

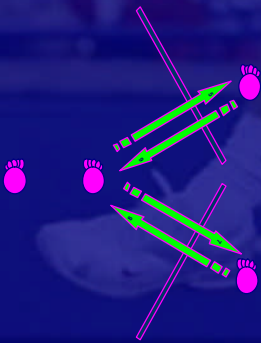


EUROPEAN COACHES SYMPOSIUM

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Differential Coordination and Speed Training for Tennis Footwork



U. BENKO, S. LINDINGER

Department of Sport Science and Kinesiology, University of Salzburg, Austria

Changed DEMAND profile in ELITE TENNIS

Performance density increased – more intensive tournament preparations – increased physical strain during the year

Development towards a more „complete player“

Increased susceptibility to injuries, especially in female tennis

The play has got faster! – Advanced equipment, techniques, increased fitness, etc.



**Claim for increased QUALITY in
coordination / conditioning training**

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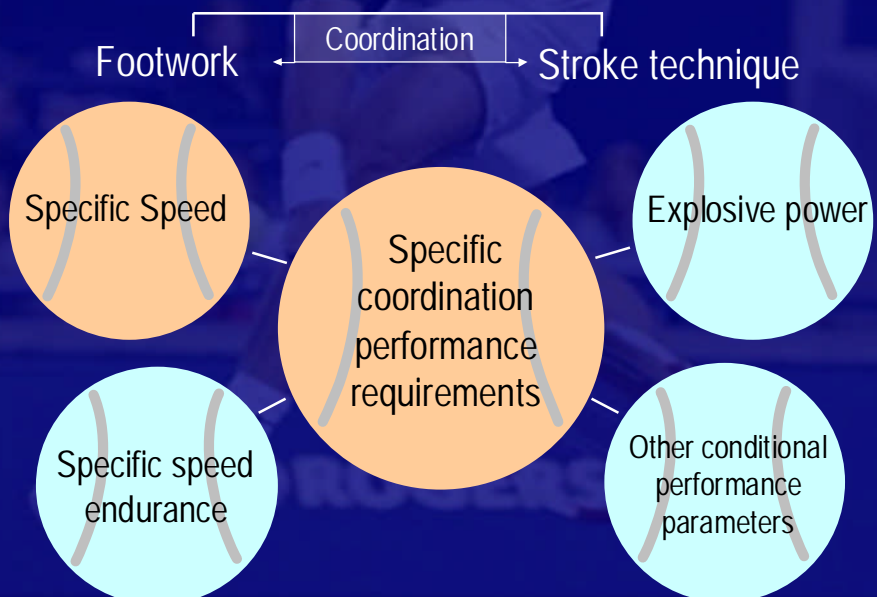


Roger Federer

WHY so successful ?

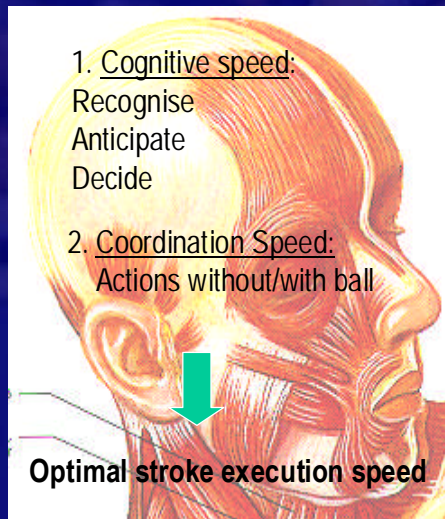
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Complex Demands in Tennis



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Complex Coordination and Speed Demands



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Constant adaption to complex and variable situations/conditions during tennis play



Is it possible for players to control and coordinate footwork and stroke techniques, while under high pressure?

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Complex, combined recruitment of
speed and coordination skills

Optimal methodology/concept for
footwork training?

