Active schools, active learning – the possibilities of formal and non-formal learning environments in active school settings

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HIPE conference 2018 in Budapest, Nov 15/16

Where do I come from? Team Sport Science Uni Basel

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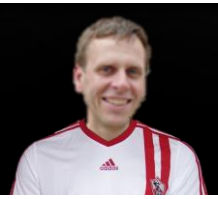

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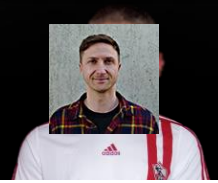

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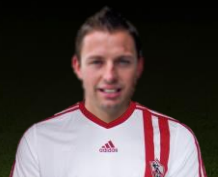

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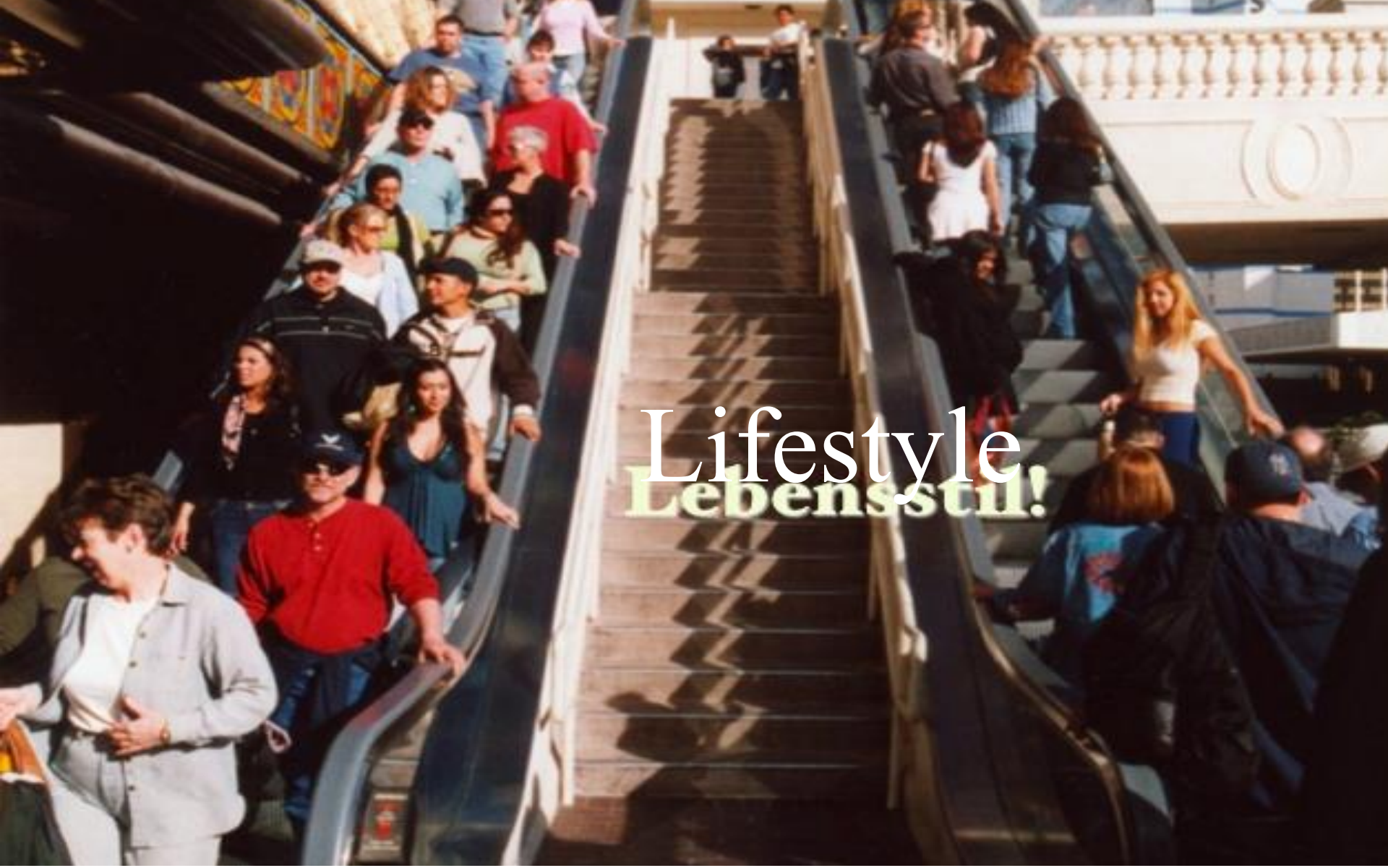
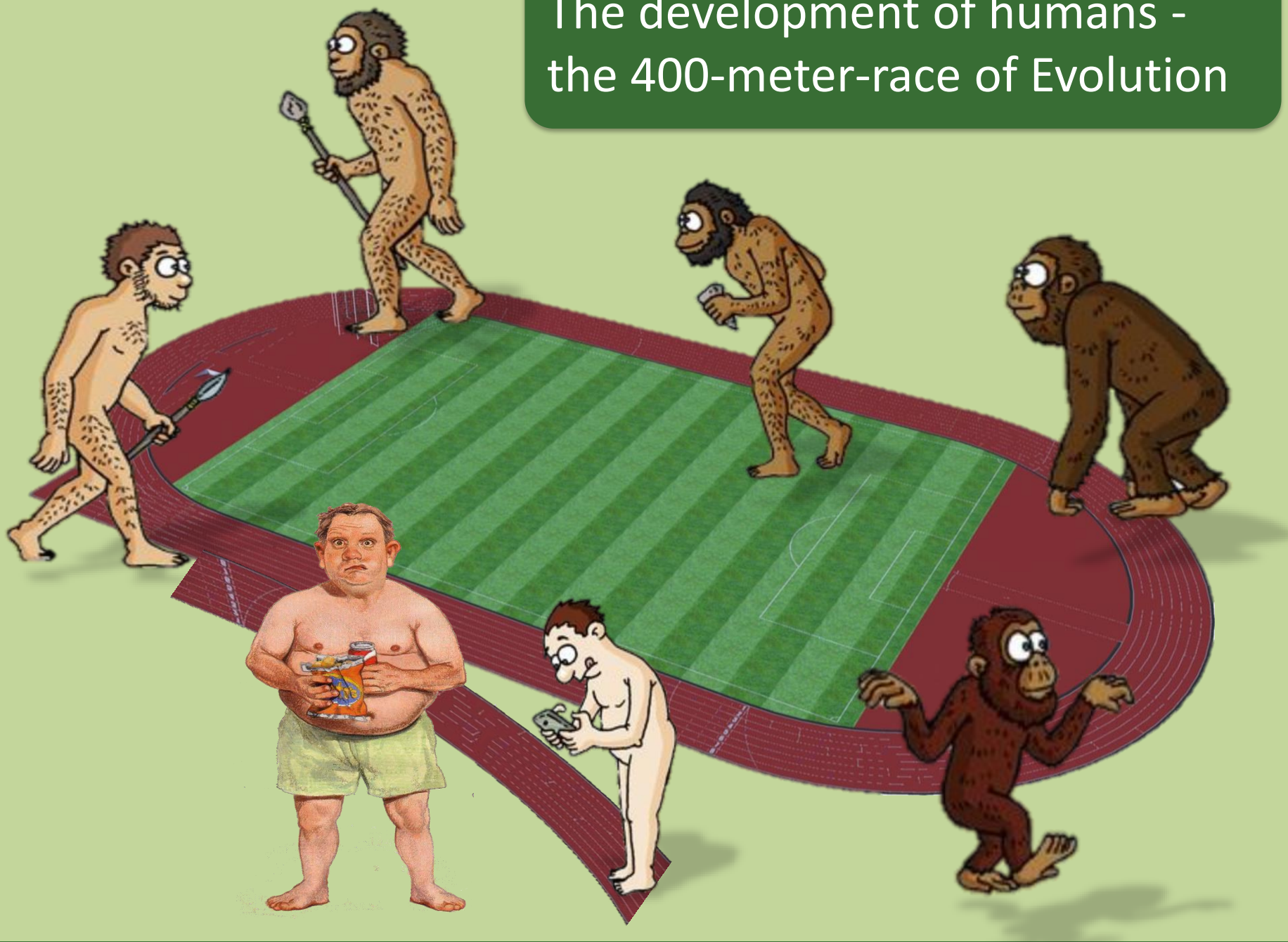
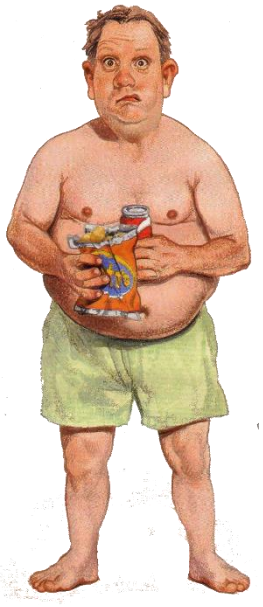


Our topic: Physical activity and health

We are getting technically more active – but physically more inactive!!

