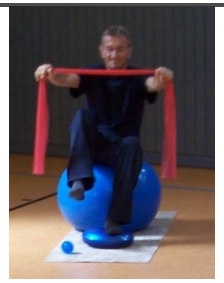
Prof. Dr. Petra Wagner



Symposium:
Health Enhancing Physical Activity Promotion
– from Theory to Practice

Exercise for Elderly Cyclists to Improve Traffic Safety and Mobility

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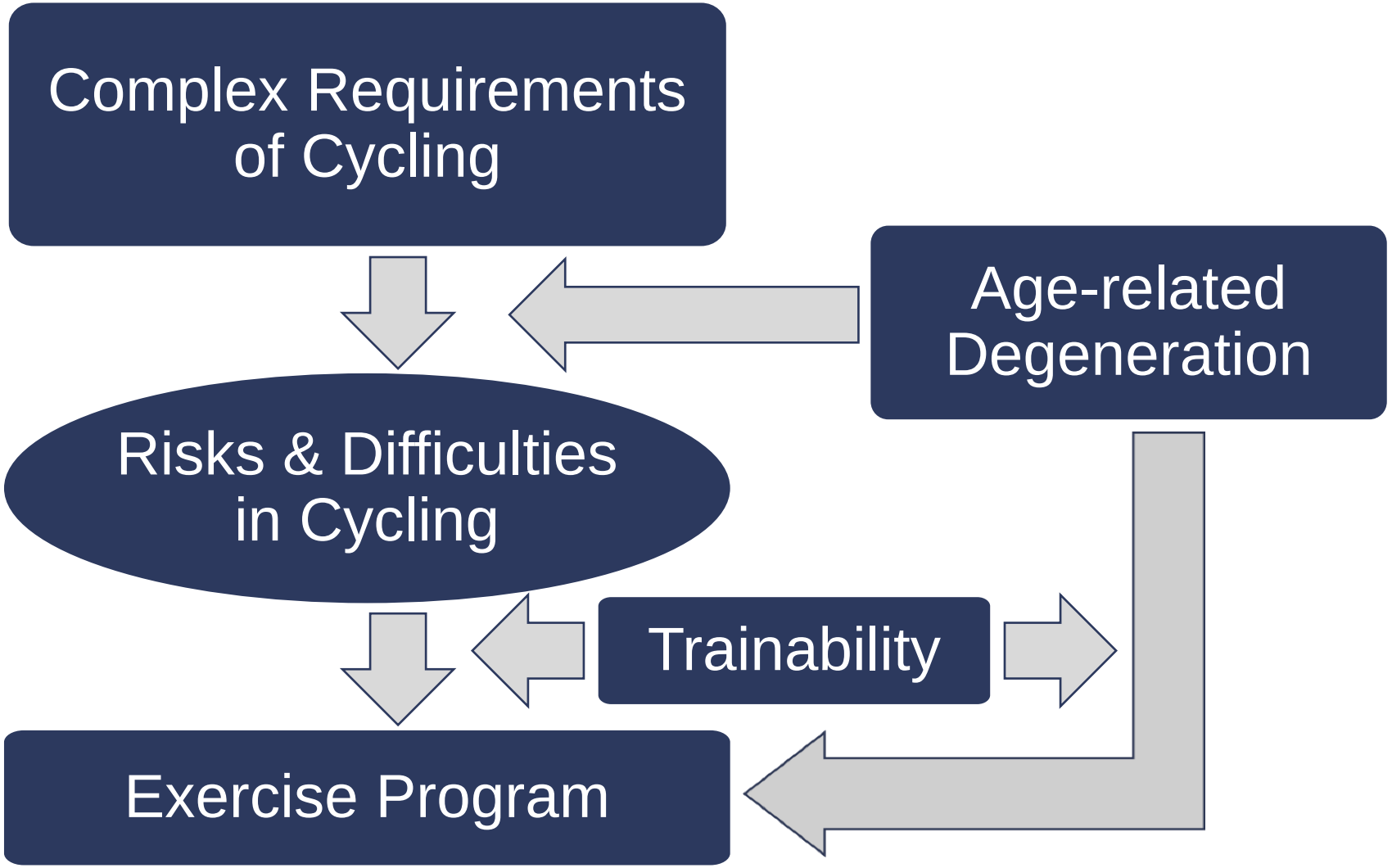
Mobility of Elderly through Cycling – the problem