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FORMER CONCEPTS

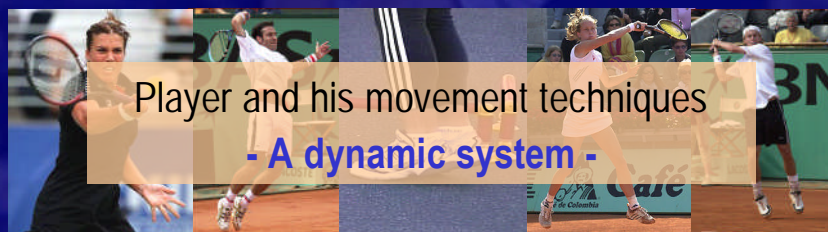
1. e. g. **LADDER**: Training of few and simple rhythms – stabilize and stereotype (programming) ⇒ lack of variation
2. Rather general exercises - lack of specification
3. Rather non-individual - same degree of difficulty for all players
4. Tool of in/decrease of exercise COMPLEXITY seldomly used
5. Training of the essential ability of „Quick ADAPTATION to changing, specific demands in tennis“ neglected

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„New“ ways“?

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Dynamic Systems Approach and Motor Learning (SCHÖLLHORN 1999)



Human being =

self-organising system under variable stimuli conditions within a learning process on the way to the optimal movement solution

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Dynamic Systems Approach and Motor Learning

Variations (= error, instability)
in movement performance are absolute requirements
for self-organising processes

..... and systems which learn!

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Differential Learning

(Schöllhorn 1999)

Perception differences between stimuli ⇒
Key factor giving relevant informations to learning systems



Method of **varied exercises** provokes
1. properly dosed stimuli differences ⇒
2. Pattern distabilisation

⇒ **Learning from differences**

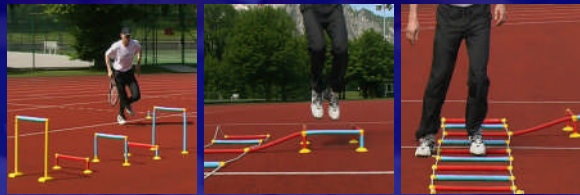
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Differential Learning

An essential characteristic

Relevant learning informations are found in the **transition** between different movement patterns

⇒ e.g. a change between **jump, sprint, step** patterns



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Principles of Variation

ONE BASIC MOVEMENT (e. g. shuttle run) and
VARIATION in 3 ASPECTS

1 MOVEMENT

Space, time, & force:

- deep/high body position
- big/small steps
- starting position
- sprint vs. slow motion
- with / without arms (racket,...)
- smooth (silent) vs. hard (loud) touch down
- small vs. large flex./exten. ROM
-

2 FEEDBACK

Variation of

- visual (glasses, closed eyes)
- acoustic (ear plugs)
- kinesthesia (socks,...)
- statico-dynamic (balance) (run-jump,...)
- conditions