The development of humans - the 400-meter-race of Evolution





Today's lifestyle has minimized the need for physical activity.

Homo Allergicus

Homo Informaticus

Homo Adipoesitas

Homo Depressivus

Homo Stressicus

Homo Allergicus

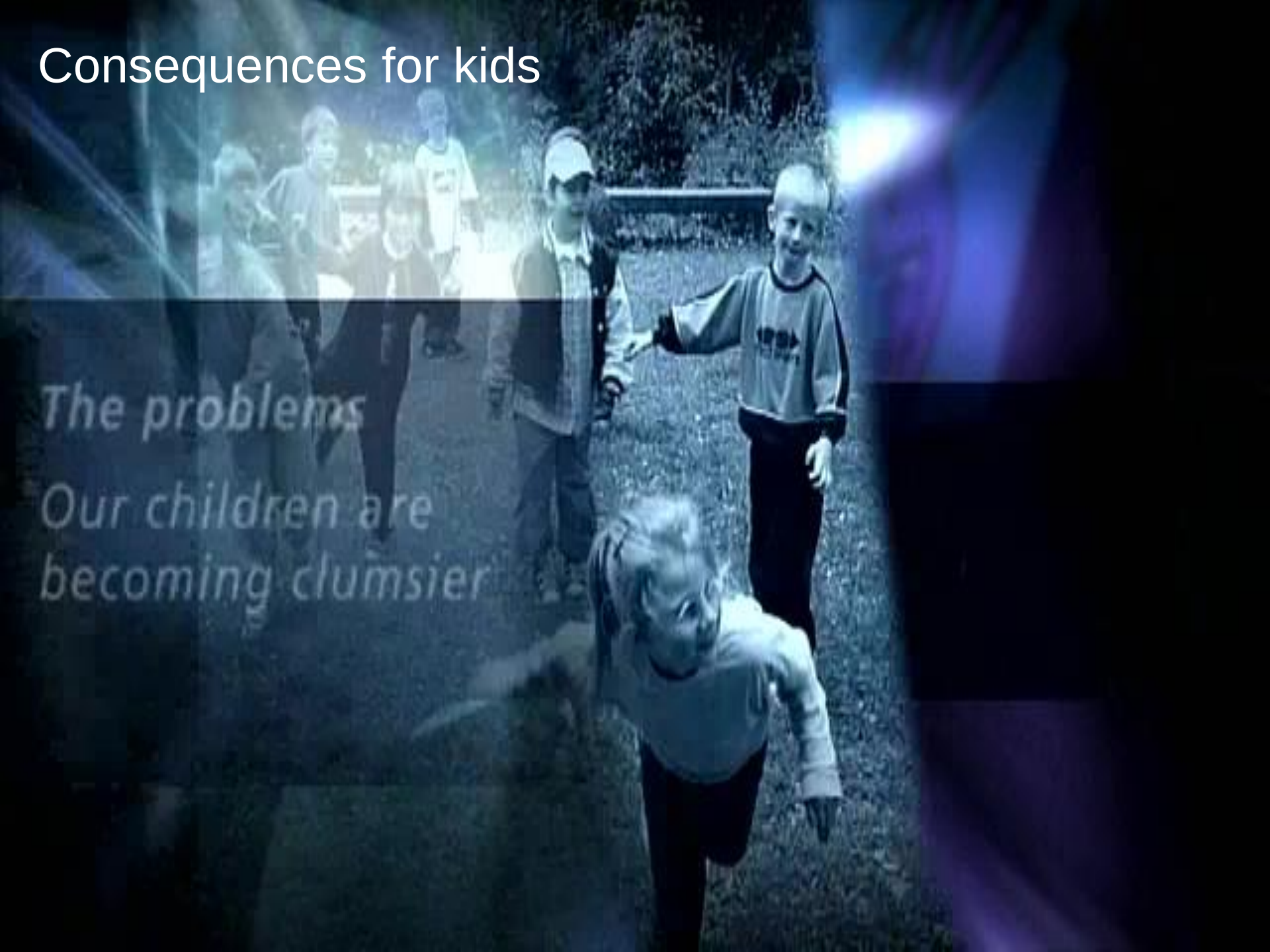
Homo Informaticus

Homo Adipoesitas

Homo Depressivus

Homo Stressicus

Consequences for kids



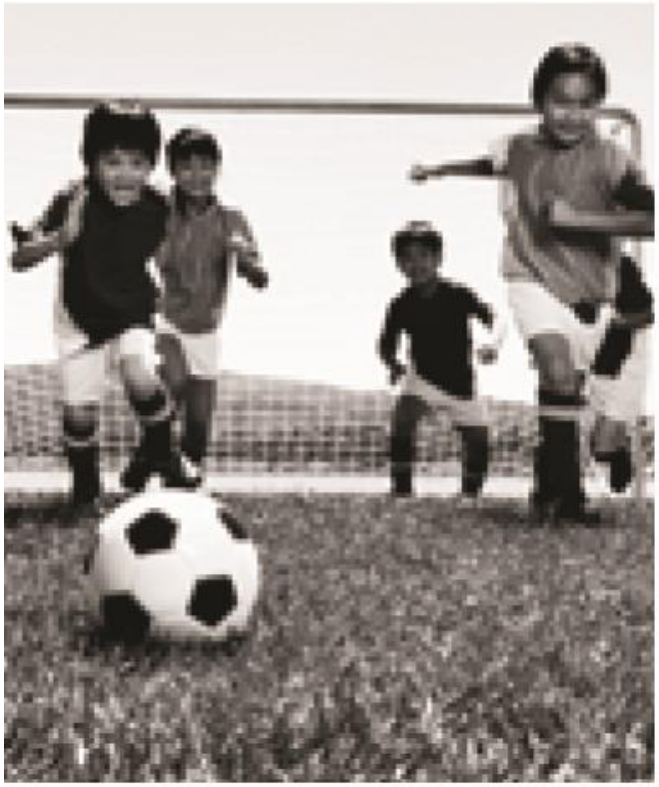
Important developments and initiatives

Recommendations and documents:

DESIGNED TO MOVE

A Physical Activity Action Agenda

ASK 1



CREATE EARLY POSITIVE EXPERIENCES FOR CHILDREN

1. Special Emphasis on Childhood: Before Age 10
2. Design for Early Positive Experiences in Physical Education, Sports & Physical Play
3. Special Emphasis on Schools as a Foundation for Impact
4. Combine Resources at the Community Level
5. Leverage Digital Platforms
6. Invest In & Recruit Diverse Role Models

Recommendations and documents:

