What cycling can learn from other sports ?

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Introduction

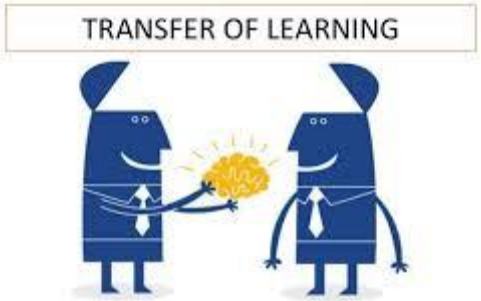
Cycling performance requieres different training methods characterised by various intensities, durations, general and specific exercises.

Most of the time, coaches incorporate into their training programs general exercises including other sports, referring to the learning/ training transfer.

What is transfer ?

Definition

«Transfer is characterized as the extent to which a response in one task or trained situation affects the response in another task or untrained situation » (Adams, 1987)



Transfer in sport

Each training system in any sport involves the execution of event-specific exercises intended to enhance physical capacities and/or technical skills in that given sport.

It is commonly believed that such modified exercises produce a positive effect on competitive performance despite their differences from the targeted discipline.

Is it working in cycling ?

Aim of the presentation

Determine the possible learning/training transfer from other sports to cycling.

Method

Web research in peer-reviewed journals using Google Scholar, PubMed electronic database, and other cycling, triathlon, websites

Results

1. Concepts of Training Transfer

Three kinds of transfer (Gagne, 1965) :

✓ Positive : the increase of the level in the general task increases the performance in the specific task.

General task →  ← Specific l task

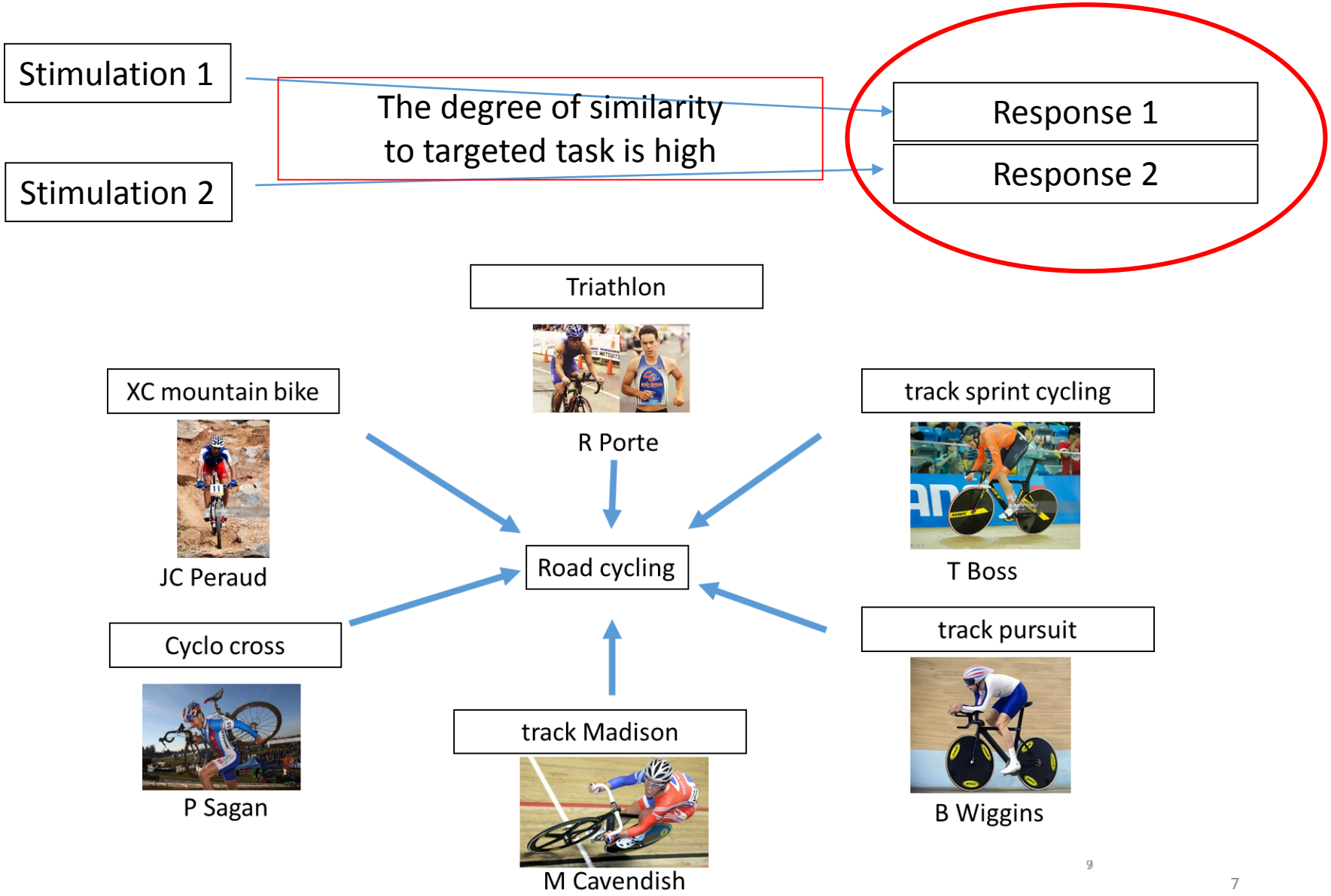
✓ Negative : the increase of the level in the general task decrease the performance in the specific task