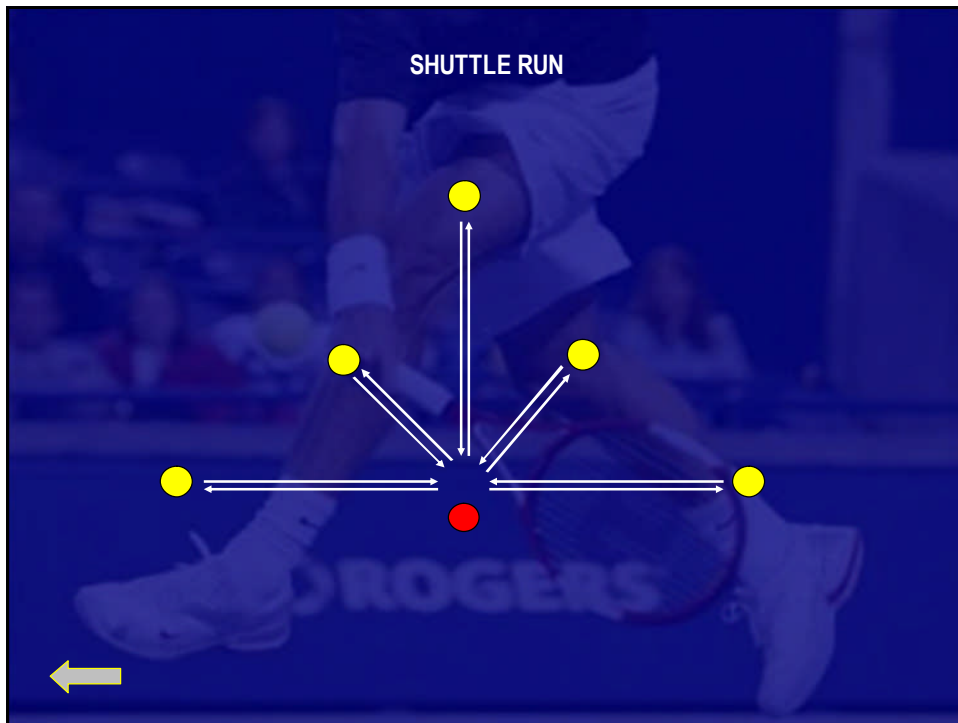
3 gen. CONDITIONS

Variation of

- surface (asphalt, grass, clay..... wet/dry)
- shoes (shoelaces open/closed; diff. shoes)
- resistance (weight vest, bungee rope,...)
- running distances
- etc.

**GOAL: provide PERCEPTION DIFFERENCES
by pattern transitions !!!**



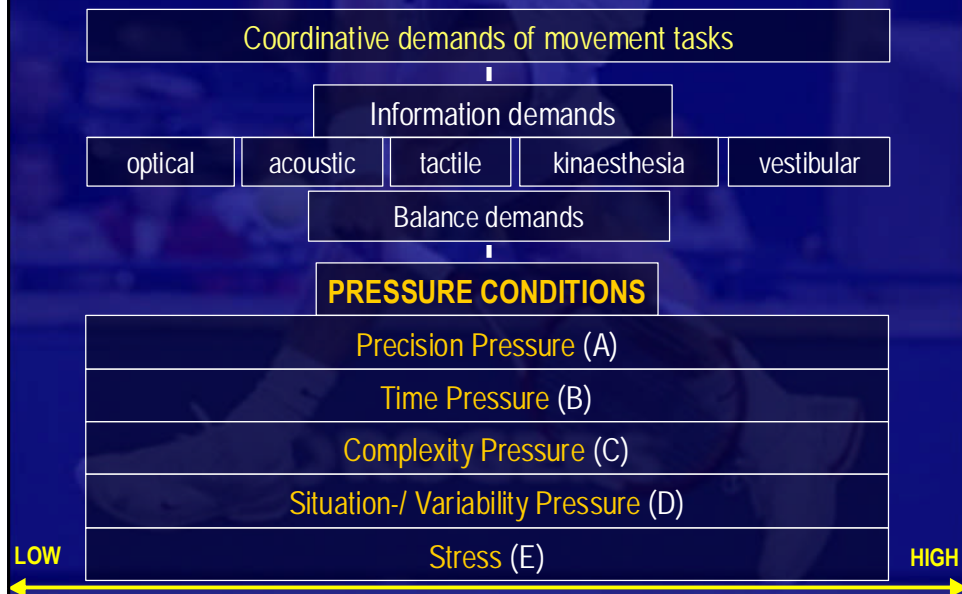


VARIATION of DEMANDS
= **KEY FACTOR** for *specific adaptation!*

Which methodological **APPROACH** provides a high degree of possibilities to **VARY** exercises?

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CONCEPT of **categories of coordinative demands/tasks**
(ROTH 1998, NEUMAIER 1999)



1. Precision Pressure

Increasing the demand on the player's ability to **master controlled movements** (ROTH 1989), i.e.

Change of demands on **result/target precision** and/or **precision of movement execution**

2. Time Pressure

(NEUMAIER/KLEIN 1991)

TIME PRESSURE or SPEED DEMANDS

Beginning of a movement
(reaction speed)

During a movement
(action speed)

Combination of both exercise categories possible and useful !!

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3. Complexity Pressure

(NEUMAIER 1999, KOCH/KNOPP 1987,...)