DESIGNED TO MOVE

A Physical Activity Action Agenda

ASK 2

INTEGRATE PHYSICAL ACTIVITY INTO EVERYDAY LIFE

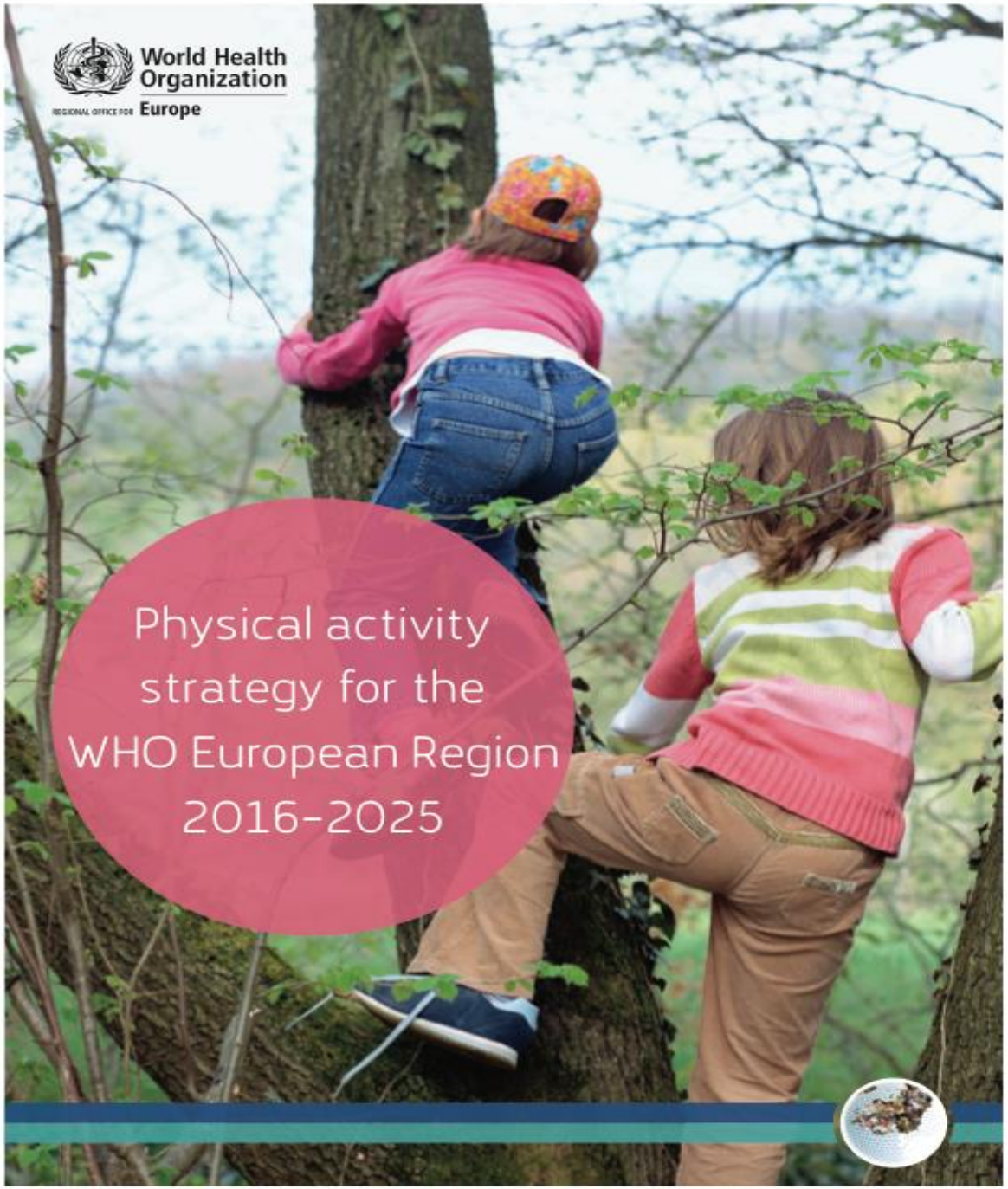
7. Design Physical Activity into the Built Environment
8. Align Sectors that Share Goals
9. Challenge Misaligned Incentive Structures
10. Challenge Everyday Signals that Reinforce the Current Norm

THE FUTURE OF EDUCATION AND SKILLS

Education 2030

OECD

OECD puts Physical Education on the agenda


World Health Organization
REGIONAL OFFICE FOR Europe
Physical activity strategy for the WHO European Region 2016–2025

Global Strategy on Diet, Physical Activity and Health

The Role of Schools

The promotion of healthy diets and physical activity in school is **essential** to fight the childhood obesity epidemic. Because children and adolescents spend a significant time of their young lives in school**, the school environment is an ideal setting to acquire knowledge and skills about healthy choices and to increase physical activity levels.**

WHO: Global Strategy on Diet, Physical Activity and Health

Suggestions to promote physical activity in schools

- encourage safe, non-motorized **modes of transportation** to school and other social activities;
- offer **extracurricular activities**: school sports and non-competitive school programmes (e.g. active recess)
- offer **daily physical education classes** with a variety of activities, so that the maximum number of students' needs, interests and abilities are addressed;
- provide **access to adequate physical activity facilities** to students and the community;
- encourage students, teachers, parents and the community to become physically active.

Global Strategy on Diet, Physical Activity and Health

Recommended levels of physical activity for children aged 5 - 17 years:

In order to improve cardiorespiratory and muscular fitness, bone health, and cardiovascular and metabolic health biomarkers:

Children and youth aged 5–17 should accumulate at least 60 minutes of moderate to vigorous-intensity physical activity daily.

Amounts of physical activity greater than 60 minutes provide additional health benefits.

Quality Physical Education Guidelines for policy-makers 2015

UNESCO

Kazan Action Plan (2017)

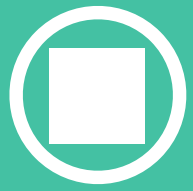
International Charter of Physical Education, Physical Activity and Sport (2015)

UNESCO Strategy on Education for Health and Well-Being (2016)


Active Schools


Sport and Academic Performance


Basic Motor Competencies for Kids


Sport for Development


Physical Education & Psychosocial Health


Quality Physical Education

Sport and Social Inclusion

Universität Basel

DSBG

Important documents about PA of kids

United Nations
Educational, Scientific and
Cultural Organization

KAZAN ACTION PLAN

The Ministers meeting at the Sixth International Conference of Ministers and Senior Officials Responsible for Physical Education and Sport (MINEPS VI), held in Kazan (13-15 July 2017)

Main Policy Area I –

Developing a Comprehensive Vision of Inclusive Access for All to Sport, Physical Education and Physical Activity

1.I.1 Align with Sustainable Development Priorities

I.2 Establish multi-stakeholder partnerships

I.3 Foster quality physical education and active schools

I.4 Promote research-based evidence and strengthen higher education

I.5 Enforce gender equality/Empower girls and women

I.6 Foster the inclusion of youth in decision-making processes

I.7 Foster empowerment and inclusive participation

Kazan Action Plan: Active Schools

Foster quality physical education and active schools

Active schools, in which physical activity is placed at the heart of the school, support the establishment of healthy lifestyles, behaviour and learning.

In addition, quality physical education is a necessary component of primary and secondary education. It supports the building of physical skills and fitness, life skills, cognitive, social and emotional skills, and values and attitudes that frame socially responsible citizens. This is most attainable when it is fully resourced, respected and valued for its holistic merits.

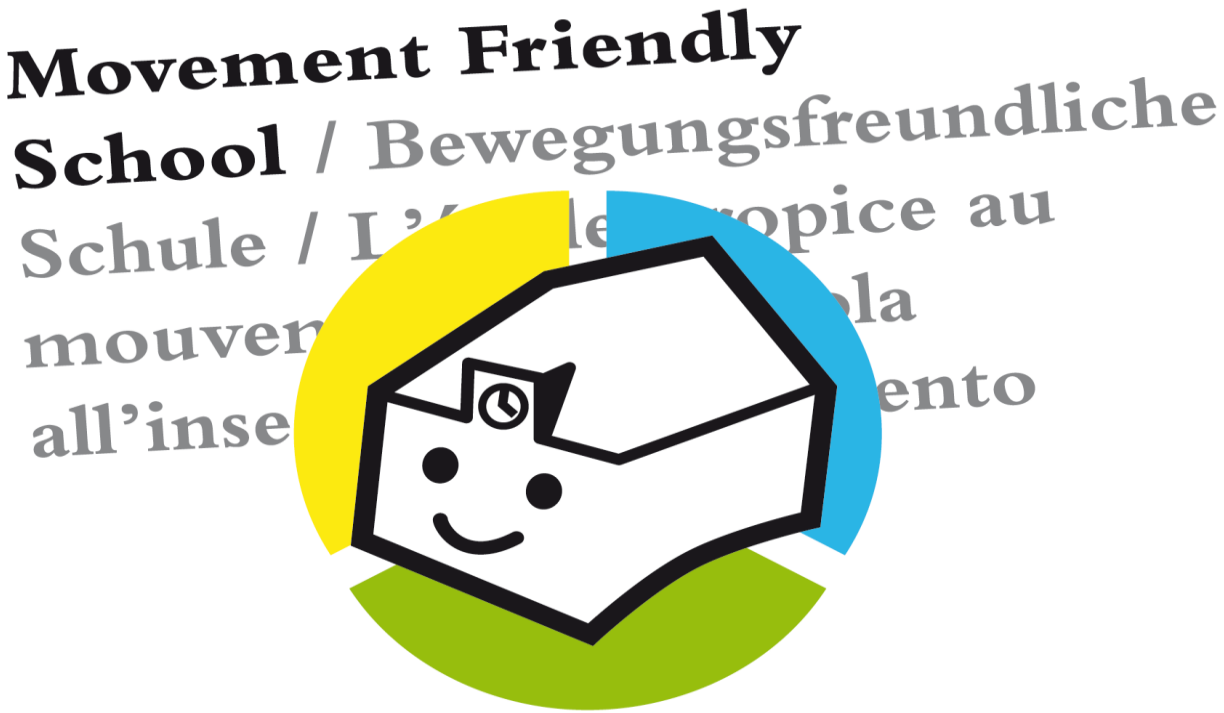
Fostering quality physical education and active schools needs provision that is varied, frequent, challenging, meaningful and inclusive (page 7).