General task →  ← Specific l task

✓ Neutral : no significant effects

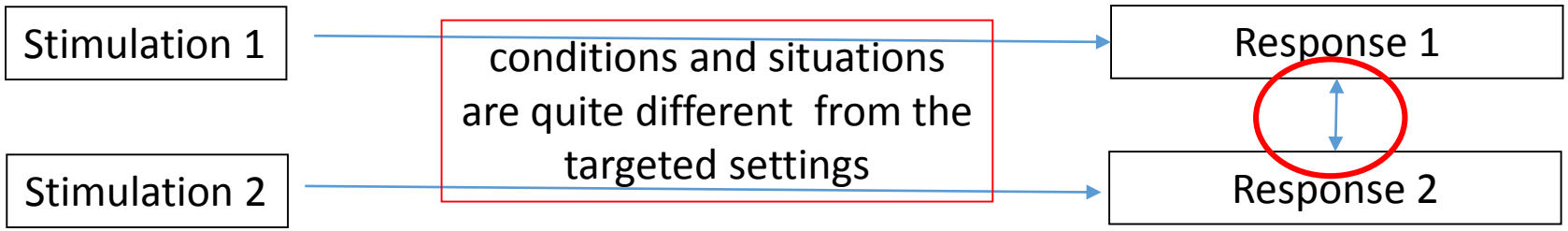
1. Concepts of Training Transfer

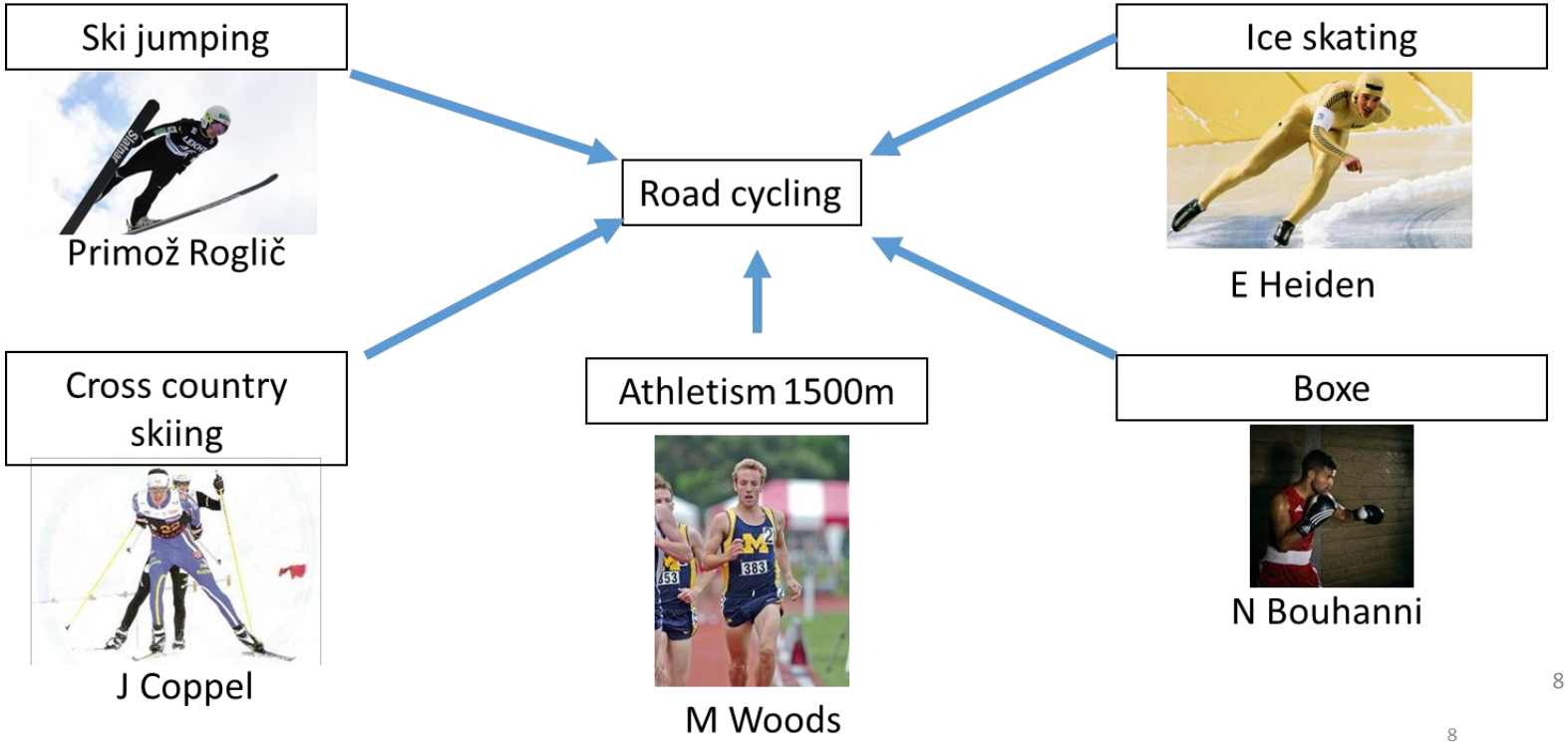
✓ Near transfer tasks :