Increased **TASK COMPLEXITY:** Changing demands on

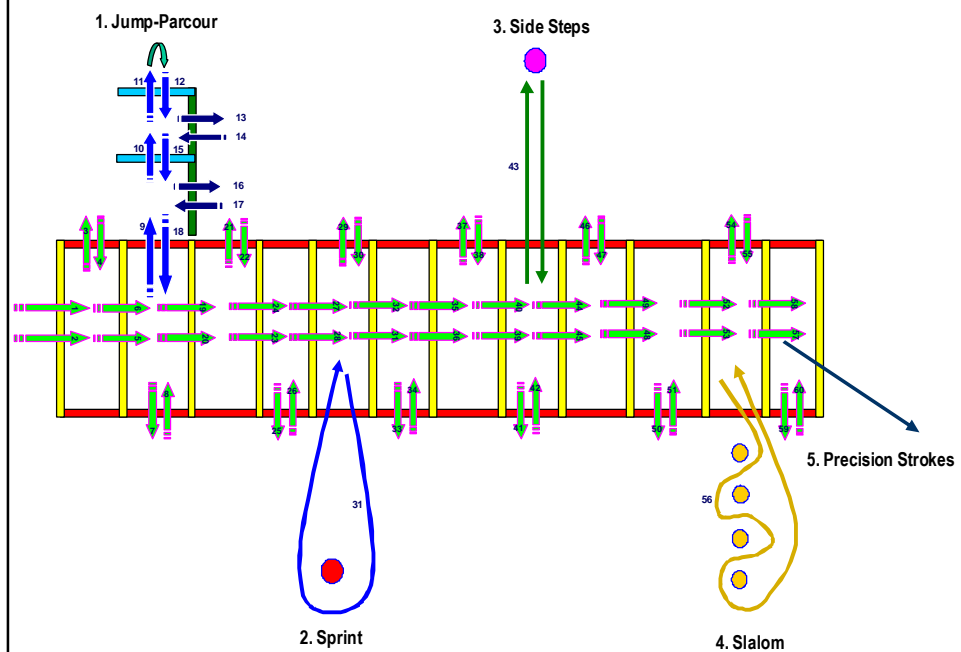
Simultaneous coordination
(simultaneous performance of additional
movements)

Successive coordination
(transition between different
movements)

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Simultaneous coordination
(simultaneous performance of additional movements)
e.g. TAPPING

Successive coordination (transition between different movements)



4. Situation/Variability Pressure

strongly related to **variability** and **complexity** of environmental conditions and/or situations

- ☺ Variability and complexity of environmental conditions during movements determines the **demands mainly on the ability movement adaptation** ! (bei ROTH 1998)
- ☺ Anticipation of changing environmental conditions can be either **more or less difficult**, depending on the movement task
- ☺ Complexity of situations according to the **number** and **diversity** of environmental characteristics (opponent, ball, light, wind, ground, audience...)

Principles of Variation

1 MOVEMENT – 2 FEEDBACK - 3 GENERAL CONDITIONS

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5. Stress

PHYSICAL STRESS:

Strong **correlation** between **coordination** and **physical requirements** in tennis competitions

⇒ *footwork* (coordination) *training* also in *fatigued situations*



PSYCHOLOGICAL STRESS:

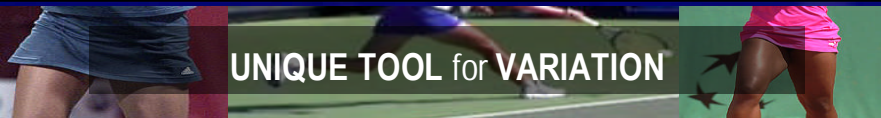
Coping perception, control and concentration processes under **competition stress**:

⇒ Increase risk of failure by performing exercises with an opponent
– „**STRESS TRAINING**“ ! (different to Time Pressure)

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PSYCHOLOGICAL and PHYSICAL STRESS

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UNIQUE TOOL for VARIATION

EXERCISE + different **COUPLINGS** of

- 1) INFORMATION DEMANDS and
- 2) PRESSURE CONDITIONS



Inexhaustible
POOL of VARIATION
possibilities

EXAMPLE:

60 exercise variations resulting from the coupling of
1 info-condition + 1 pair of pressure conditions