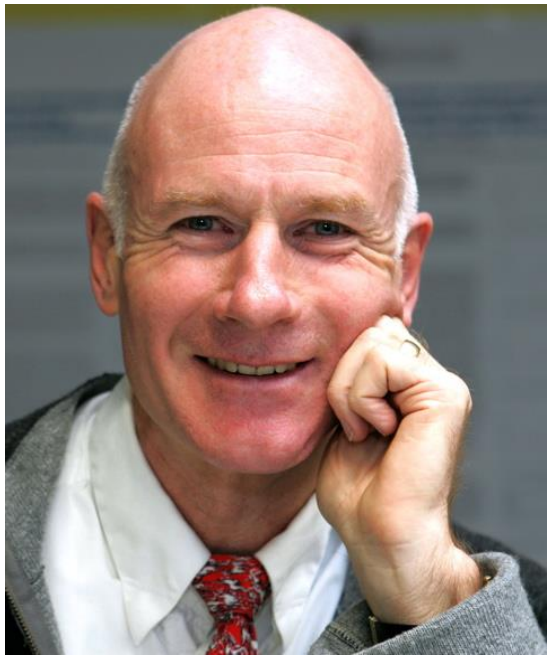
Let‘s summarize

How can we achieve at least 60 minutes of PA a day?

The ‘movement friendly’ school

How can we guarantee, that children are at least 60 min a day physically active?





Interdisciplinary approach

Lukas Zahner

Exercise Science

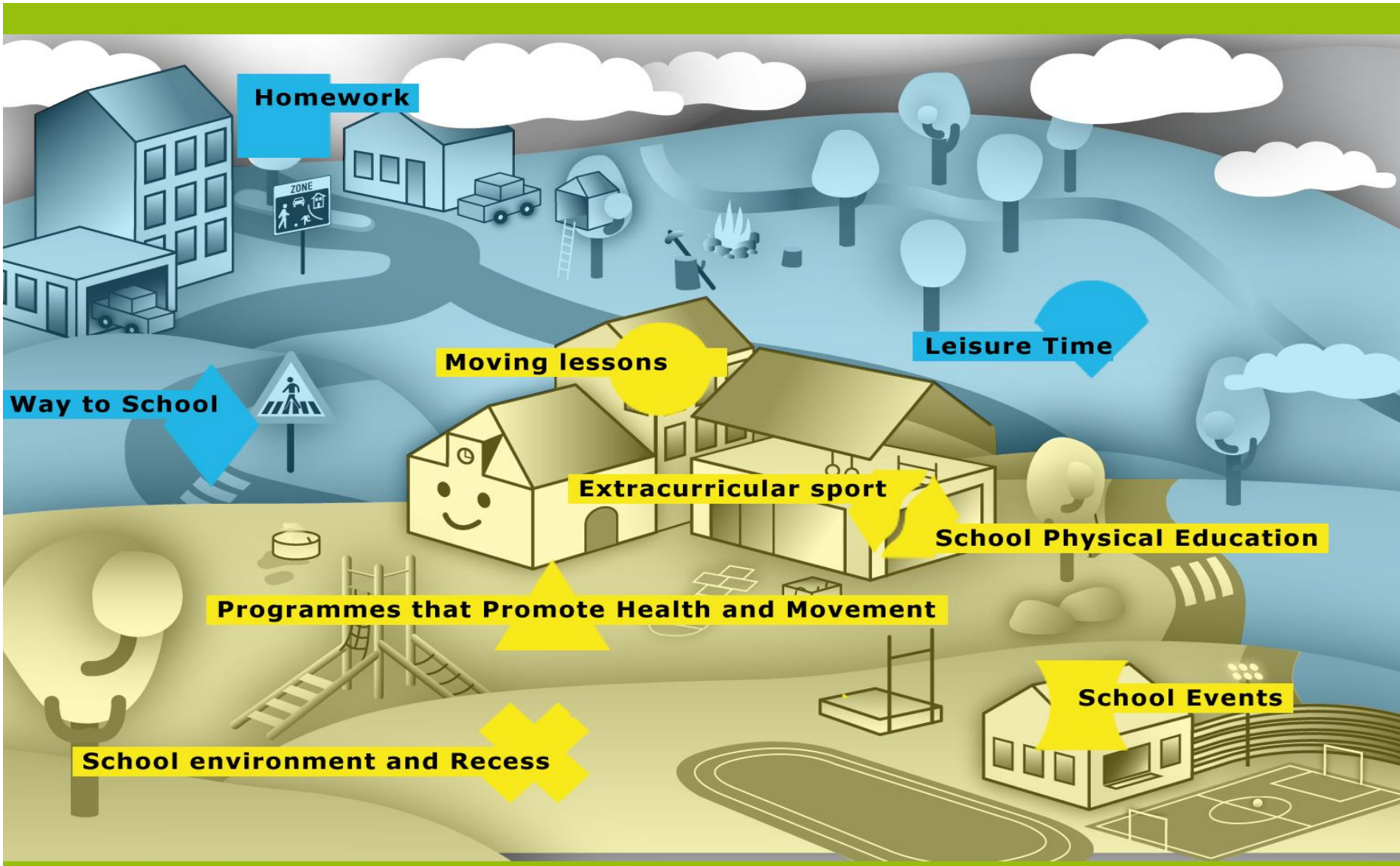
Head of project

Uwe Pühse

Sport Pedagogy and

Social Sciences

Multi component approach - Examples



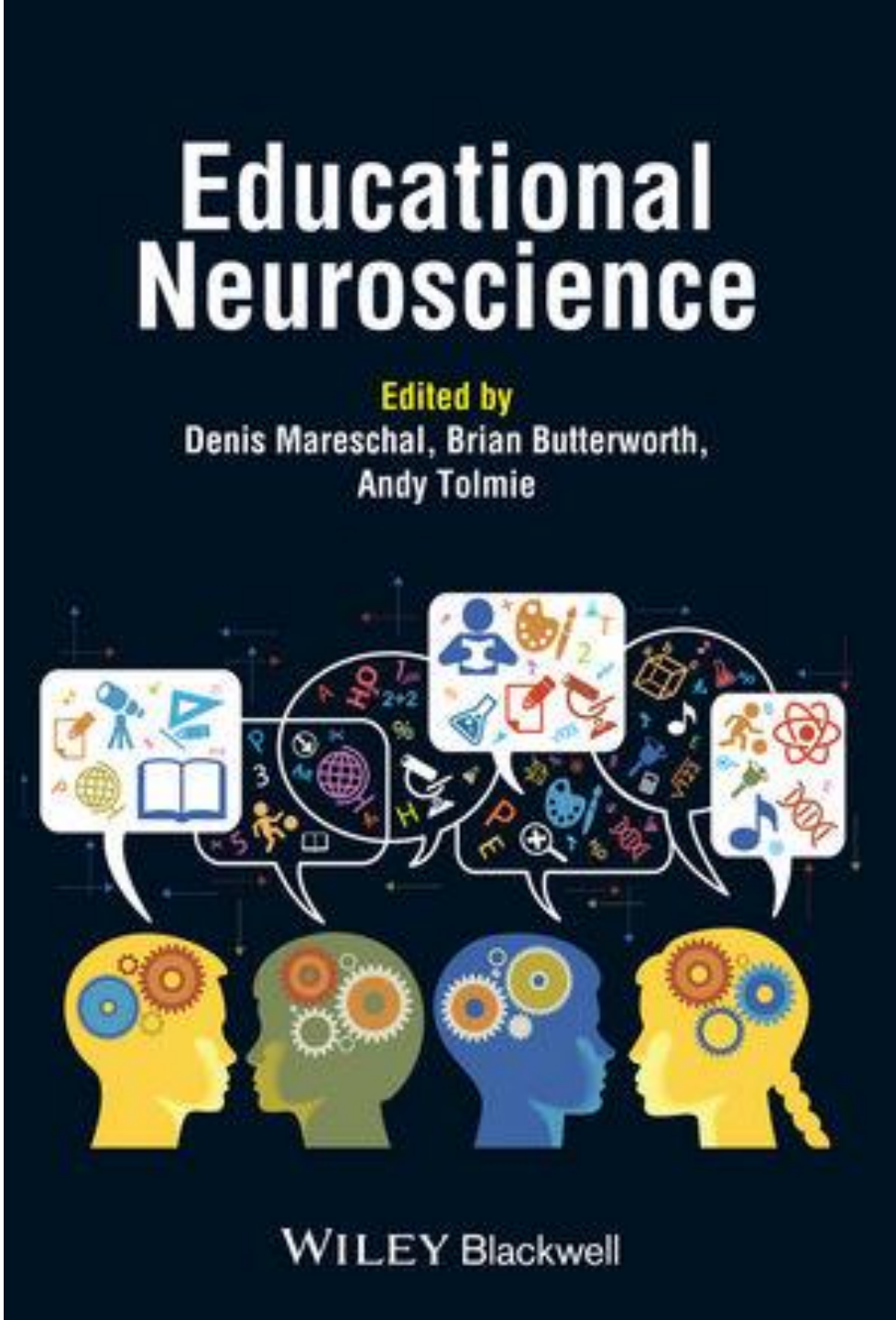
WHO: encourage safe, non-motorized modes of transportation to school and other social activities - **Way to school**