1. Concepts of Training Transfer

✓ Far transfer tasks





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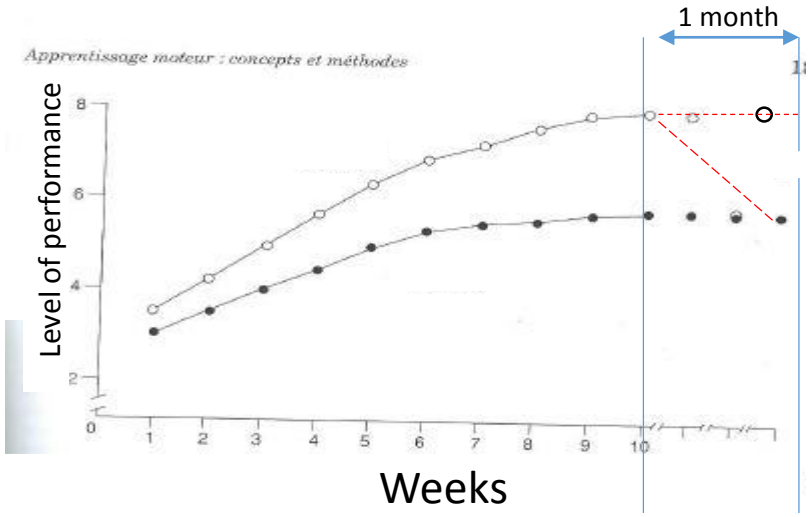
2. Dimension of transfer (Barnet & Ceci, 2002)

Maintenance : outcomes of learning and training persist over time

- ● Control method
- O New method



3.Orientation of the transfer (Barnet & Ceci, 2002)

- ✓ Lateral transfer of physical capacities : outcomes of training process are used in a wide spectrum situations of similar complexity as the previous settings

Pauline Ferrand Prevost

- ✓ Vertical transfer : acquired skills and abilities are exploited for the acquisition of more difficult and complex settings

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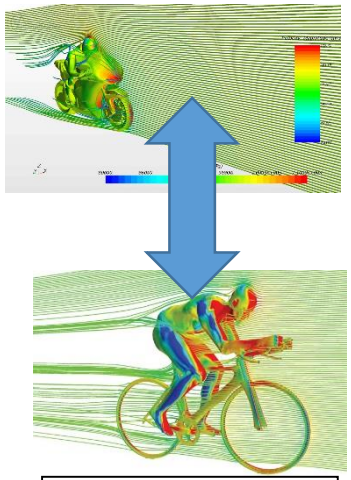
3. Lateral and vertical transfer (Barnet & Ceci, 2002)

Lateral transfer of technology : outcomes of process can be utilized in a wide spectrum of tasks and situations of similar complexity as the previous settings

Disc brake

Vertical transfer : acquired technology are exploited for the acquisition of more difficult and complex settings



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4. Factors Affecting Training Transfer (Cheng & Ho, 2001)

- ✓ Individual factors : personality, locus of control, self-efficacity, confidence

- ✓ Motivational factors : acceptance of training goals, willingness to take part in training decisions

- ✓ Environmental factors : transfer climate and continuous-learning culture

5. Training transfer in sport Science and practice

«Fitness gains require a load (stimulus) magnitude that exceeds the accustomed level. The load magnitude can be regulated by varying its three components: training intensity, training volume, and novelty of exercises » (Zatsiorsky, 1995)

The transfer is different between :

- ✓ Technical skills (fine motor skills, postural control, etc..)

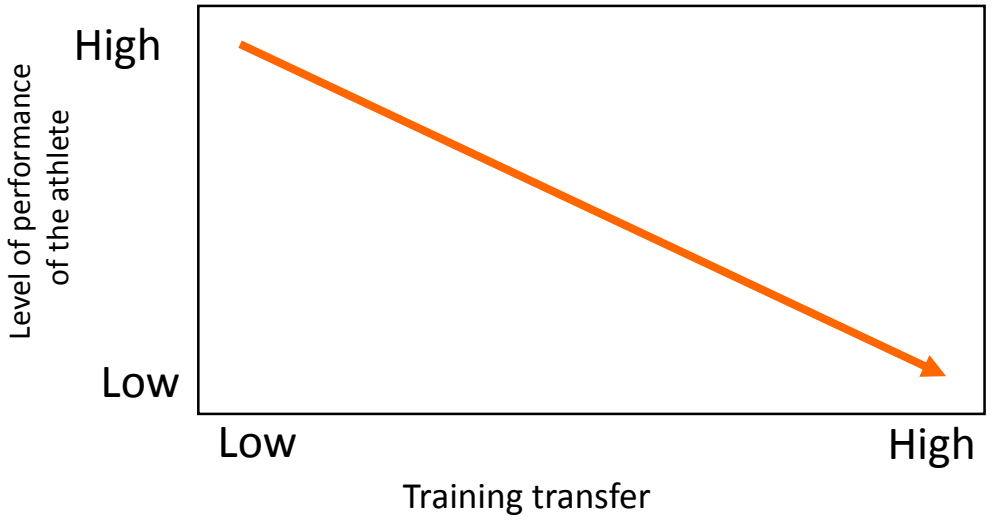
- ✓ Motor abilities (strength, endurance, velocity etc.)

