



Orienteering Performance – Limiting Factors and Training



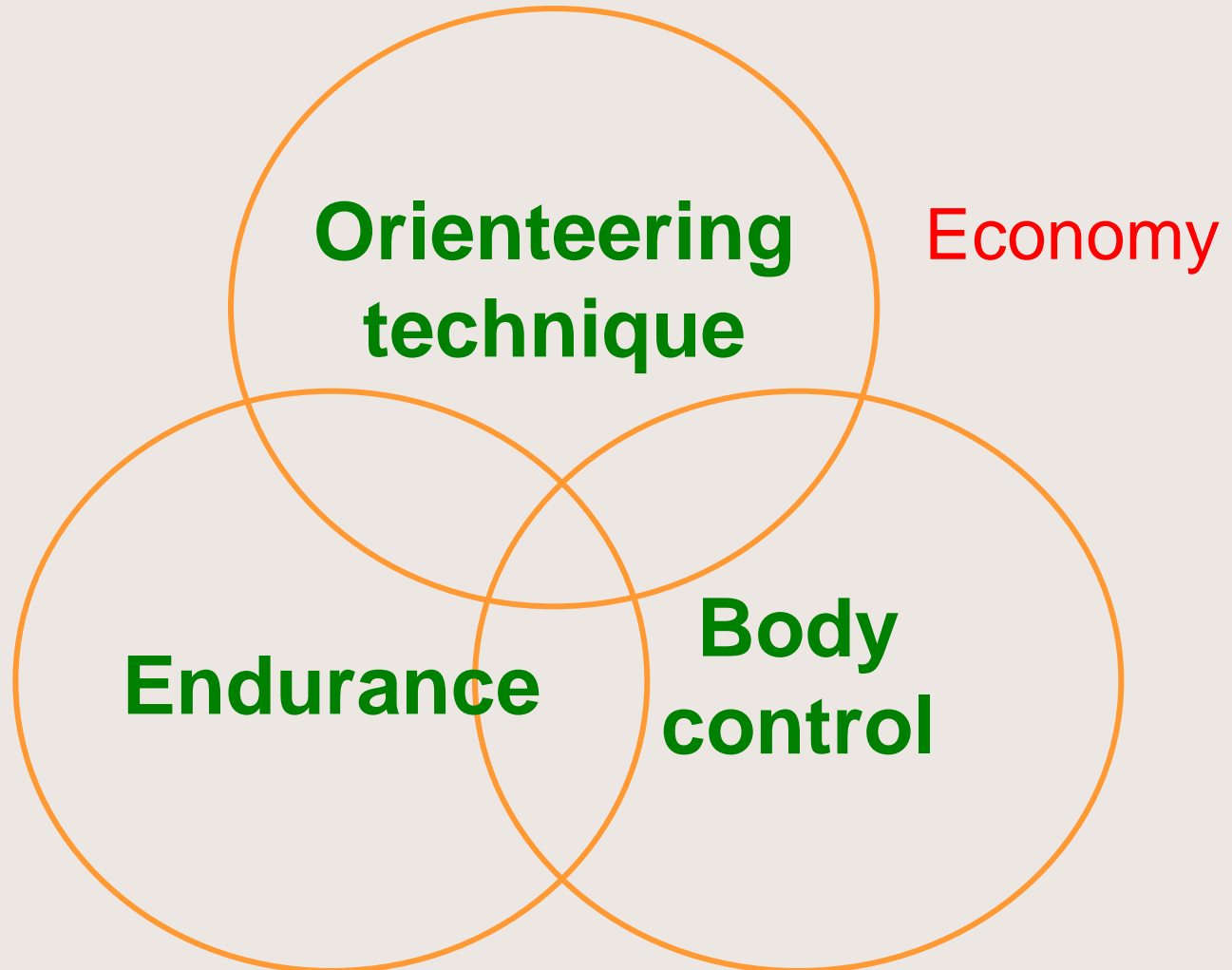
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Three Main Areas of Orienteering