O + AB	A + AB	T + AB	K + AB	V + AB	B + AB
O + AC	A + AC	T + AC	K + AC	V + AC	B + AC
O + AD	A + AD	T + AD	K + AD	V + AD	B + AD
O + AE	A + AE	T + AE	K + AE	V + AE	B + AE
O + BC	A + BC	T + BC	K + BC	V + BC	B + BC
O + BD	A + BD	T + BD	K + BD	V + BD	B + BD
O + BE	A + BE	T + BE	K + BE	V + BE	B + BE
O + CD	A + CD	T + CD	K + CD	V + CD	B + CD
O + CE	A + CE	T + CE	K + CE	V + CE	B + CE
O + DE	A + DE	T + DE	K + DE	V + DE	B + DE

Methodical Principles:

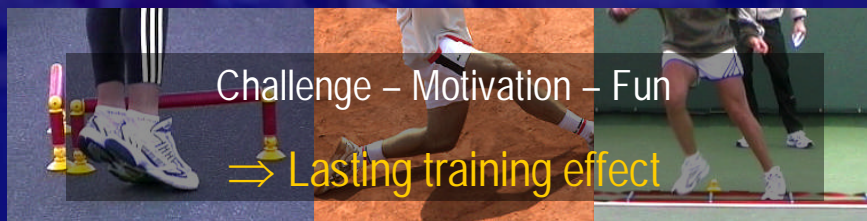
- 1 New and uncommon exercises (faster adaptations to varying demands)

The motto is: ‘Repeating without repetition’ (Bernstein 1988) !

- 2 Repeat an exercise **only until** the quality of the movement is **solid and stable!**
- 3 Various levels of difficulty („critical“ = according to the performance level) ⇒ **constant instabilities**

Methodical Principles:

4 Demanding exercises help athletes to stay alert and get effectively stimulated



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KEY BENEFITS of

Differential Learning + Pressure Conditions Concept

- ⇒ Repertoire of motoric solutions increases ⇒ development of **fast & flexible adaptation** to **steadily changing demands** during the match vs. **stereotyping of patterns** (drill)
- ⇒ High **VARIABILITY** of tasks and **MOVEMENT TRANSITIONS** creates **specific motor learning potential** (SELF-ORGANISATION)
- ⇒ Concept demands coaches' creativity and provides a tool to develop exercises (vs. pure exercise collection)
- ⇒ Footwork training can be easily adapted to individual coordination level
- ⇒ Exercises difficulty adjustable by various information and pressure demands

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Categories of complex footwork training methods for tennis specific coordination/speed

1. **Frequency-speed-training:** Tapping exercises combined with specific tasks
2. **Action speed training** (combined step exercises, sprints and jumps)

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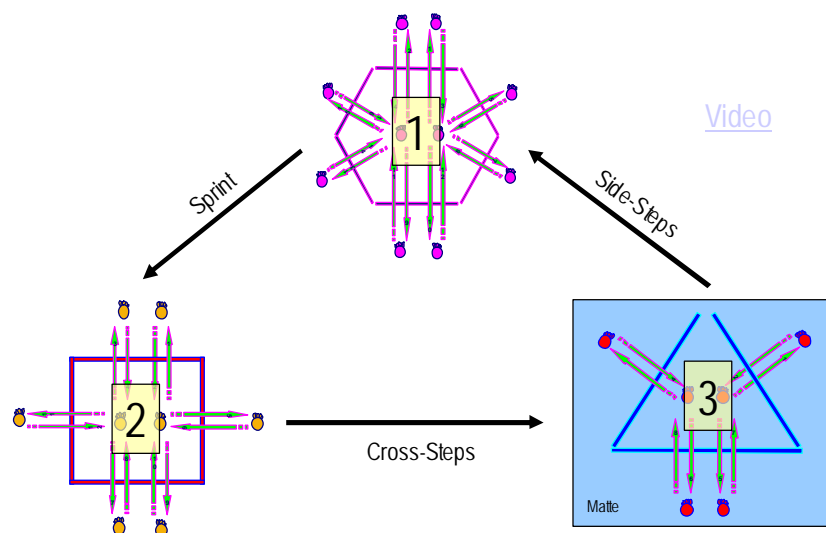