- Mobility is a resource of independence, participation and quality of life
- Demographic change in Germany: => Increasing percentage of Elderly
- use of automobiles and bicycles to obtain mobility …
- But: the percentage of elderly cyclists in Germany only 11% (60-74 years); 7% (>75 years)
- Benefits of cycling: health enhancing physical activity, ecologically friendly, easy available, inexpensive, alternative locomotion (faster and less exhausting than walking)
- If elderly are involved in accidents there is a high risk of heavy injuries and mortality!
- Typical accident reasons are: ascending on/dismounting from the bike, trail conditions, complex traffic situations (e.g. crossroads, left-turning, gateways; tram tracks)

(Bauman et al., 2011; Gajewski et al., 2010; Hagemeister & Tegen-Klebingat, 2011; Haustein et al., 2008; Oja et al., 2011; Schlag, 2008; Wagner et al., 2004)

Development of an Exercise Program



Complex Requirements of Cycling

Demands in traffic	Skills	Required abilities
Get off the bike	• Precise stop • Rising from sitting to standing • Standing on one pedal • Lifting the leg over the bike frame	• Anticipation • Reaction • Balance • Flexibility in the trunk-, hip-, and foot joints • Movement coupling
Cycling in a narrow alley	• Keep in lane • Cycle strait on	• Balance • Stabilize the trunk and shoulders • Concentration • Differentiation ability within the upper extremities
Turning	• Indicate turning (cycle one-handed) • Looking over the shoulder while cycling	• Movement coupling • Balance • Torso stability • Flexibility in shoulders and neck joints • Orientation, peripheral seeing

(Bast, 2009; Greule & Friedrich, 2007, Könemann, 1996; Hottenrott, 2001)

Age-related Degenerative Processes

Trainability

- Physical abilities
  - endurance
  - Strength (legs, torso, shoulders)
  - flexibility (ankles, torso, neck)

- Coordinative abilities (e.g. balance, reaction, orientation, anticipation)

- Cognitive and sensory abilities (e.g. attention, information processing, decision-making ability)

- Vision and hearing
- Capacity of the vestibular system

The training of endurance, strength and coordinative abilities also improves cognitive abilities

- Chronic degenerative diseases
- Medication

➡Excessive demands
➡Anxiety
➡Falls and accidents

?

(Colcombe & Kramer, 2003; Eichberg & Mechling, 2009; Gajewski, 2010; Granacher, 2011; Granacher et al., 2009, 2012; Granacher & Gollhofer, 2005; Kramer & Erickson, 2007; Lan et al., 1998; Latham et al., 2004; Rinkenauer, 2008; Rosenhall & Rubin, 1975; Schuler et al., 1993; Suomi & Lindauer, 1997; Voelcker-Rehage et al., 2011)

Objectives and Methods of the Project

Objectives

- Development and evaluation of a structured exercise program to improve
  - motoric and cognitive abilities of older cyclists
  - safety perception
  - quality of life and health
  - motivation for everyday use of the bicycle

Design

- Controlled longitudinal study with adults from 60 years
- Pre-, post- and follow-up tests (2013 – 2014)
- 14 small and medium cities in Eastern Germany with
  - Poor public transport
  - Population > 10 000 inhabitants

Intervention

- 7-sequences intervention: Combined exercise program (muscle strenght, postural control, coordination, flexibility, cognitive skills, psycho-social ressources)
- 6 months, 120 min./week (60 min., 2x/week)

(Gajewski, 2010; Könemann, 1996; Schlag, 2008; Wagner et al., 2004)

Objectives and Methods of the Project

Groups

- Intervention Group (IG, n=145, ∅ 67.5 years, 43.4% women) → structured exercise program
- Control Group (n=162, ∅ 67.4 years, 36.4% women)

Fitness Tests

Abilities		Tests
Endurance		Six-minute walk test
Muscle strength	Hand-grip strength	Citec-handheld-dynamometer
	Knee extension	
Coordination	Reactivity	Rolling ball
	Balance	Balance track
	Postural stability	Functional Reach and Lateral Reach Test
	Functional mobility	Timed-Up-and-Go Test
Flexibility	Torso and hamstrings	Sit-and-Reach Test
	cervical spine	CMS pro

Objectives and Methods of the Project

Questionnaires

physical activities, quality of life, health status, perceived complaints, self-efficacy, social support, safety perception, mobility habits, self concept, etc.