Performance



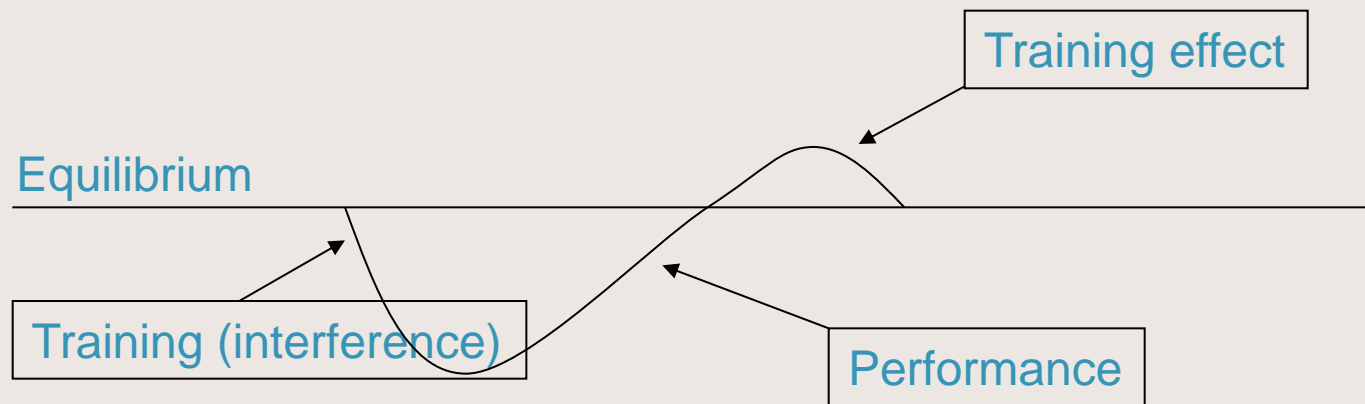


Most Important Theories of Training

- **Adaptation:** the body adapts to current conditions (homeostasis = steady state, equilibrium)
- **Super-compensation:** training impulse (perturbation of homeostasis) => rest and training effect
- **Changing training impulse:** continuous improvement by continuously changing training
- **Incremental learning:** view → new experience → new view
- **Flow state:** balance between ones own ability and the challenges

Super-compensation

- With regular training & compensation average performance improves for about 3...6 months
- How to use it during the week:
 - time the next hard training for maximum gain at the super-compensation peak → listen to your body
 - time peak performance for important competitions



