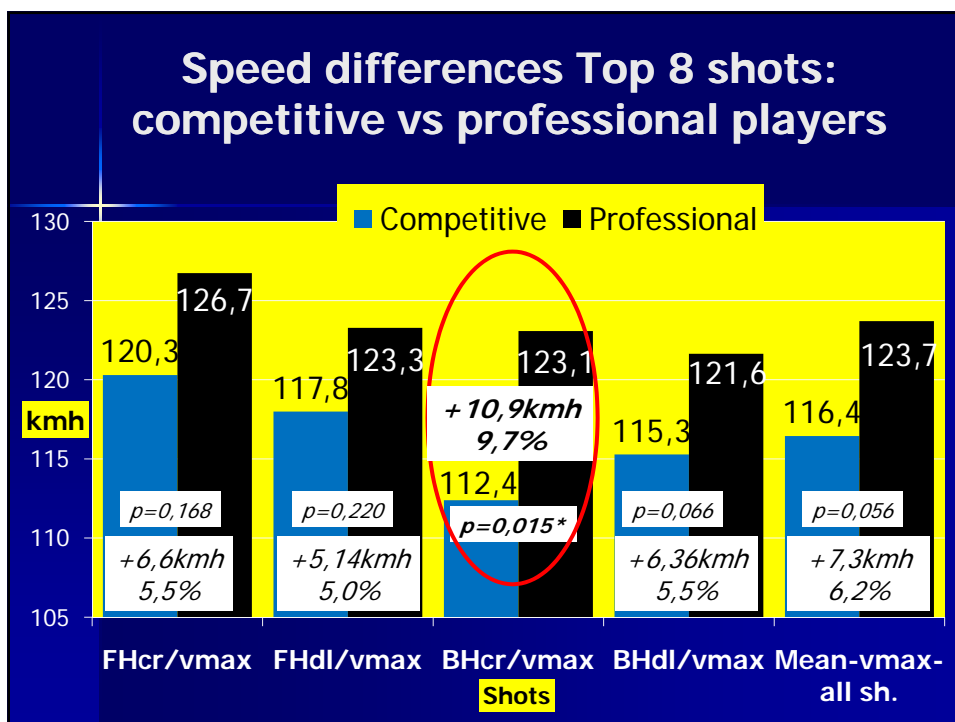


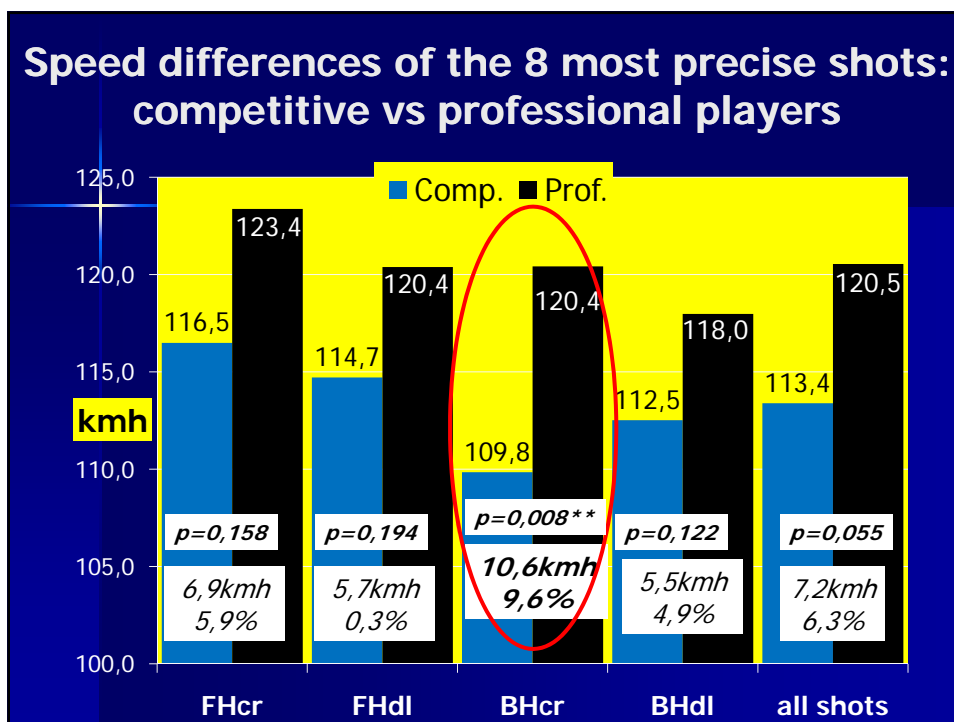
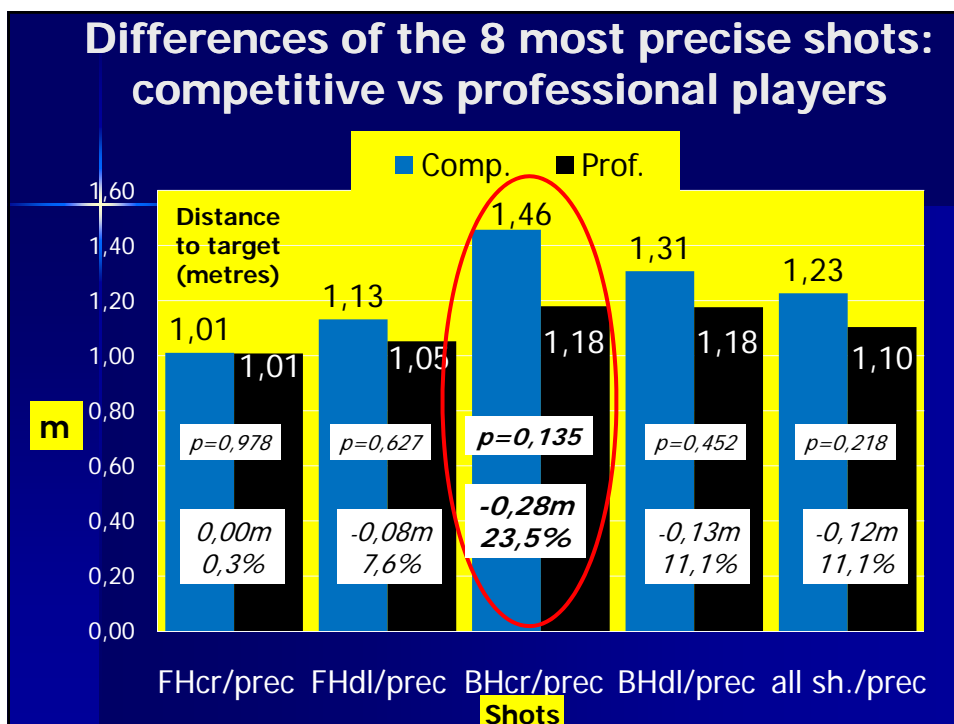