Mandatory (daily?) PE and PA in schools

WHO: offer **extracurricular activities**: school sports and non-competitive school programmes (e.g. active recess)

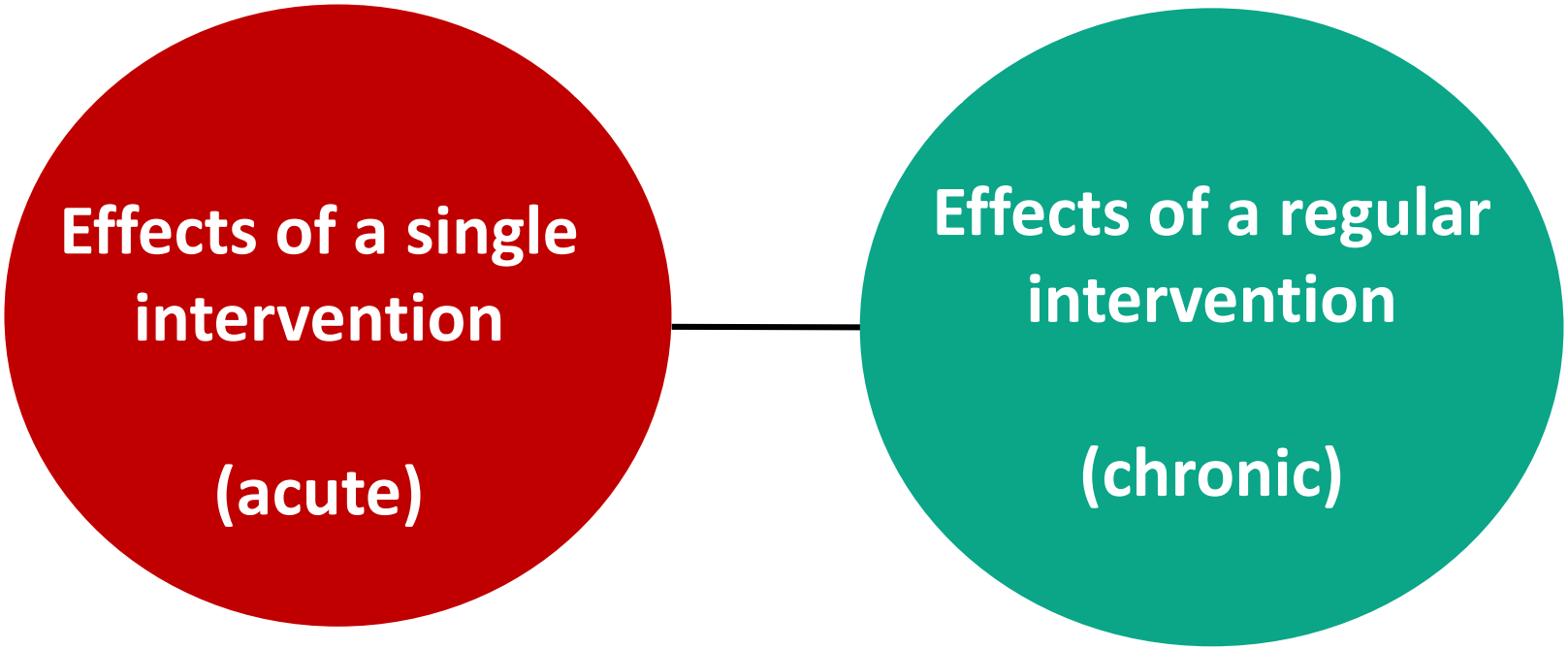
Research topics in future:

The impact of the ‚active school‘ on the brain and on the learning child

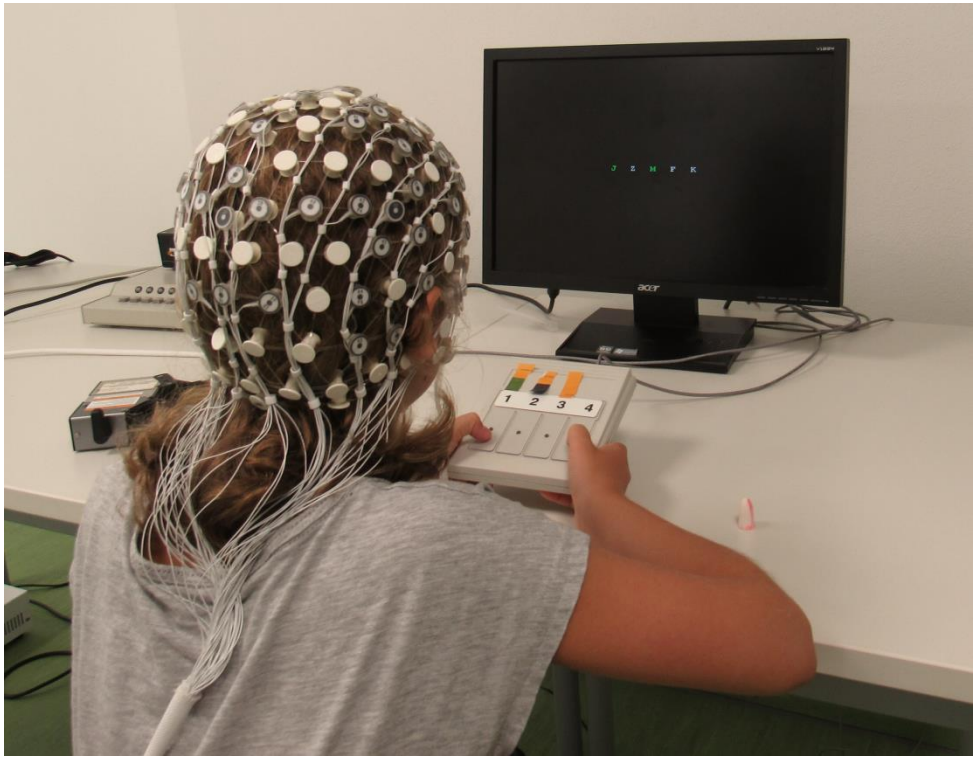


Pühse/Ludyga

Evidence based research
Neuroplasticity in school children



Acute effects of exercise
Laboratory assessment



- Typical testing situation for cognitive assessments combined with EEG recordings
- Participants have to give responses by pressing a button
- Cognitive tests typically last around 20 min
- Set-up allows the assessment of cognitive process that influence behavioral performance

Acute effects of exercise
ADHD vs. healthy controls

20 min aerobic vs. 20 min coordinative exercise vs. 20 min video (control condition)

- 34 children aged 13 years (16 with ADHD; 18 healthy controls)