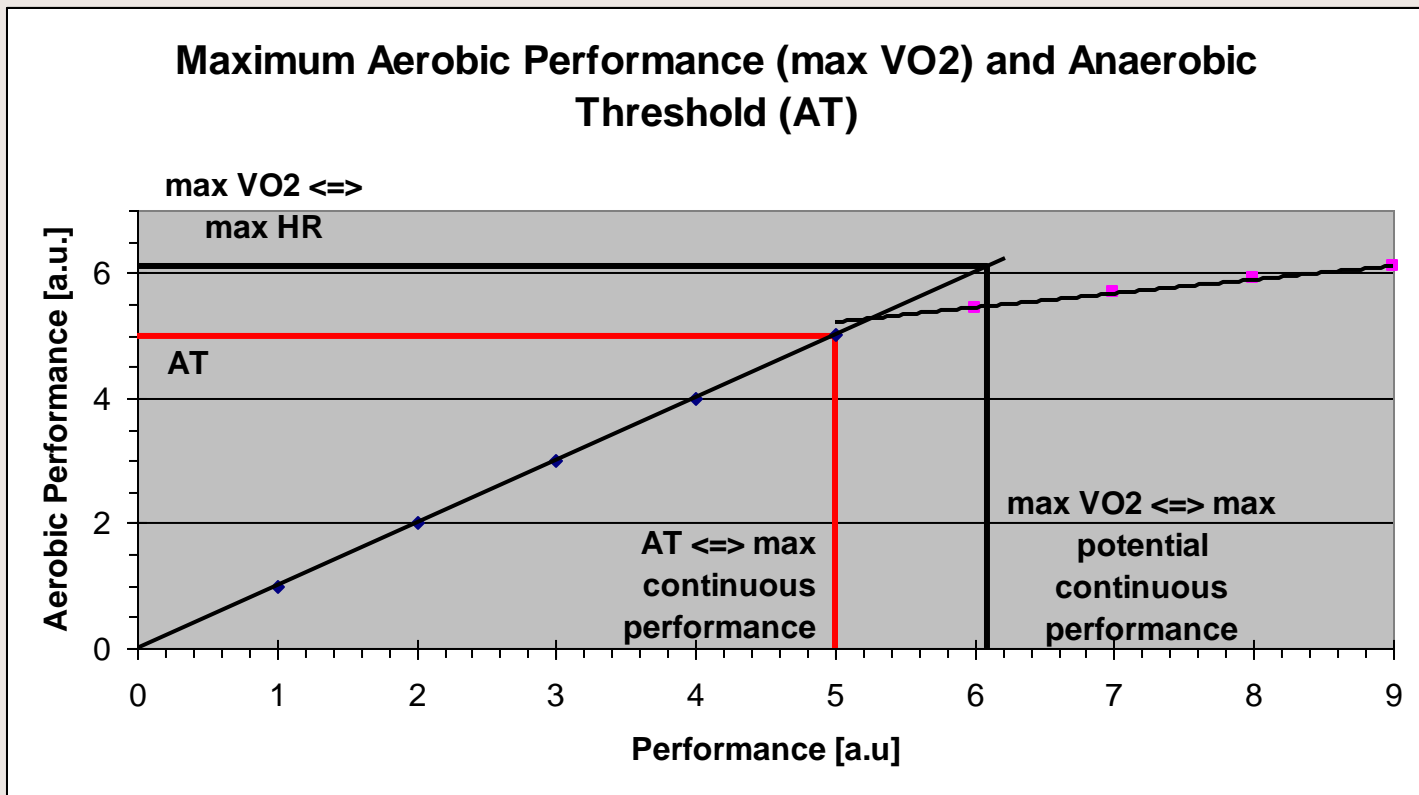
Training Principles

- Training breaks homeostasis => body compensation / super-compensation during enough recovery => new level of performance => next hard training ...
- Continuously training with large variety and continuously changing training for maximum continuous development
- Regularly inserting massive training blocks (training camps, multi-day competitions) to even more break homeostasis and generate performance leaps

Training Long Term Capacity – The Fundament of Endurance Sport

- Long term capacity is best trained with long (2...3 times competition time) endurance training at or slightly above the Aerobic Threshold (AeT) – the level, where the aerobic machinery is fully awake and the level of lactate is at its minimum in the body
- AeT corresponds to about 60% of max HR
- Good training options are e.g. cross-country skiing, walking in terrain with map, jogging or bicycling
- The food intake is also important for improving long term capacity, e.g. remember to eat fat
- A well trained athlete with optimum food mix has much higher fat burning rates at much higher performance levels
- This training should normally be 70...90% of the total and is needed to be able to make high intensity training

Aerobic Capacity



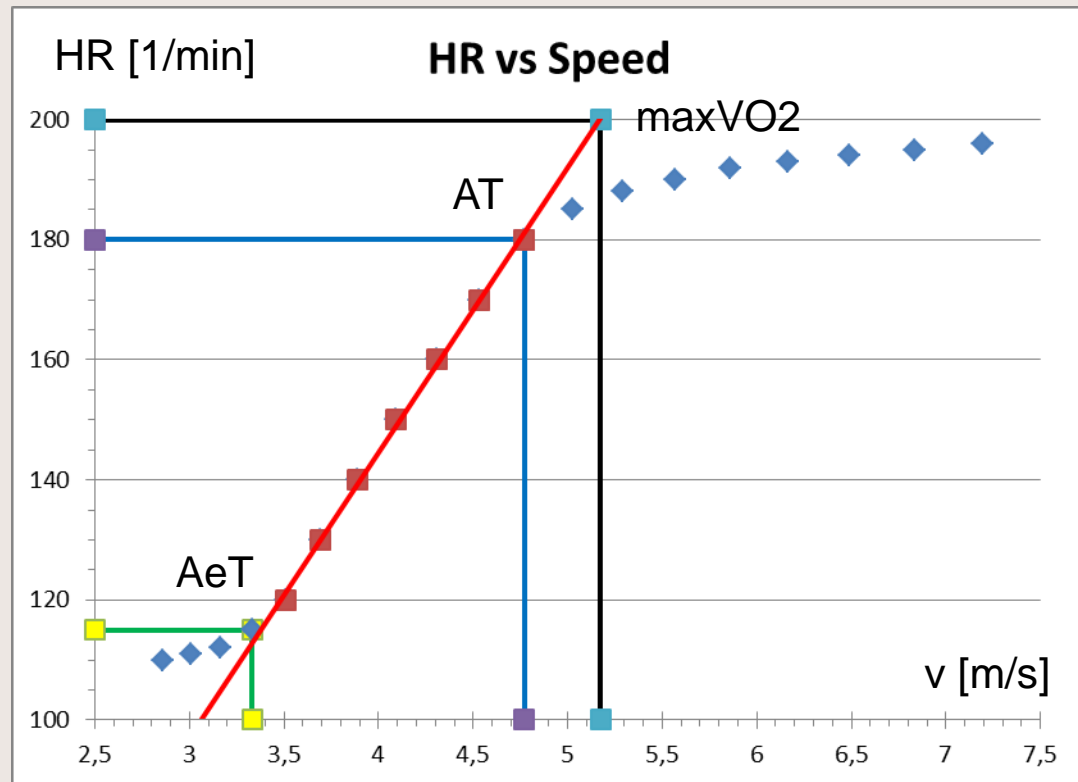
Maximum Aerobic Capacity determined by the amount of oxygen delivered to the muscles – maximum continuous performance determined by Anaerobic Threshold