2. Action speed training (step exercises, sprints and jumps)

- 1 Step-rhythms on the spot
- 2 Step-rhythms through the agility ladder combined with tennis specific movements
- 3 Specific jump and sprint coordination with increasing levels of difficulty
- 4 Exercises for reaction- and explosive speed combined with complex step exercises (agility ladder) and stroke tasks (=precision pressure)

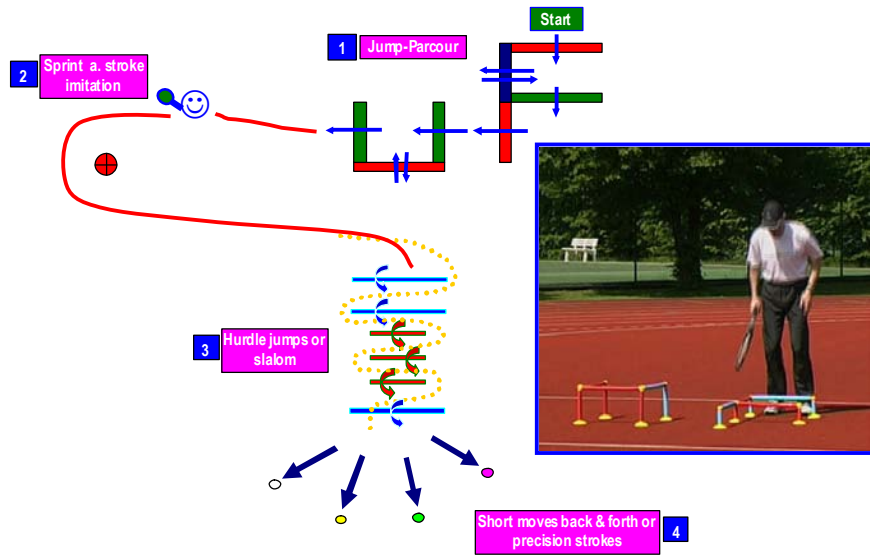
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1 Step-rhythms on the spot



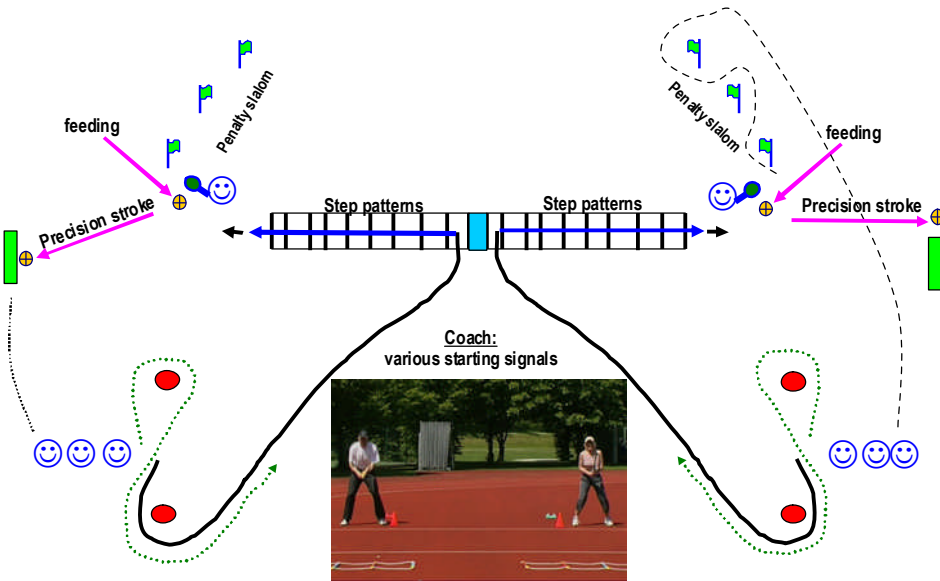
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3 Specific jump and sprint coordination with increasing levels of difficulty



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4 Exercises for reaction- and explosive speed combined with complex step exercises and stroke tasks



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CONTACT:

Dr. Ulrike BENKO & Dr. Stefan LINDINGER
Department of Sport Science & Kinesiology
University of Salzburg
Rifer Schlossalle 49, A-5400 Rif/Hallein
ulrike.benko@sbg.ac.at
stefan.lindinger@sbg.ac.at

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