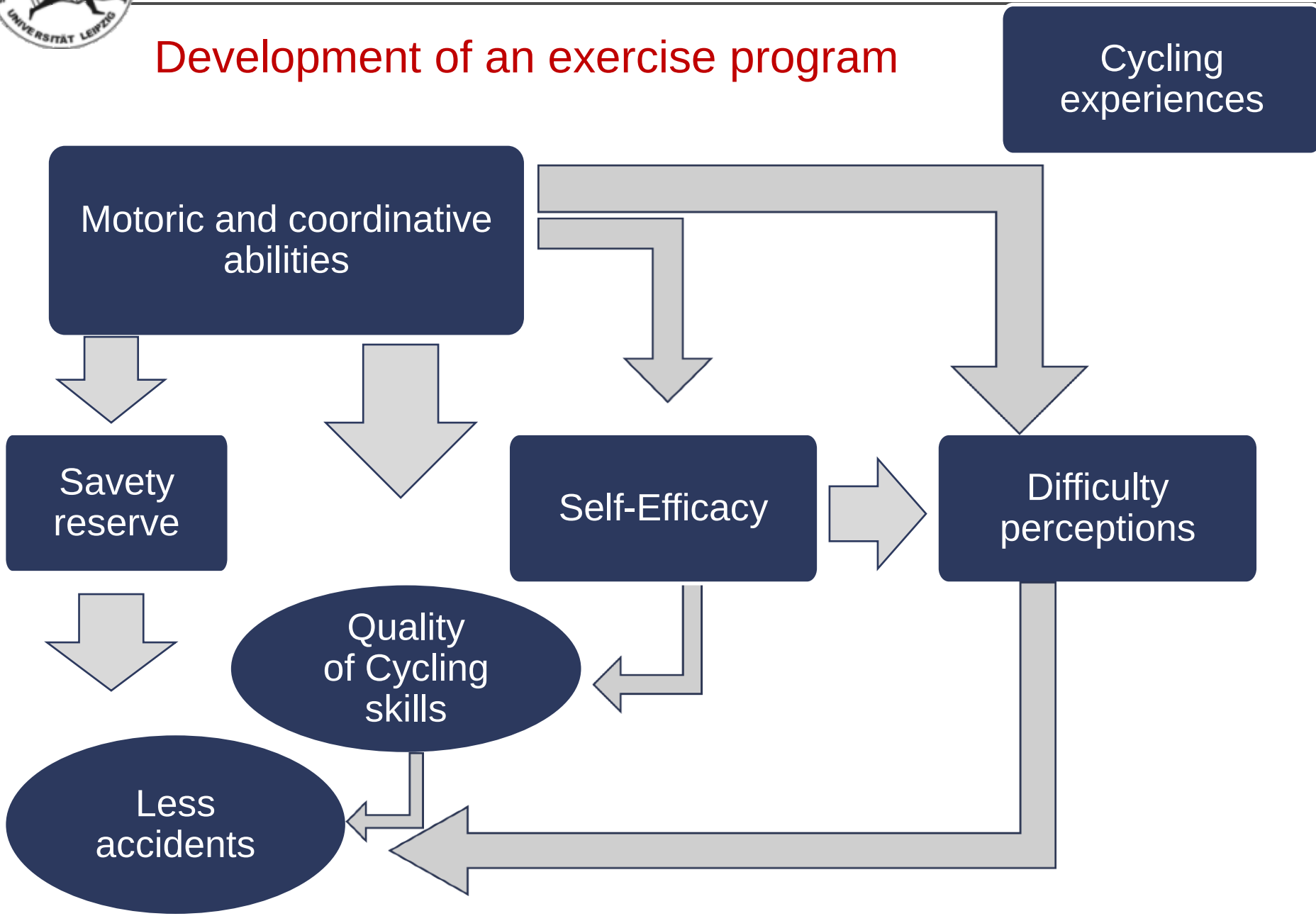
cognitive tests (mental rotation, perceptual speed)