Anaerobic Threshold

- Anaerobic Threshold (AT) is the point, from which onwards the aerobic energy conversion system does not anymore fully correspond to the power needed in the muscles and the non-aerobic energy conversion leads with time to accumulation of lactate
- AT determines the level at which you can continuously work in e.g. a sprint or middle distance competition

How to Measure Anaerobic Threshold

- Standard measurement using lactate level vs. speed (expensive, inaccurate and not suitable for field test)
- Modified Conconi method (easy, robust and low cost):
- 200m intervals
- good recovery
- linear range = aerobic range from AeT to AT
- max. VO₂ at max HR



Training VO2

- Max VO2 can best be trained with maximum hypoxia training sessions – easiest to train with max speed intervals with short recovery
- AT, i.e. maximum usage of max VO2, is best trained by massive hypoxia training – easiest to train with sub-maximal intervals with high level of repetitions (=> long duration 1...1.5h) or sub-maximal endurance training (1...1.5h)
- One can adjust the effective level by altering the relative length of recovery
- High speed intervals also improve running technique

Training Running Economy

- Running economy is determined by having trained the nervous system for right motion and reflexes, having the strength in the central body to keep right motion over time and having enough muscular flexibility for efficient motion
- The nervous system can best be trained by running at high tempo (short intervals), higher than in competitions, taking into account right posture and motion as well as with coordination exercises – a large number of repetitions for automating the right motion
- Soft surface or uphill training for leg strength and gymnastics for body strength and flexibility will take care of the rest

Physical Development



- Running speed development (AT1 -> AT2 -> AT3) as a result of increase in max VO₂, running economy and Anaerobic Threshold (% max VO₂)

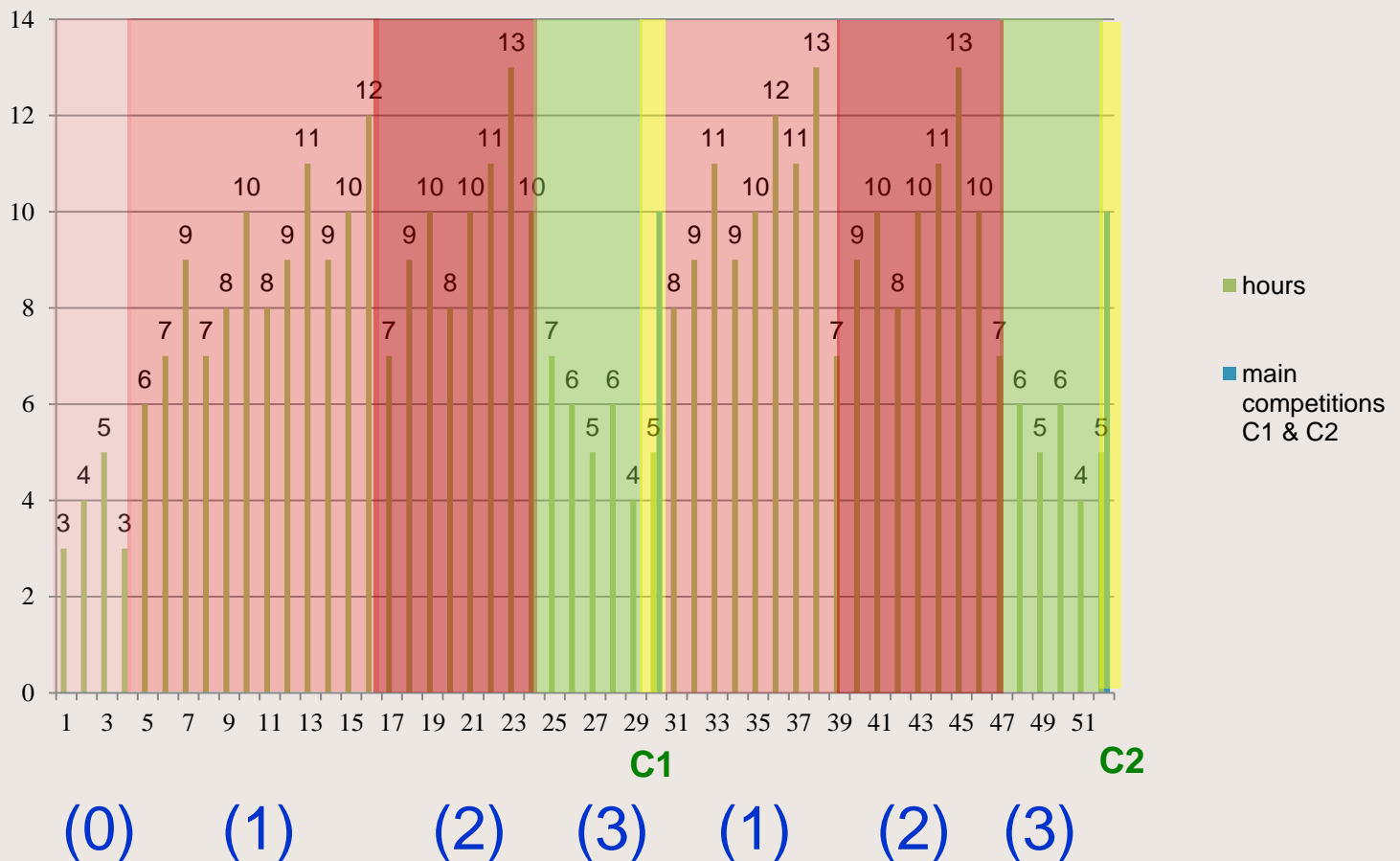
Long Term Capacity – The Fundament of Endurance Sport