5. Training transfer in sport Science and practice

- ✓ The transfer of technical skills is much more restricted than the transfer of motor abilities (Zatsiorsky, 1995).

- ✓ Both are highly dependent on athletes' qualifications.

- ✓ Low- and medium-level athletes are more sensitive to any kind of training stimuli, including non-specific ones, whereas training transfer among high-performance athletes is strongly restricted by the specificity of auxiliary exercises (Issurin, 2008).



5. Training transfer in sport Science and practice

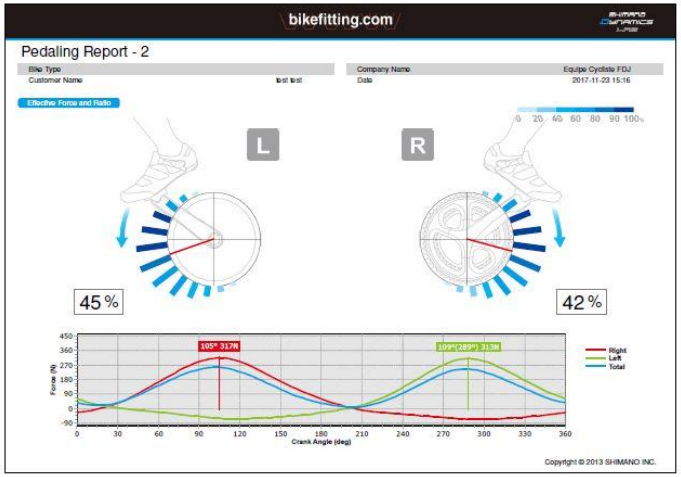
- ✓ The problems of training transfer can be avoided by using competitive exercises exclusively and manipulating their volume and intensity. Apparently this tactic leads to overtraining.

- ✓ Therefore, varying and innovating routine exercises and enriching the content of training exercises are desirable means of increasing training stimulation.

6. Transfer of Technical Skills

It corresponds to sportspecific coordination demands : relatively narrow circle of exercises provides positive transfer.

6.1 **Bilateral pedaling pattern transfer with bike fitting in injured athletes**

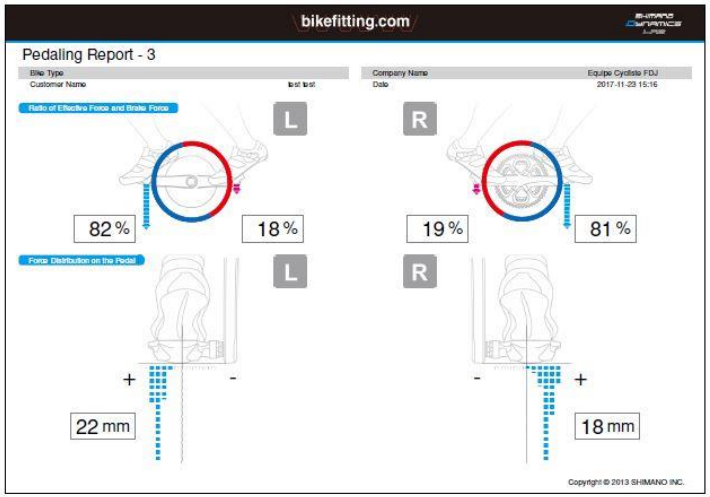


The performance of a motor task by a unilateral limb causes changes in cortical areas and changes at the motor neuron level on the nonexercising side (Schultze et al. 2002)

6. Transfer of Technical Skills

6.2 **Biofeedback with bike fitting**

The term ‘‘biofeedback’’ refers to external physiological, biomechanical, or psychophysiological feedback that is intended to provide athletes with information that can assist them to perform movement more efficiently.



Positive effects in cycling (Mc Lean, Lafortune, 1988

6. Transfer of Technical Skills

6.3 Artificial environment and video modeling training

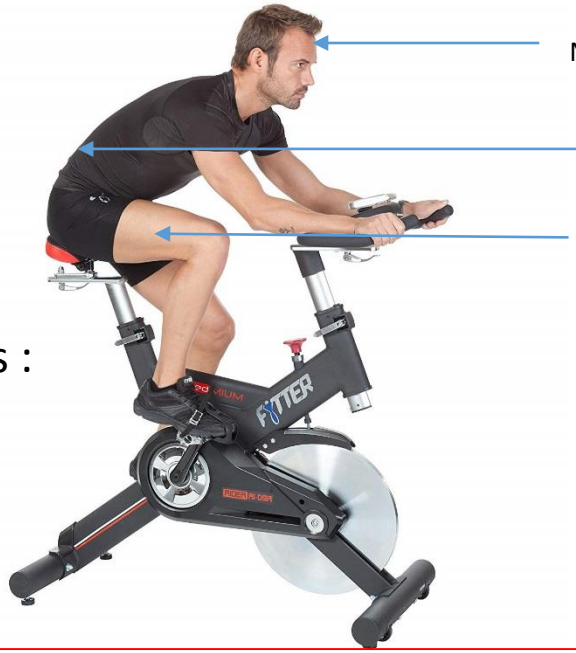
Augmented video

Artificial environment that simulates a real-world setting, emphasizing specially selected demands, could increase the performance (Dal Monte, 1988; Gonzales et al. 2015).