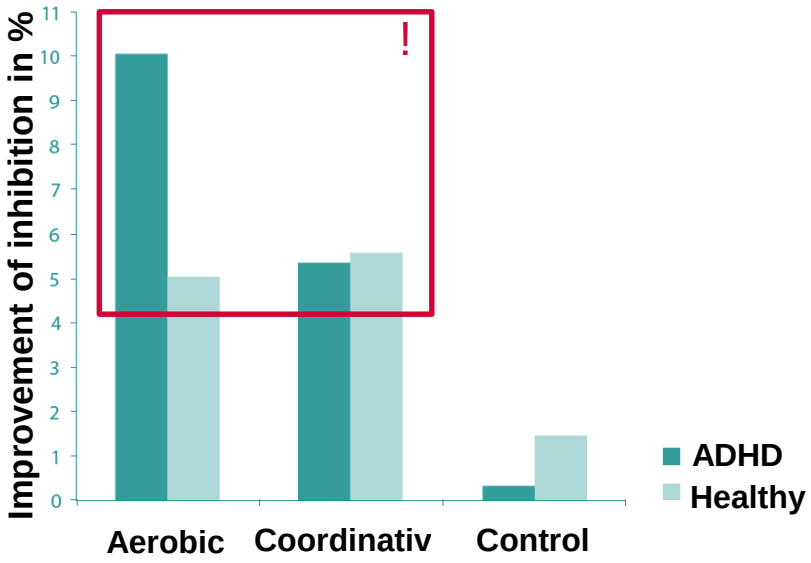
- Cycling on an ergometer
- Moderate intensity (70% maximal heart rate; 140 bpm)

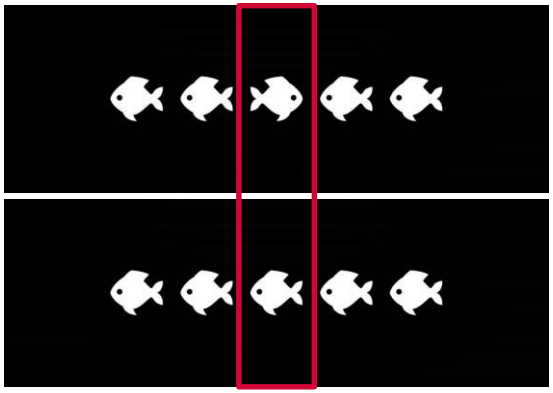
- Coordiantive exercises (e.g. quickly switching between different variations of jumping jacks, stepping through coloured rings)

Ludyga, S., Brand, S., Gerber, M., Weber, P., Brotzmann, M., Habibifar, F., & Pühse, U. (2017). An event-related potential investigation of the acute effects of aerobic and coordinative exercise on inhibitory control in children with ADHD. *Developmental cognitive neuroscience*, 28, 21-28. doi:10.1016/j.dcn.2017.10.007

Acute effects of exercise
ADHD vs. healthy controls

20 min aerobic vs. 20 min coordinative exercise vs. 20 min video (control condition)



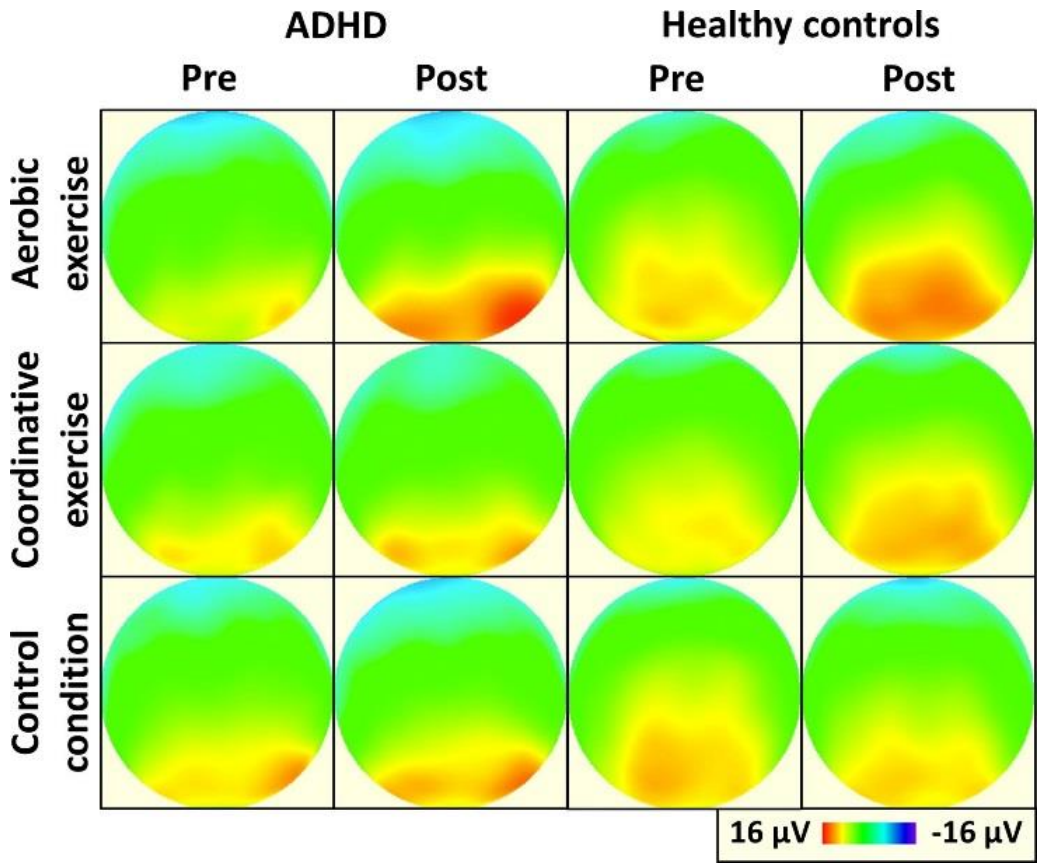


Flanker task (requires to respond to the direction of the central fish)

- Inhibitory control = ability to resist distractions
- High inhibitory control is favorable for learning (improves time spent on tasks and classroom behavior)
- Aerobic exercise has greater effects in children with ADHD

Acute effects of exercise
ADHD vs. healthy controls

20 min aerobic vs. 20 min coordinative exercise vs. 20 min video (control condition)



- **Red area = higher amplitude**
- **= increased attentional resources**
- Increased allocation of attentional resources after aerobic exercise in ADHD
- Increased allocoation of attentional resources after aerobic and coordinative exercise in healthy children
- Greater benefits in ADHD compared to healthy children

Acute effects of exercise
Summary

Current evidence on acute effects of aerobic exercise

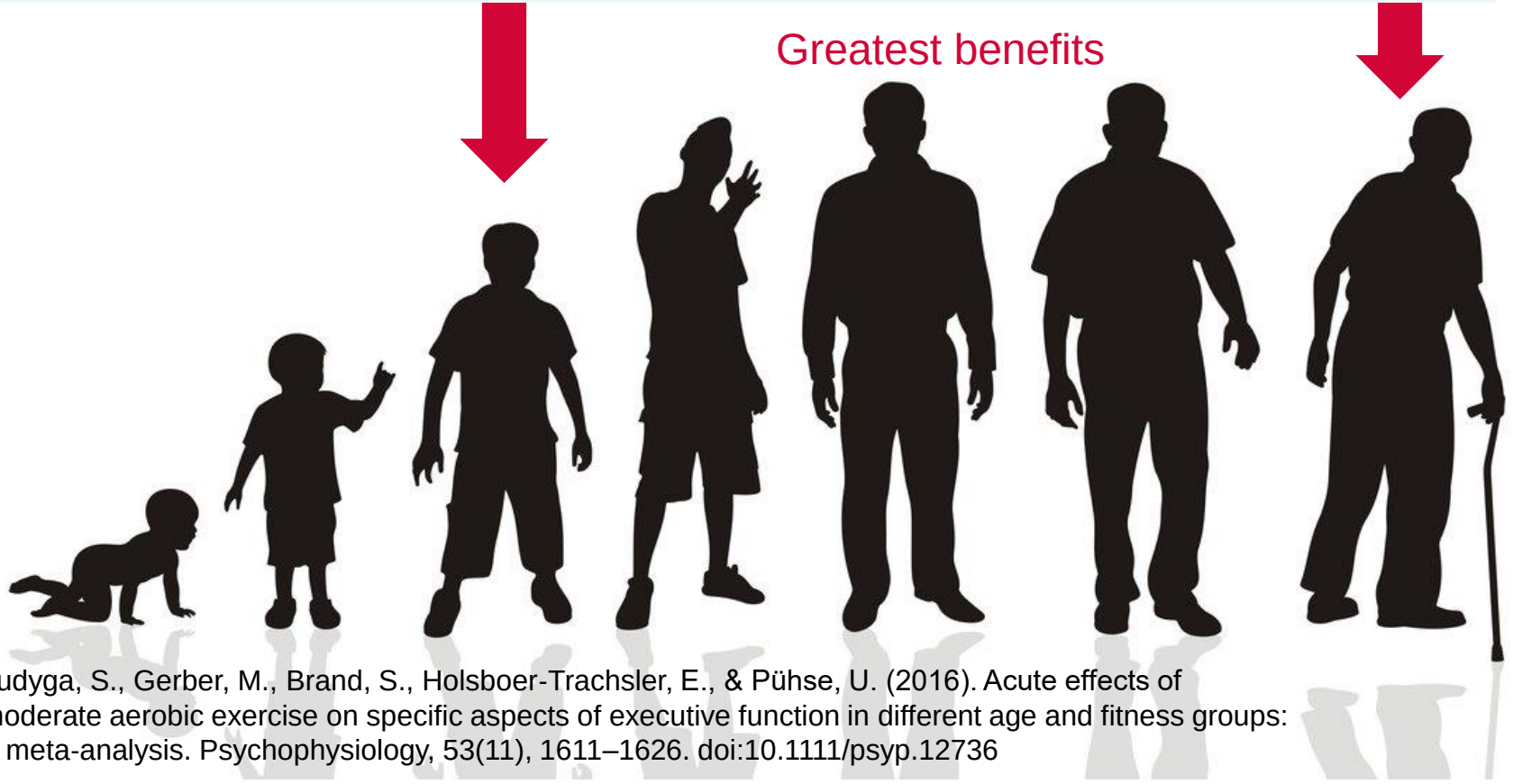
Exercise intensity	Higher-order cognition after exercise	Higher-order cognition following a delay after exercise (>15 min)
Low	→ or ↑	→
Moderate	↑	↑
Submaximal	→ or ↑	↑
Maximal	↓	→ or ↑