- In a performance (and training) longer than about 30...40 minutes other factors in addition to AT start to play a role
- These include e.g. how you can use the energy stored in the body – sugar and fat, how you can handle your liquid and salt levels and how you can take in new energy



Training Year Weekly Hours

Total 426 hours

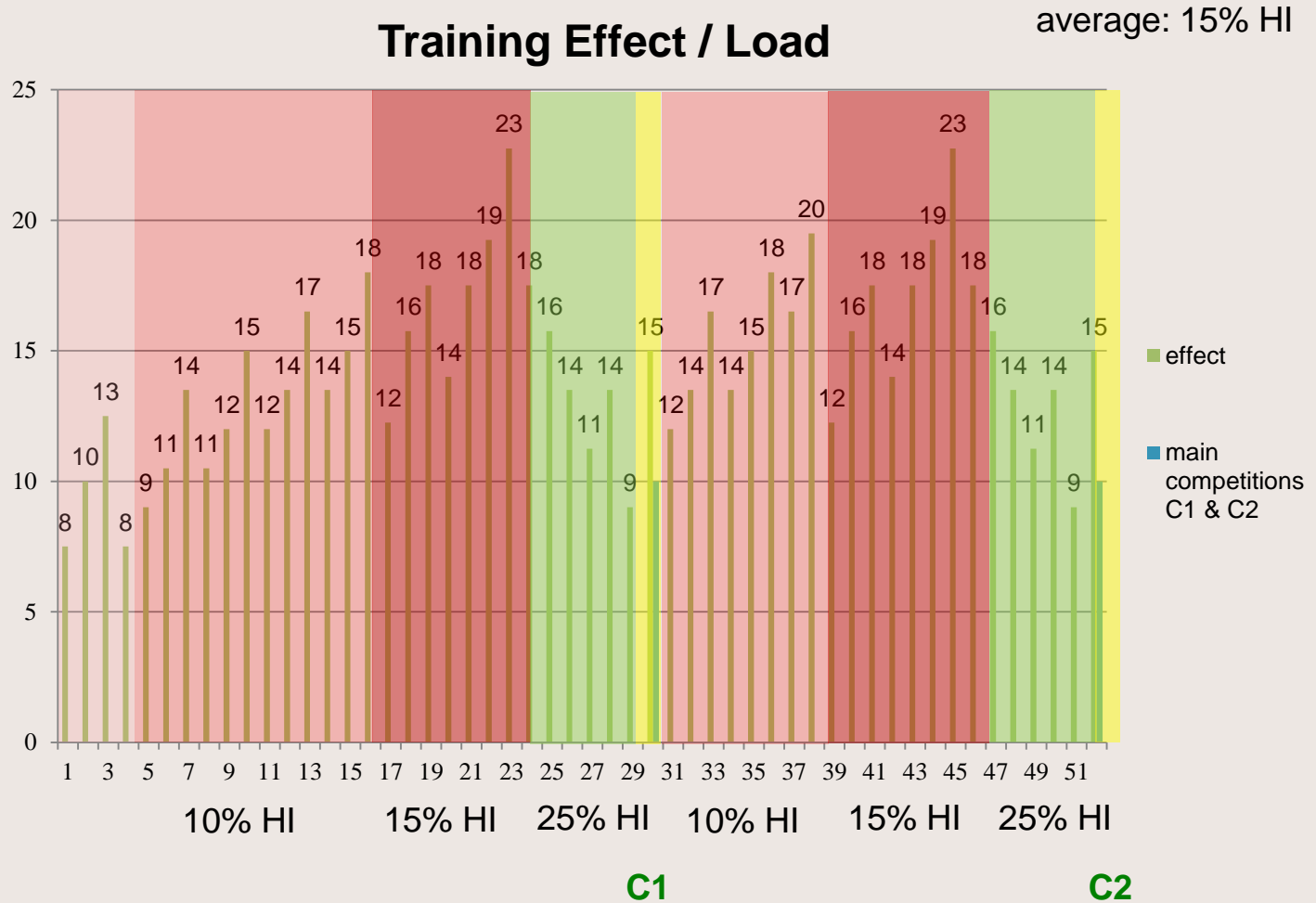


Training Focus over the Year

- (0) – short competitions, analysing last year's important runs, testing the technique, testing and analysing route choices, resting and having fun
- (1) – ~90% low intensity, high intensity intervals for running technique, very difficult middle distance trainings - preferably at night - to better prepare for terrains with limited visibility, special technique trainings, central body gymnastics, towards the end of (1) or in (2) you can have a heavy week block (training camp, multi day orienteering,...)
- (2) – increasing intensity (~ 15% of total), longer high intensity runs to get used to pain, uphill / loose sand trainings for leg strength, all technique trainings/competitions at high intensity (lots of repetitions), starting special trainings for main competition, analysing old maps and requirements for it, training handling competition stress
- (3) – decreasing hours, increasing intensity (~25% of total), all trainings aiming at maximizing performance at main competition, training handling competition stress
- gymnastics all the time and recovery measurement and analysis
- total training load scaled to take into account enough recovery and other loading (e.g. school stress or illness)



Training Year Weekly Load



Training Effect

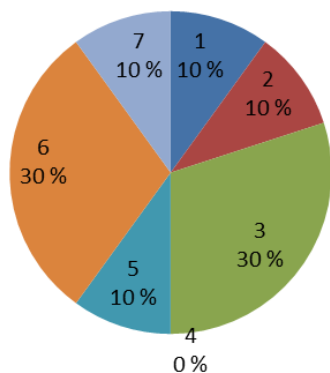
- When planning the recovery vs. training a good estimate for the Training Effect (TE) is needed
- A good formula for the duration multiplier DM:
 - 1 @ AeT and slightly below
 - 5 @ AT and above
 - $1 + 4 * [(HR - AeT)/(AT - AeT)]^2$, i.e. 2...3 when between the thresholds
- $TE = \int DM(t) * dt \approx \Sigma(DM_i * \Delta t_i)$



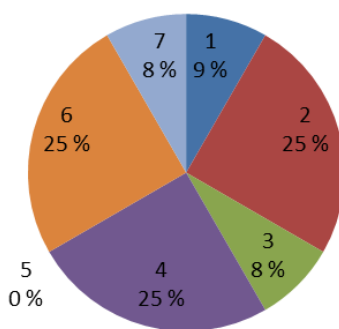
Training Week Examples

(Relative daily load days 1...7)