7. Training Transfer of motor abilities

7.1 Contralateral transfer following one-limb strength training with cyclo-ergometer

Mechanisms :



Neural Interactions Between Cerebral Hemispheres (Lee & Carrol 2007)

Spinal Cord Mechanisms (Hortobagyi et al., 1999)

Peripheral Blood Flow Activation (Yasuda, 1983)

The magnitude of the contralateral training effect, equals 13.7 % (Issurin, 2013)
The strength gain in untrained limbs is much less than in trained limbs, reaching about 60 % (Lee & Carrol, 2007) of the values obtained in the limbs subjected to unilateral training.

7. Training Transfer of motor abilities

7.2 **Arm–leg cross-transfer in endurance training**

Kayak training in a professionnal cycling team

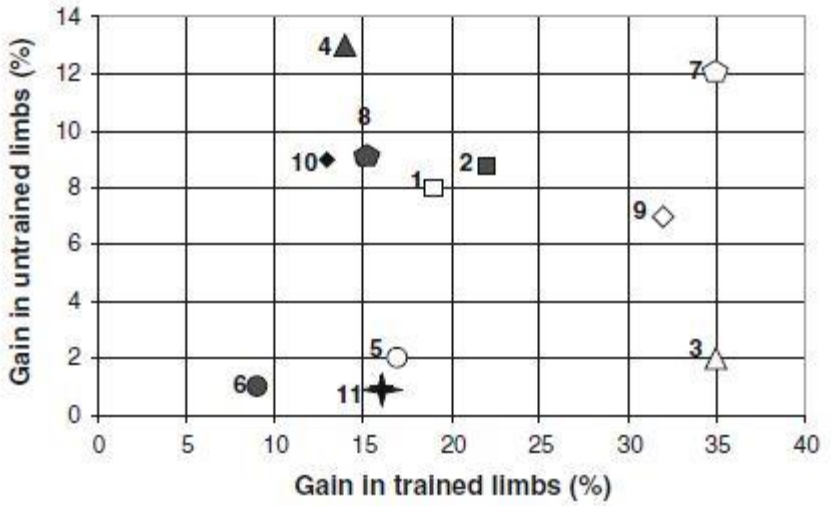


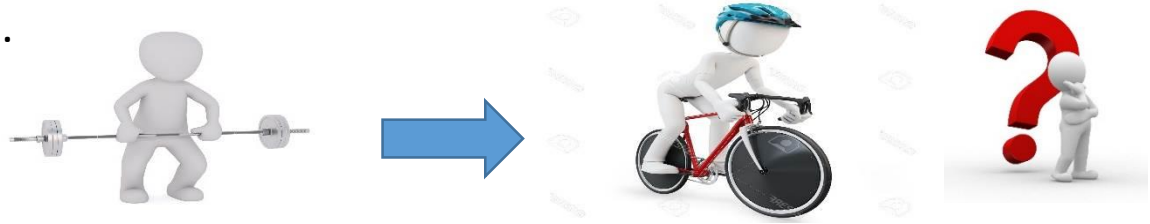
Fig. 1 Gain in oxygen consumption following training lasting 5–12 weeks separately for legs or arms measured by testing the trained and untrained limbs. *Open symbols* signify data for arm testing; *filled symbols* signify data for leg testing. *1–2* Pogliaghi et al. [98], *3–4* Tordi et al. [101], *5–6* Bhambani et al. [99], *7–8* Lewis et al. [97], *9* Loftin et al. [100], *10* Roesler et al. [102], *11* Magel et al. [103]

The transferred training effect to the untrained limbs was relatively small (32 %) compared to specific training (Issurin, 2013), but could be interesting in injured riders

7. Training Transfer of motor abilties

7.3 Transfer of Strength Training in Endurance Performance

Many publications presented arguments supporting this concept. However, some studies found no positive impact of strength exercises on endurance performance (Issurin, 2013).



Possible Mechanisms :

- ✓ Hypertrophy of muscle fibers (Kraemer et al. 1995) => pb relative power output !!
- ✓ Increasing work economy by increasing the stiffness in eccentric contractions. => no eccentric in cycling
- ✓ Enhancement of peripheral blood circulation (Clausen et al. 1973)

Possible benefits but mecanisms remain unclears

7. Training Transfer of motor abilities

7.4 Impact of Endurance Workloads on Strength/ Power Performances

A large group of publications showed an interference effect and reported that endurance workloads could compromise the development of strength/power ability (Hickson, 1980, Dudley & Djamil, 1985)