What was analysed?

STEP 1

- Vmax of top8 shots: FH/BH cr./dl
- Mean Vmax of all top8 shots
- The 8 most precise shots: FH/BH cr./dl
- Mean Precision of all the most precise shots
- Vmax of the 8 most precise shots: FH/BH cr./dl
- Mean Vmax of all the most precise shots





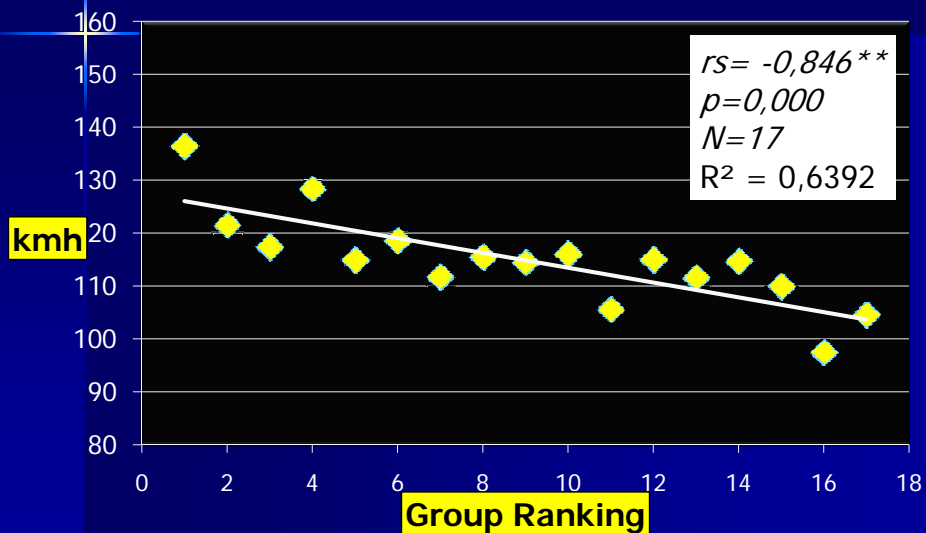


Correlations with ranking

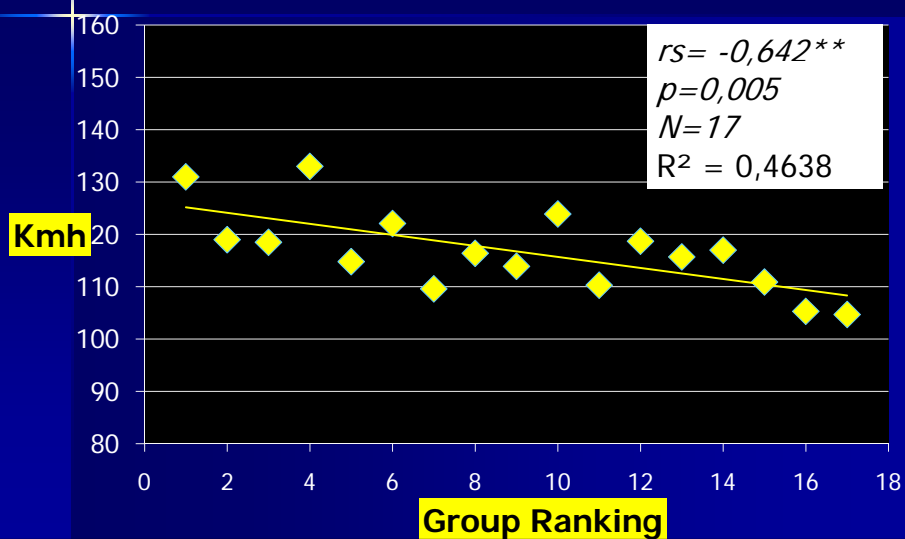
vmax = max. velocity; **prec.** = precision; **all sh.** = all shots
FH/BH-cr./ll = forehand /backhand cross-court/longline

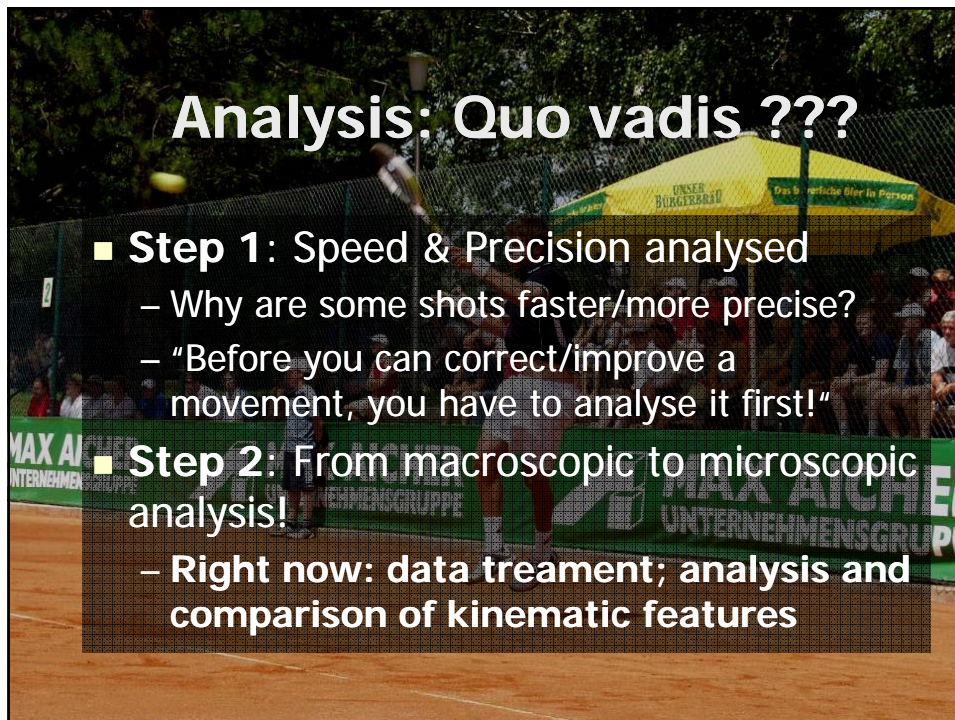
	vmax- vmax-prec.- -FH-II FH-II		vmax- vmax-prec.- -BH-cr BH-II		vmax- vmax-prec.- -BH-cr Bh-II		vmax- vmax-prec.- -BH-cr BH-II		Mean- vmax- vmax-prec.- all sh. all sh.		Mean- vmax- vmax-prec.- all sh.
rs	-0,492*	-0,574*	-0,775**	-0,615**	0,508*	0,495*	-0,559*	-0,846**	-0,642**	-0,642**	0,500*
p	0,045	0,016	0,000	0,009	0,037	0,043	0,020	0,000	0,005	0,005	0,041
n	17	17	17	17	17	17	17	17	17	17	17

Correlation: vmax of the 8 most precise BH-cross shots & Ranking



Correlation: vmax of all the most precise shots & ranking





Analysis: Quo vadis ???