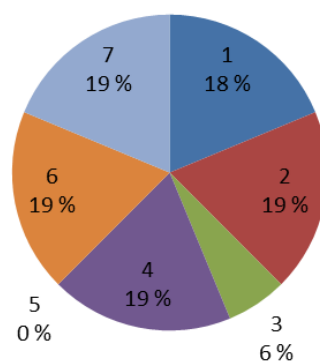
week1 10



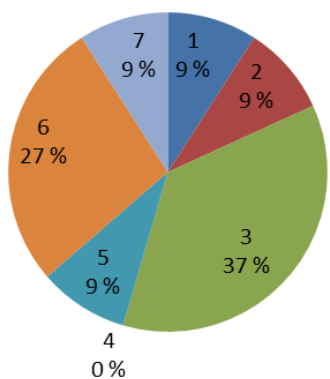
week2 12



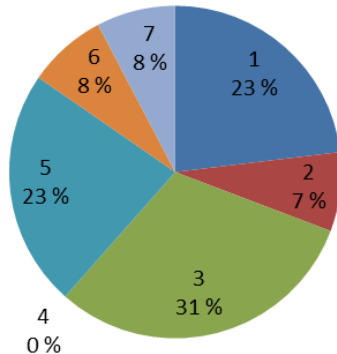
week3 16



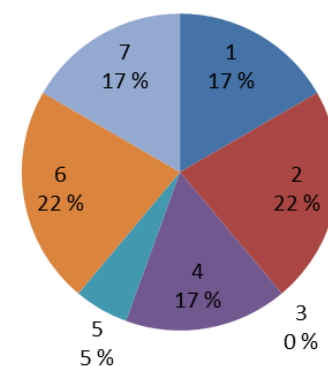
week4 11



week5 13



week6 18



Training for Top Performance

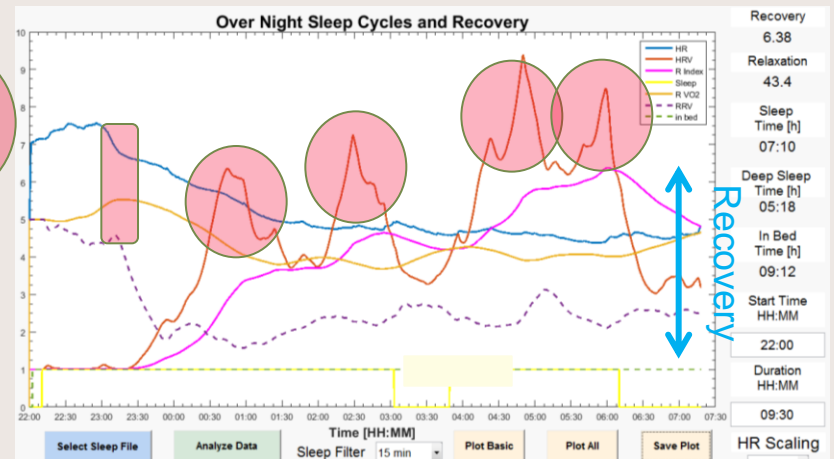
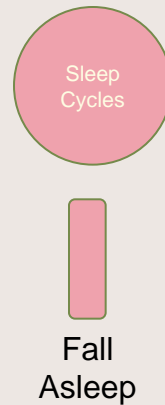
Typical annual training hours of top endurance athletes:

- H/D21 600...800h (endurance: 450...700)
- H/D19-20 500...600h
- H/D17-18 400...550h
- H/D15...16 350...450h