Mecanisms

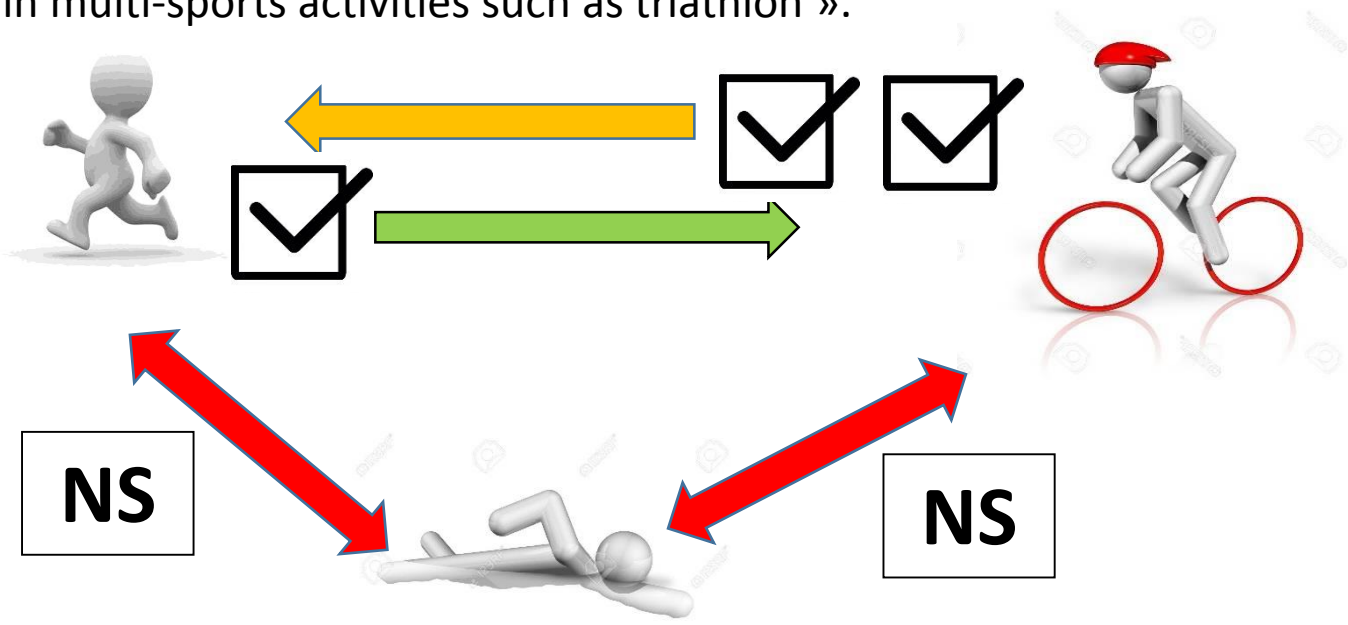
- ✓ Specificity of neural adaptations to strength and endurance training
- ✓ Hormonal factors affecting strength and concurrent training
- ✓ Intracellular regulation induced by strength and endurance exercises

Endurance could produce a negative impact on strength/power .Thus, administration of these workloads should be reasonably restricted. In road cycling sprinters, developing both power and endurance is a great training challenge to perform high level performance.

7. Training Transfer of motor abilities

7.5 Cross-Training : the example of triathlon

« Cross training involves different sports or training forms intended to (1) improve general and/or event-specific fitness for a given sport; (2) diversify the training routine of recreational athletes; provide correct preparation for athletes in multi-sports activities such as triathlon ».



Training transfer from running to cycling is higher than vice versa. The superiority of the running cross-training effect pertain to higher maximum heart rate than in cycling, higher pulmonary ventilation (Millet et al. 2002, 2009)

7. Training Transfer of motor abilities

7.6 « Nordic Cross-Training » Oja et al, 1988

	Cycling	Rowing	Running	Cross-country skiing
Distance (km)	132	35	33	90
Time of the event (min)	4 h 58 (+/- 34)	4 h 20 (+/- 35)	3 h 30 (+/- 29)	8 h 29 (+/- 49)
Mean Heart rate (bpm)	153 (+/- 10) (*)	137 (+/- 15)	159 (+/- 8) (*)	145 (+/- 5) (*)
Proportion of event HR above 90% event-specific maximal HR	31.2% (+/- 19%)	17.9% (+/- 26%)	59.7% (+/- 24%)	21.6% (+/- 23%)
%VO2 max from the event-specific HR/VO2 regression line	79.3 (+/- 6)	72.9 (+/- 13)	85.7 (+/- 4)	72.8 (+/- 7)

(*) p<0.05 compared to rowing

Oja P, et al. Cardiorespiratory strain of middle-aged men in mass events of long-distance cycling, rowing, jogging, and skiing. Int J Sports Med. 1988 Feb;9(1):45-51.