Bike course – quality of cycling

Assessment	Rating scale
Slalom	1 – 2 faults
Slow driving	1 – 2 faults
Dismounting (left/right)	correct/false
Narrow lane	correct/false

Assessment	Rating scale
Precise stop	1 – 3 faults
Left turn	1 – 4 faults
One-handed driving figure eight	1 – 3 faults

Development of an exercise program



Selected Results at t1

Correlations between qualities of cycling and motoric abilities?

There are correlations between all of the quality of cycling and selected motoric abilities

Hand-grip strength (in Newton)	-.315***
Knee extension strength (in Newton)	r: -.330*** l: -.313***
For Timed-up-and-go test (time in sec.)	.298**
Rolling ball (rolling path in cm)	.209***

a: Spearman rank correlation

* p≤.05, ** p≤.01, ***p≤.001

Selected Results at t1

- Correlations between perceived difficulties and motoric abilities?

Correlations between Lateral Reach Test (motoric abilities) and perceived difficulties in… (N=273-276)	r^b
… dismounting	n.s.
… holding the handlebar under control	-.128*
… controlling the bicycle and giving a hand sign	-.219***
… turning the head backward	-.181**

There are low correlations between the perceived difficulties of cycling and selected motoric abilities

… driving fast	-.278***
… driving ascending slopes	-.305***
… maintaining balance	-.197**

a: perceived difficulties from 1= not at all difficult to 5= very difficult

b: Spearman rank correlation

* p≤.05, ** p≤.01, ***p≤.001

Selected Results at t1

- Correlation between perceived difficulties of cycling and quality of cycling?

Perceived difficulties[b] in …	Errors while …	n	r [a]
… dismounting	… dismounting (left/right)	254 257	.206** .132*
… guiding with one hand	… one-handed driving figure eight	290	.221***

There are low correlations between the perceived difficulties of cycling and selected qualities of cycling

Selected Results at t1

- Correlation between self-efficacy and the perceived difficulties of cycling?

Correlations of self-efficacy with perceived difficulties in … (N=242-245)	Median[a]	r[b]
… dismounting	1	-.274***
… holding the handlebar under control	1	-.251***
… controlling the bicycle and giving a hand sign	1	-.370***
… turning the head backward	2	-.438***

There are low to medium correlations between the perceived difficulties of cycling and self-efficacy

… driving slowly	1	-.284***
… driving fast	1	-.381***
… driving ascending slopes	2	-.394***
… maintaining balance	1	-.289***

a: perceived difficulties from 1= not at all difficult to 5= very difficult

b: Spearman rank correlation

* p≤.05, ** p≤.01, ***p≤.001

Selected Results at t1

Self-efficacy

- and frequency of cycling?
- and motoric abilities?
- and the quality of cycling?

N=245	Self-efficacy
Frequency of cycling[a]	.145*

Qualities (N=222-270)	Self-efficacy
Slalom	-.265***

There are low to medium correlations between self-efficacy and frequency of cycling, some motoric abilities and some qualities of cycling

knee extension strength, balance, postural stability, functional mobility, flexibility	n.s.

One- handed driving figure eight	-.214***

a: median=4; frequencies from 0= never; 5= daily or almost daily; 4= 3-4 times/week