Annual increase typ. 5...15%, depending on level and development of intensity

Recovery – the Most Important Factor at Level of Optimum Training

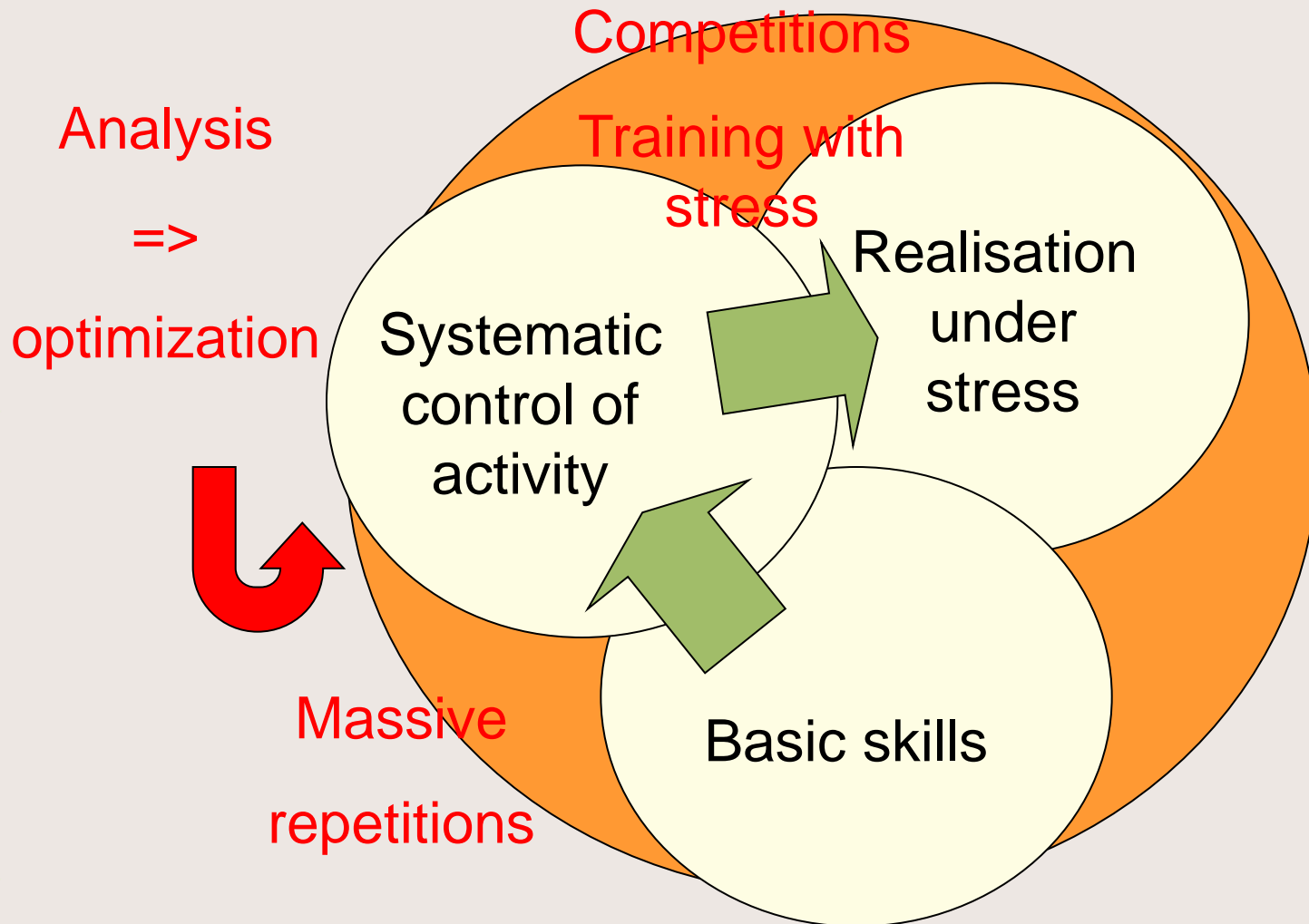
- Full recovery no longer than 48h after hard training period to avoid elevated infection risk
- Recovery status can be monitored with orthostatic test (standing up and monitoring increase in HR) in the morning or Heart Rate Variability (HRV) in the morning or over night (also sleep quality)
- When knowing one's body, a subjective recovery / stress assessment based on feeling can also be made