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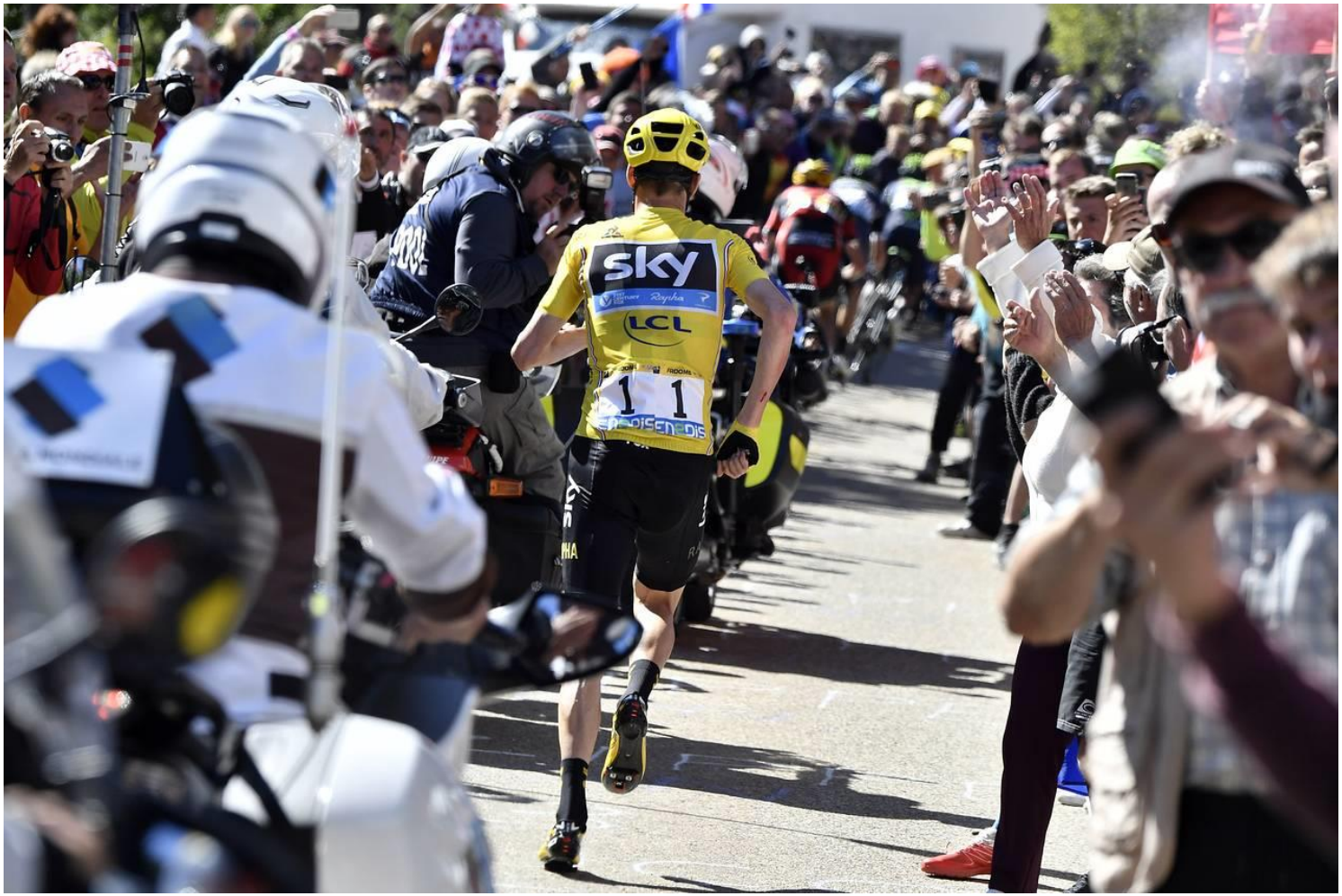
In summary, it can reasonably be claimed that cross-transfer effects occur to a higher extent for moderately fit athletes and much less in the preparation of elite athletes.

Why do some high-level athletes persist to train in other sports?

8.1 Why do some high-level athletes persist to train in other sports?



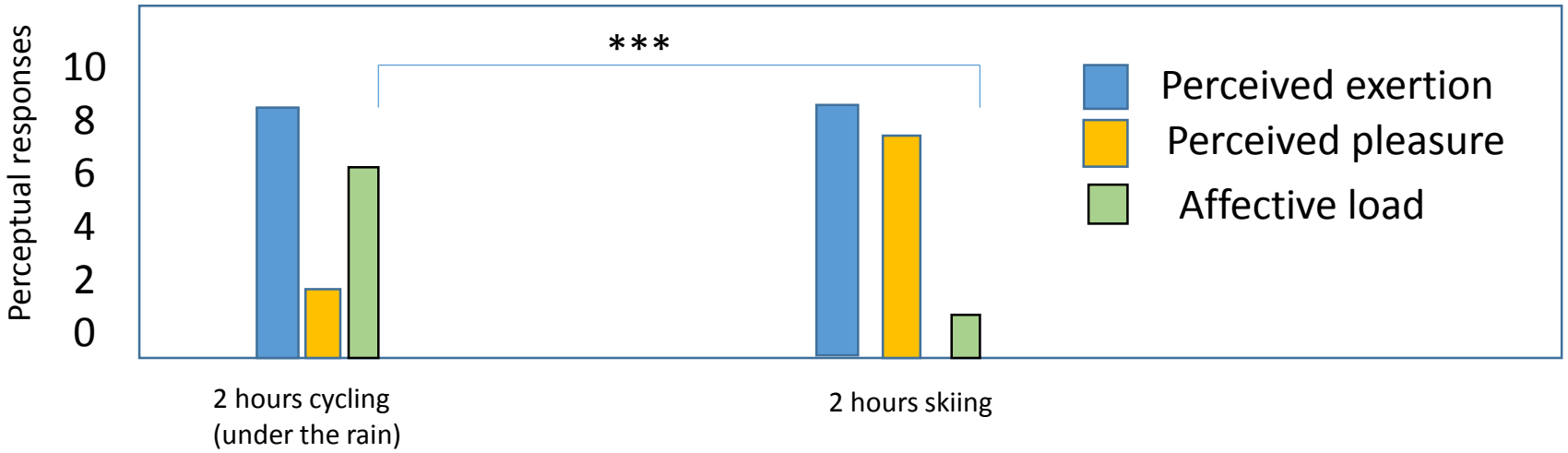
Sometimes, running can be usefull

8.1 Why do some high-level athletes persist to train in other sports?

« Load magnitude can be regulated by varying training intensity, training volume, and novelty of exercises. » (Zatsiorsky, 1995)