* p≤.05
** p≤.01
***p≤.001

Selected Results at t1

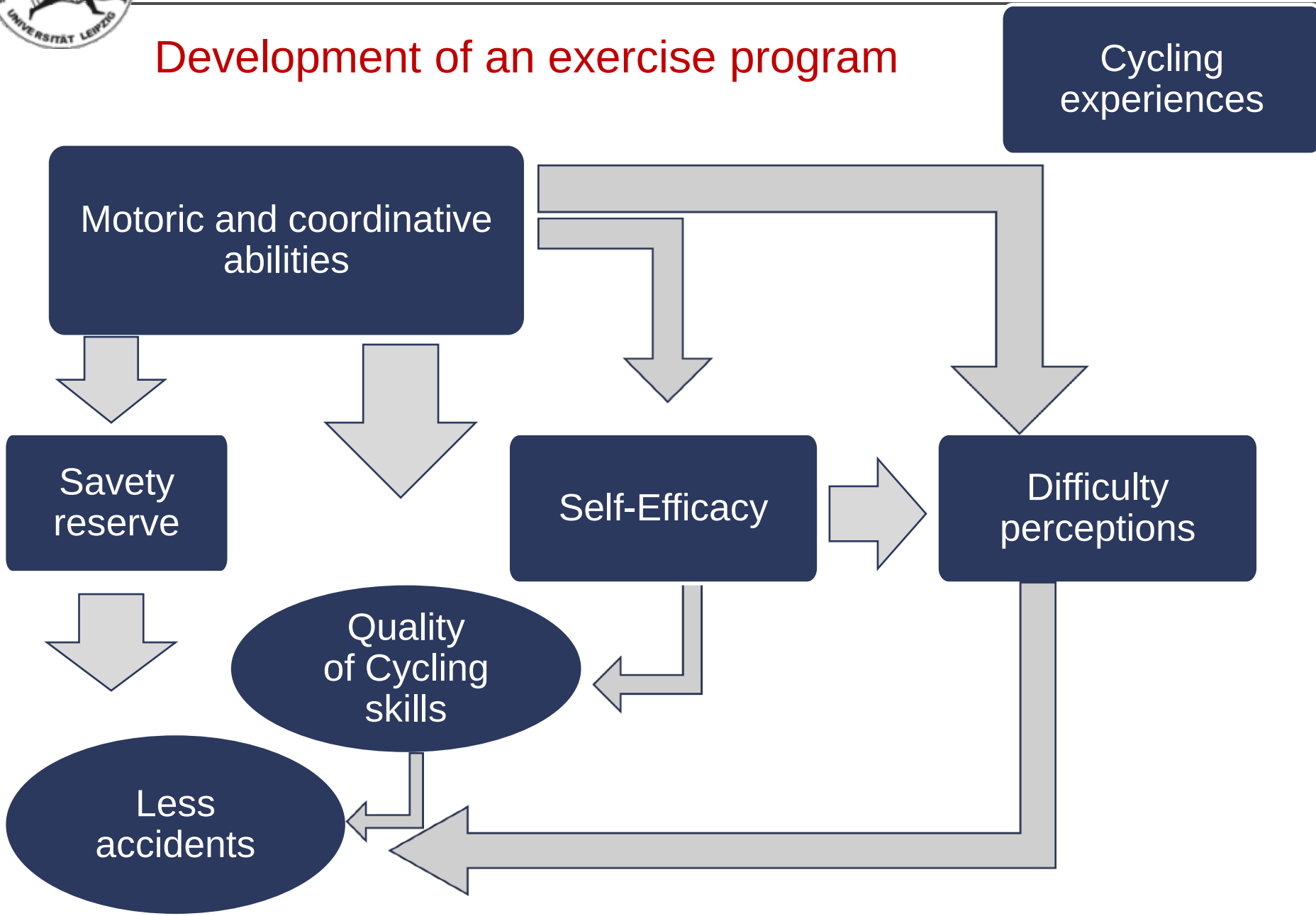
Correlation between cognitive abilities and motoric abilities?

Correlation of motoric abilities and perceptual speed[b] (cognitive abilities) (N=266-303)	r[a]
Six-minute walk distance (in meter)	-.169**

There are low correlations between selected cognitive abilities and some motoric abilities, but not with the qualities of cycling

- Mental rotation test (points): Ø=14.6 (SD=6.4); no significant correlation to motoric abilities
- No correlations between the selected cognitive abilities and the qualities of cycling

Development of an exercise program



Perspectives for the longitudinal study

- → An improvement of motoric abilities required for bike riding should increase self efficacy and consequently quality of cycling, perceived difficulties while cycling as well as the frequency of cycling in daily living.
- → A structured exercise program may contribute to a secure cycling-behavior in everyday traffic situations and also enhances a physical active way of life and health.

Thank you for your attention!

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