Ludyga et al. (2016); Chang et al. (2012); McMorris et al. (2012)

- Moderate aerobic exercise (55-70 % maximal heart rate; around 130 to 140 bpm) is most promising in eliciting cognitive benefits
- Duration of the exercise should be 10 to 30 min
- Evidence on the acute effects of other exercise modalities is limited

Acute effects of exercise
Meta-analysis

- Acute aerobic exercise improves higher-order cognition (*top-down mental processes necessary to guide behavior*) across age
- Magnitude of improvements are influenced by age, but not by fitness



Ludyga, S., Gerber, M., Brand, S., Holsboer-Trachsler, E., & Pühse, U. (2016). Acute effects of moderate aerobic exercise on specific aspects of executive function in different age and fitness groups: A meta-analysis. Psychophysiology, 53(11), 1611–1626. doi:10.1111/psyp.12736

Long-term effects of exercise
Exercise implemented in break-time

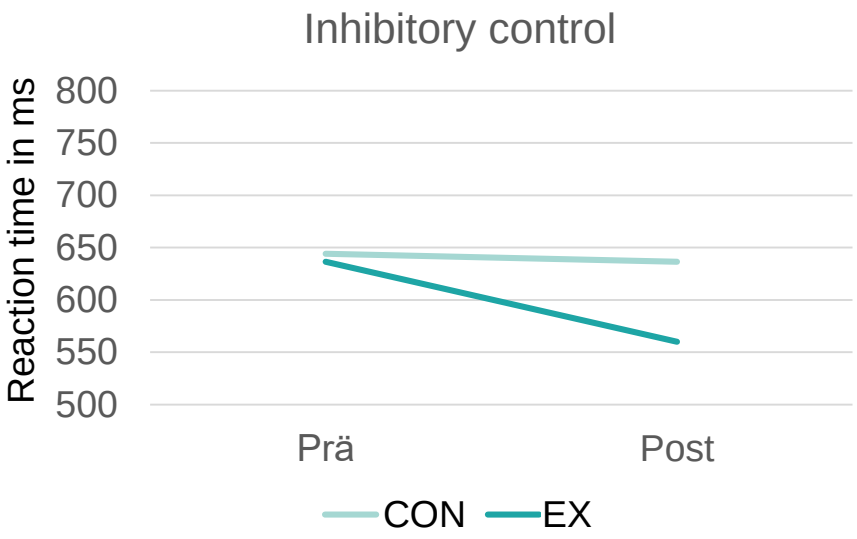


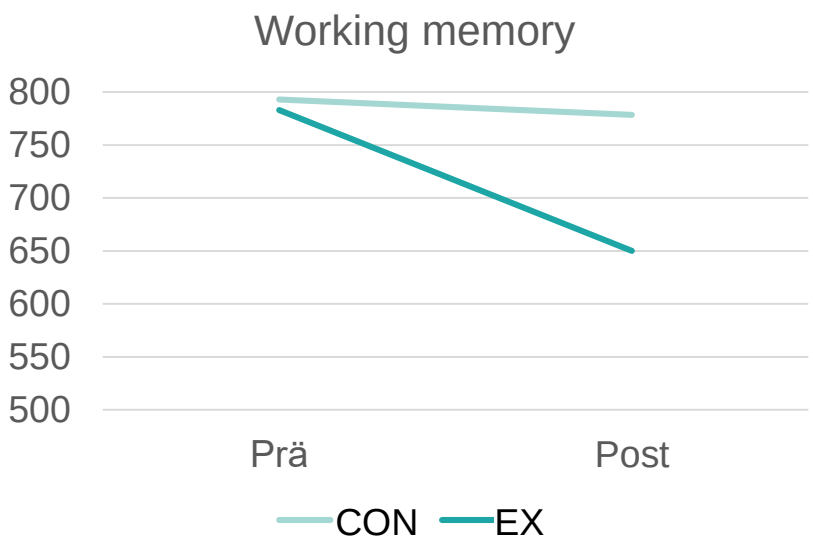
- 36 children aged 12-15 years (20 in exercise group; 16 in control group)
- Exercise group performed an active break program with 20 min per school day (after lunch); control group engaged in social interaction
- Active break program was completed over 8 weeks and included aerobic and coordinative exercise (e.g. variations of ball games, relay games and playing tag, with a high degree of body coordination)

Ludyga, S., Gerber, M., Herrmann, C., Brand, S., Pühse, U. (2017). Chronic effects of exercise implemented during school-break time on neurophysiological indices of inhibitory control in adolescents. *Trends in Neuroscience and Education*, 10, 1-7. doi:10.1016/j.tine.2017.11.001

Long-term effects of exercise
Exercise implemented in break-time

Exercise group (EX) vs. control group (CON)



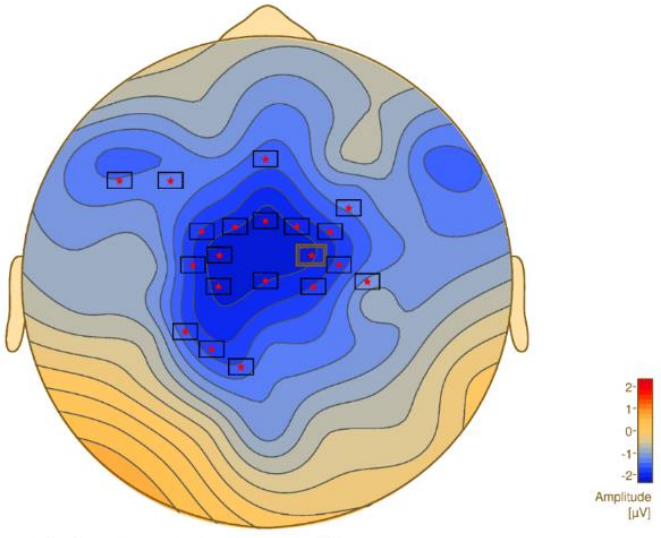


- Shorter reaction times indicate that cognitive processes are faster / more efficient
- Improvements in inhibitory control indicate that children can resist distractions more easily and focus on what is important in class
- Improvements in working memory indicate increased ability to aquire and maintain information in mind, which is critical to learning
- Active break program improved both cognitive functions

Long-term effects of exercise
Motor competence and cognition

Children with high vs. low motor competencies

Brain activity related to task preparation in a working memory task



- 82 children aged 10 to 15 years completed a motor competence assessment battery (MOBAK-5) and cognitive testing
- More effective task preparation indexed by increased negative amplitude (blue area) at central brain region
- Children with high vs. low motor competences showed more effective task preparation processes and higher working memory
- Exercise aimed at improving motor competence can improve the way children prepare to react
- Improved recall of information held in mind, thus increasing learning abilities in class

Ludyga, S., Herrmann, C., Mücke, M., Andrä, C., Brand, S., Pühse, U., Gerber, M. (2018/in press). Contingent negative variation and working memory maintenance in adolescents with low and high motor competencies. *Neural Plasticity*.