✓ Novelty → Motivation → Affective Load (Baron et al. 2011)

Affective load = perceived exertion – perceived pleasure (Baron et al. 2011)

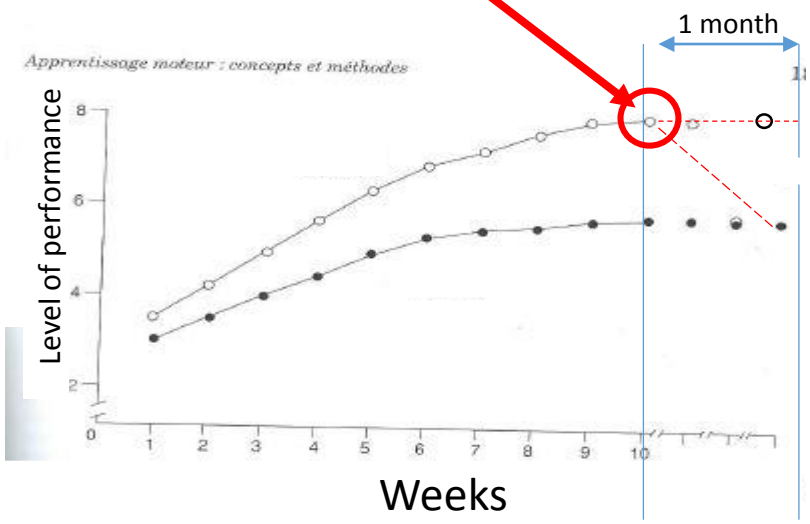


8.2 why do some high-level athletes persist to train in other sports?

Dimension of transfer (Barnet & Ceci, 2002)

Maintenance : outcomes of learning and training persist over time

Peak of performance



- Control method
- O New method

The increase of the performance is not caused
by the transfer but by the increase of motivation

8.3 why do some high-level athletes persist to train in other sports?

Mental transfer : fighting spirit

Social transfer : team cohesion

Mental and/or social transfer from other sports could increase cycling performance. Further investigations are encouraged to confirm this hypothesis.

Conclusion

- ✓ Yes, cycling can learn from other sports

  However :
- ✓ It is important to differentiate the training transfer with regard to the enhancement of movement skills and developing physical abilities which strongly depends on the athletes' skill qualifications.
- ✓ Sometimes, the increase of the performance is not caused by transfer but by the novelty of the training exercise that lead to decrease the affective load and increase the motivation.
- ✓ Mental and/or social transfer from other sports could increase cycling performance

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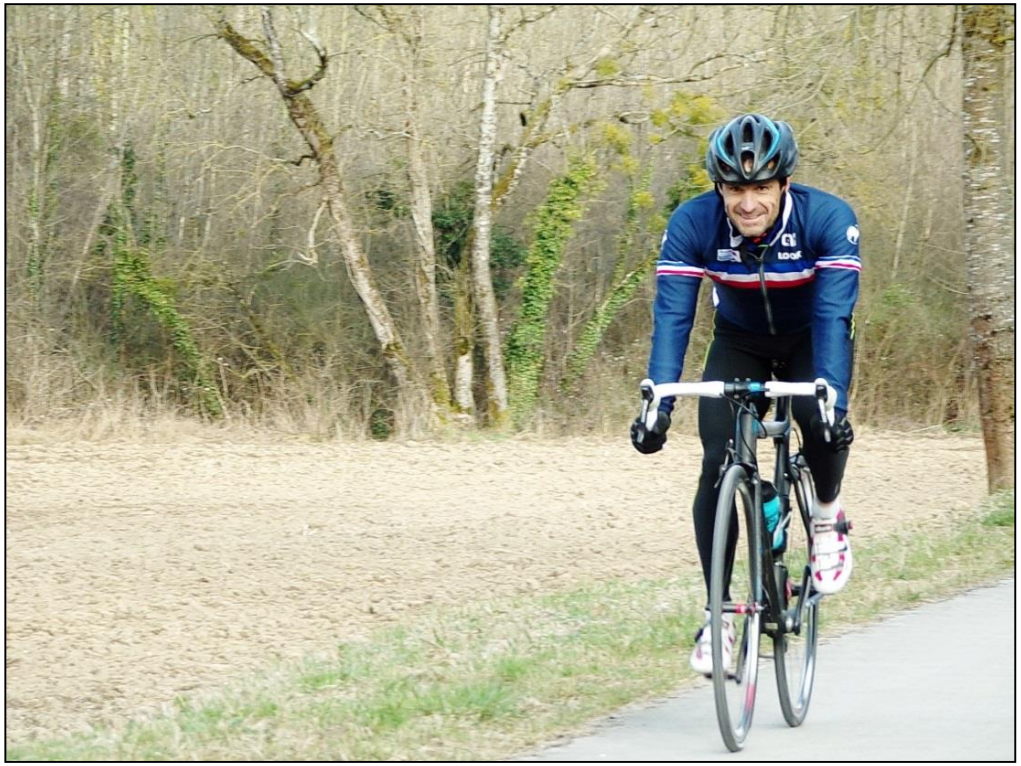

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