- **Step 1: Speed & Precision analysed**
 - Why are some shots faster/more precise?
 - “Before you can correct/improve a movement, you have to analyse it first!”
- **Step 2: From macroscopic to microscopic analysis!**
 - Right now: data treatment; analysis and comparison of kinematic features

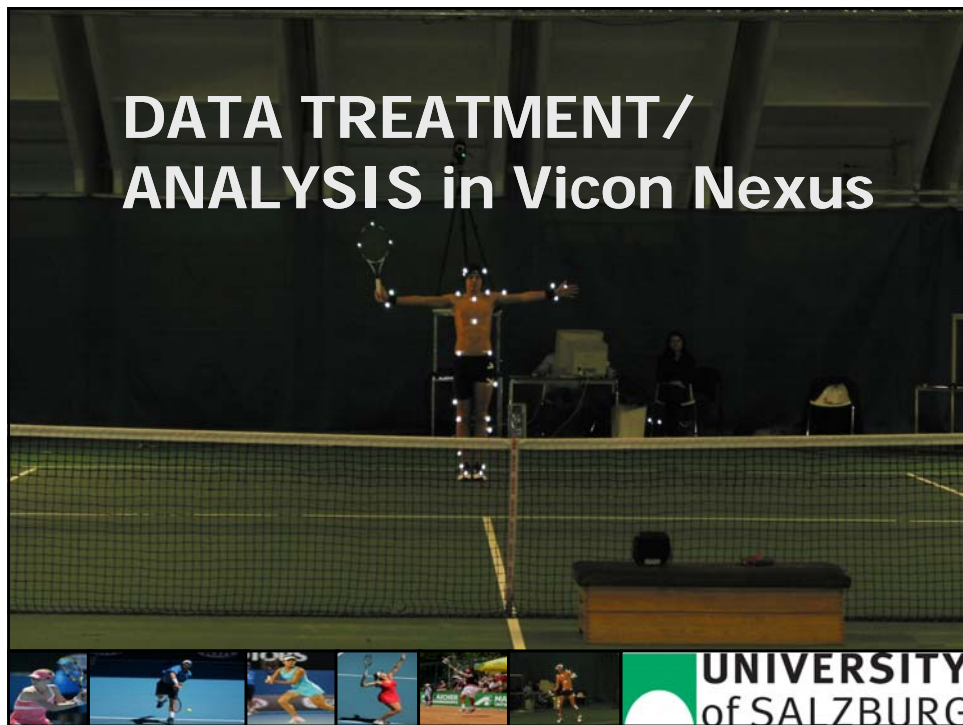
How is this done?

Getting an overview...




ATP Ranking 214

ITF Ranking: 81



Outlook

- **Step 3:** working with kinematic results
 - possible variations in body kinematics in forhand or backhand strokes (separation angle, accelerations, peak velocities or angles of joints, trajectories, ...)
- **Step 4:** creating biomechanical models and practical transfers for coaches
 - New “open” model for FH/BH technique?
 - Support for models that already exist?
 - Practical hints/exercises for shot improvement?

Approximate contribution to impact racquet velocity (%)

	Topspin forehand (forward direction)
Shoulder	15
Upper arm	
Horizontal flexion	25
Internal rotation	40
Forearm	
Extension	negligible
Pronation	negligible
Hand	
Flexion (palmar/radial)	20

Elliot, 2006

Why could all this be useful for Coaches ?

- Only slight yearly improvements in elite sports
- Amount of practice time has come to a limit
- "Quality coaching for the future"

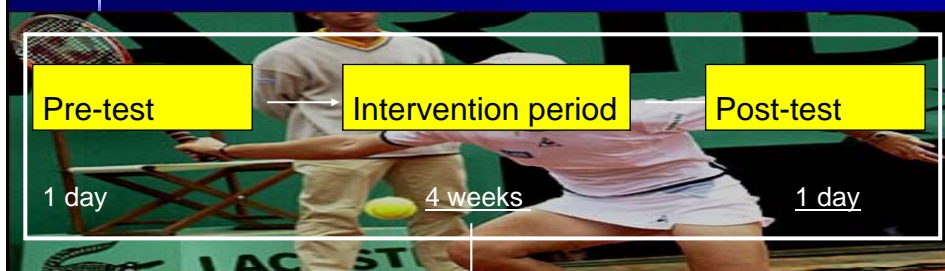
Example for a successful transfer from theory into practice?



Theoretical background “Hypothesis”

“Players with a faster arm are able to generate higher racquet speed”

Evaluation of arm speed training programme



Training-group (6 subjects): 3 sessions a week á ~30min

Control-group (6 subjects): completed regular training

Out of balance concepts

"repetition without repeating"
(Bernstein)

"learning from differences"
(Schoellhorn)

"concept of coordinative
demands" (Neumaier)

Training study: *Results Forehand*