Acute and long-term effects of exercise

Final statements

- Physical activity / exercise does not per se enhance higher-order cognition

  BUT: Enriched physical activity (long-term exercise paradigm) and moderate aerobic exercise (acute exercise paradigm) are optimal for enhancing cognition

- Benefits elicited by acute exercise are only temporary

  BUT: It can easily be implemented in the school routine to restore cognitive resources for the following classes

- Long-lasting benefits for cognitive performance require regular engagement in PA

  BUT: It is worth the effort, because long-term exercise promotes the development of higher-order cognition across childhood and adolescence

Effects of physical activity interventions on cognitive and academic performance in children and adolescents: a novel combination of a systematic review and recommendations from an expert panel

Amika S Singh,[1] Emi Saliasi,[1] Vera van den Berg,[1] Léonie Uijtdewilligen,[2] Renate H M de Groot,[3] Jelle Jolles,[4] Lars B Andersen,[5] Richard Bailey,[6] Yu-Kai Chang,[7] Adele Diamond,[8] Ingegerd Ericsson,[9] Jennifer L Etnier,[10] Alicia L Fedewa,[11] Charles H Hillman,[12] Terry McMorris,[13] Caterina Pesce,[14] Uwe Pühse,[15] Phillip D Tomporowski,[16] Mai J M Chinapaw[1]

► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/bjsports-2017-098136).

For numbered affiliations see end of article.

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ABSTRACT

Objective To summarise the current evidence on the effects of physical activity (PA) interventions on cognitive and academic performance in children, and formulate research priorities and recommendations.

Design Systematic review (following PRISMA guidelines) with a methodological quality assessment and an international expert panel. We based the evaluation of the consistency of the scientific evidence on the findings reported in studies rated as of high methodological quality.

Data sources PubMed, PsycINFO, Cochrane Central, Web of Science, ERIC, and SPORTDiscus.

Eligibility criteria for selecting studies PA-intervention studies in children with at least one cognitive or academic performance assessment.

Results Eleven (19%) of 58 included intervention studies received a high-quality rating for methodological quality: four assessed effects of PA interventions on cognitive performance, six assessed effects on academic performance, and one on both. All high-quality studies contrasted the effects of additional/adapted PA activities with regular curriculum activities. For cognitive performance 10 of 21 (48%) constructs analysed showed statistically significant beneficial intervention effects of PA, while for academic performance, 15 of 25 (60%) analyses found a significant beneficial effect of PA. Across all five studies assessing PA effects on mathematics, beneficial effects were reported in six out of seven (86%) outcomes. Experts put forward 46 research questions. The most pressing research priority cluster concerned the causality of the relationship between PA and cognitive/academic performance. sample size, the use of valid and reliable measurement instruments for physical activity and cognitive performance, measurement of compliance and data analysis.

PROSPERO registration number CRD42017082505.

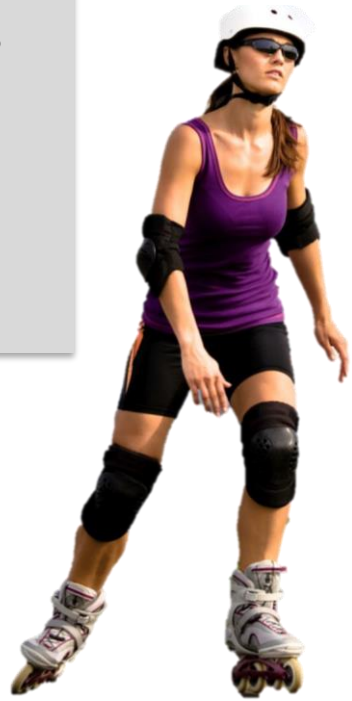
INTRODUCTION

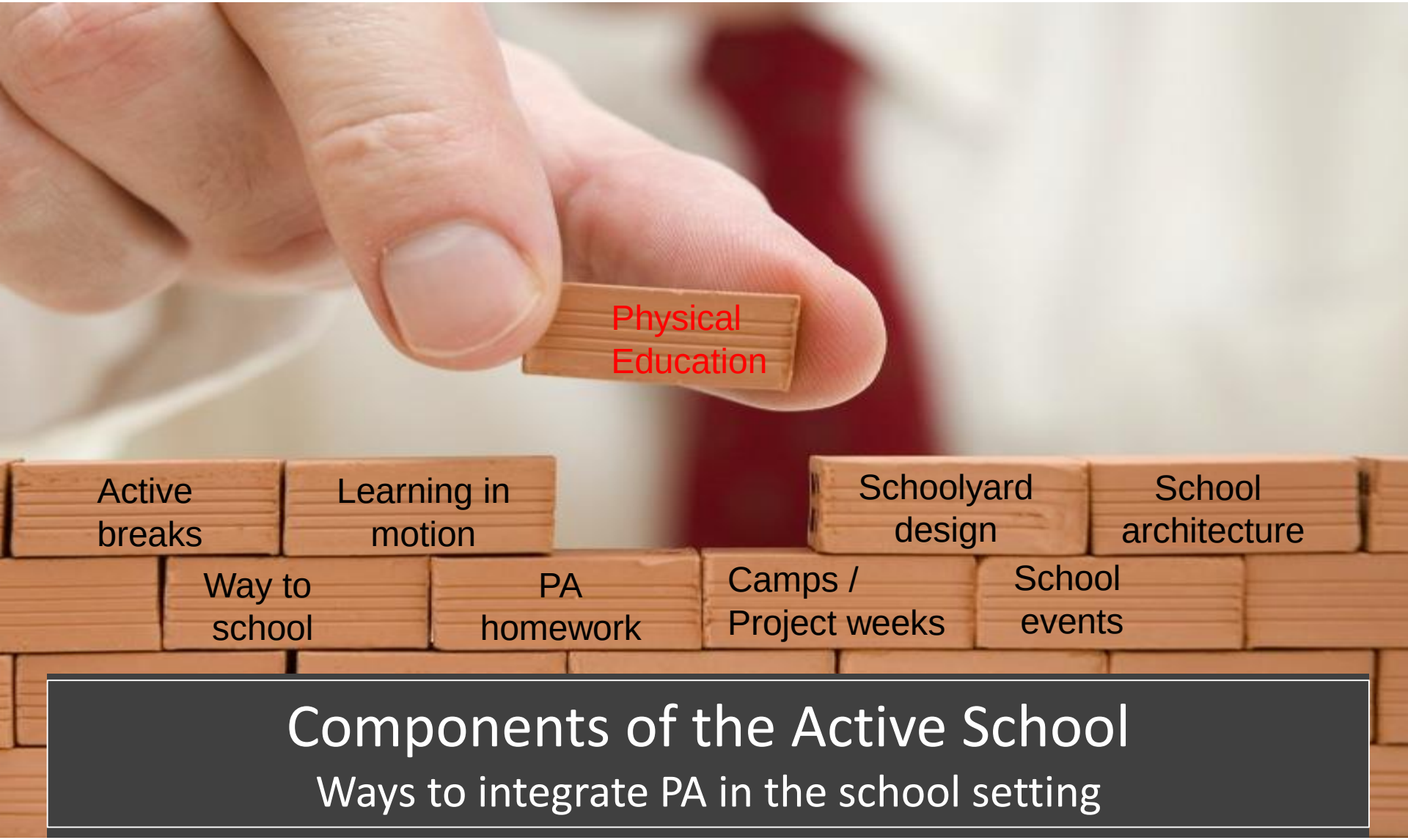
Cognitive skills are crucial for school readiness and academic performance,[1–3] and are supported by a variety of brain regions, which continue to mature throughout adolescence.[4] This developmental window poses a great opportunity for experience-dependent plasticity,[5] as the structural and functional organisation of the brain can be positively influenced through enriched environmental conditions[6] like, for example, physical activity (PA). As such, it is critical to advance our understanding of opportunities that have the potential to positively influence brain development.

The physical and mental health benefits of PA are widely acknowledged,[7 8] but less is known about the potential effects of PA on cognitive and academic performance. A number of reviews and reports on this topic have been published during the last decade,[9–19] mainly concluding that PA is positively associated with cognition and with structural and functional brain health and a neutral association with academic performance for children.[12] Not all of these reviews were systematic, took into account the methodological quality of the studies included, and were exclusively looking at intervention studies.

Lessons learned:

Start early	Integrate into daily life	Active school	Daily PE
Pay special attention to the first 10 years	Contribute to an active lifestyle of children and adolescents 60-90 min daily	Implement a physically active and healthy school	Guarantee at least 3 hours – but better daily PE in schools





Components of the Active School

Ways to integrate PA in the school setting

Thank you for your attention!

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