Orienteering Capacity

- Orienteering capacity is finally determined by how well you can convert your aerobic capacity into an orienteering performance
- How good your running technique in different terrains is and how well you can keep it through the competition – running economy
- How well you can optimize the capacity usage for minimum total time under continuously varying terrain conditions
- How much your orienteering is limiting the performance under different conditions (orienteering reserve)

Orienteering Technique





Basics of Orienteering Technique

- **Know the terrain – get acquainted with a variety of terrains, judgement of shapes, positions and distances**
- **Know the map – study maps, terrain vs. map, alignment of map, versatile map training, analysing runs, contour map training**
- **Know how to make orienteering easy for oneself in various terrains and situations**
- **Know various equipment and techniques (compass, other techniques to keep direction, Emit, SI, measuring distance in terrain ...)**



Controlling Activity

- **Plan – anticipate – observe**
- **Route choice – map dominant / terrain dominant – control taking**
- **Identifying important details – simplification**
- **routine at controls – look at direction to next control => check control code => punch => continue to next control**
- **forward looking in sprint orienteering**
 - **train - train - train => routine, gather models how to act in a large variety of situations**
 - **analyse - analyse - analyse => optimisation**



Technique Reserve Test

Analysis leg by leg with varying orienteering challenges

Kontroll	1	2	3	4	5	6	Total
Sabrina 1	2:15	2:47	3:07	4:48	4:30	2:37	20:04
Sabrina 2	1:53	1:43	2:46	3:53	4:21	2:31	17:07
Reserv	0:22	1:04	0:21	0:55	0:09	0:06	2:57
%	16 %	38 %	11 %	19 %	3 %	4 %	15 %
Utan bom							1:53
%							11 %
Victor 1	1:53	1:47	2:11	3:37	2:52	2:00	14:20
Victor 2	1:35	1:13	2:05	2:58	2:44	1:54	12:29
Reserv	0:18	0:34	0:06	0:39	0:08	0:06	1:51
%	16 %	32 %	5 %	18 %	5 %	5 %	13 %
Utan bom							1:17
%							10 %

Psychology of Orienteering

- A human being is slow in intelligence, but good in using learned models – repetitions in systematic control of orienteering
- To work systematically under stress – in an optimal flow state
 - Avoid any potential cause for lack of self confidence
 - Good preparation for all important competitions – feel like at home in the coming terrain and on the map
 - Study old maps, figure out probable controls, legs and route choices
 - Avoid surprises
 - Be in good physical shape

Summary Physical

- Train and rest, vary training from one day to another and one week to another (harder – easier – type of training) – test recovery in the morning (standing up – time of pulse up and back down level) – test time you need from hard training to maximum performance
- Train 80% at 60% of max heart rate and 20% at 80...90% (= AT) of max heart rate
- Strengthen your central body, train your legs in loose sand and uphill (for European and Nordic terrains)
- Do gymnastics every day for flexibility
- Start to decrease training load about 6...8 weeks before most important competition

Summary Technical

- Train in various terrains – in particular those, which you feel difficult, learn how you should do in different terrains
- Learn to be systematic – at control routines (before control check code, direction to next control) – in all kinds of situations in different terrains (see above: by training them and learning from mistakes)
- Analyse your route choices against others (split times) and test by yourself by running a leg using different route
- Do technique reserve test by running the same legs several times and looking at the improvement (train those types of legs with biggest improvement)
- Study maps of important competitions, put controls on the map and think how you would enter (guess starting point, controls, etc. from the info from the organizer)
- Train stress handling for important competitions (by doing competitions, relays, run with GPS etc.)
- Feel being mentally and physically prepared!