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Departement für Sport, Bewegung und Gesundheit

Exergaming and Self-Tracking in the Treatment of Obesity and Type 2 Diabetes – Improving Exercise Adherence

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Prevalence:

- 1.9 billion individuals worldwide overweight and 600 million obese^[1]
- 8.5% of all adults diagnosed with type 2 diabetes mellitus^[2]

Fact:

- Clear link between physical inactivity and type 2 diabetes^[3]
- Increased risk of various comorbidities as when physically inactive^[3]

^[1] WHO | Obesity and overweight. (2014). Abgerufen 19. Februar 2015, von <http://www.who.int/mediacentre/factsheets/fs311/en/>

^[2] WHO | Diabetes. (2015). Abgerufen 27. Januar 2016, von <http://www.who.int/mediacentre/factsheets/fs312/en/>

^[3] Kohl, H. et al. (2012). The pandemic of physical inactivity: global action for public health. *Lancet*, 380(9838), 294–305.

Regular physical activity in diabetes has various health benefits:

- better glucoregulation^[4]
- lowers blood pressure and LDL-cholesterol^[4]
- weight loss and weight stabilization^[4]
- lower risk of cardiovascular disease^[4]
- ...

^[4] Colberg, S. R. et al. (2010). Exercise and type 2 diabetes: American College of Sports Medicine and the American Diabetes Association: joint position statement. Exercise and type 2 diabetes. *Med Sci Sports Exerc*, 42(12), 2282–2303.

Key problem of all physical activity promoting programs:

- **Exercise Adherence**^[5]

Exergaming as an innovative approach to address the problem

- Nintendo Wii Fit can motivate obese individuals^[6] and those with type 2 diabetes^[7,8] to become more physically active

^[5] Zhao, G., Ford, E. S., Li, C., & Balluz, L. S. (2011). Physical activity in U.S. older adults with diabetes mellitus: prevalence and correlates of meeting physical activity recommendations. *J Am Geriatr Soc*, 59(1), 132–137.

^[6] Warburton DER, Bredin SSD, Horita LTL, et al. (2007). The health benefits of interactive video game exercise. *Appl Physiol Nutr Metab.*, 32:655–663

^[7] Kempf, K., & Martin, S. (2013). Autonomous exercise game use improves metabolic control and quality of life in type 2 diabetes patients - a randomized controlled trial. *BMC Endocr Disord*, 13(1), 57.

^[8] Thompson, D. (2012). Designing serious video games for health behavior change: current status and future directions. *J Diabetes Sci Technol*, 6(4), 807–811.

A few selected exergame modes allow for a training that corresponds to current ACSM and ADA guidelines ^[9, 10]:

- Average VO_2 of 42-44% VO_{2peak}
- Average HR of 67-70% Hf_{max}
- RPE (Borg) 11-13
- Positive correlation between treadmill VO_{2peak}
und exergame VO_{2peak}

^[9] Morton, R. D., West, D. J., Stephens, J. W., Bain, S. C., & Bracken, R. M. (2010). Heart rate prescribed walking training improves cardiorespiratory fitness but not glycaemic control in people with type 2 diabetes. *Journal of Sports Sciences*, 28(1), 93–99.

^[10] Höchsmann, C., Zürcher, N., Stamm, A., & Schmidt-Trucksäss, A. (2016). Cardiorespiratory Exertion While Playing Video Game Exercises in Elderly Individuals With Type 2 Diabetes. *Clinical Journal of Sport Medicine*, 26(4), 326–331

However:

- No exergames that are fitted to needs of individuals with chronic diseases^[11]
- No individualized and structured exercise regimens^[11]
- Exercise modes not of sufficient duration (at least 10 minutes)^[11]
- Long-term effects regarding increases in daily physical activity unclear^[11]
- No RCTs with type 2 diabetes^[11]

^[11] Höchsmann, C., Schüpbach, M., & Schmidt-Trucksäss, A. (2016). Effects of Exergaming on Physical Activity in Overweight Individuals. *Sports Medicine*, 46(6), 845–860

Pedometers induce more physical activity and various health benefits:

- Significant increases (36%) of steps /day in obese subjects after 12 weeks^[12]
- Significant health benefits in type 2 diabetes after 12 weeks^[13]
 - lower HbA1c
 - lower weight
 - lower body fat
 - more steps/day

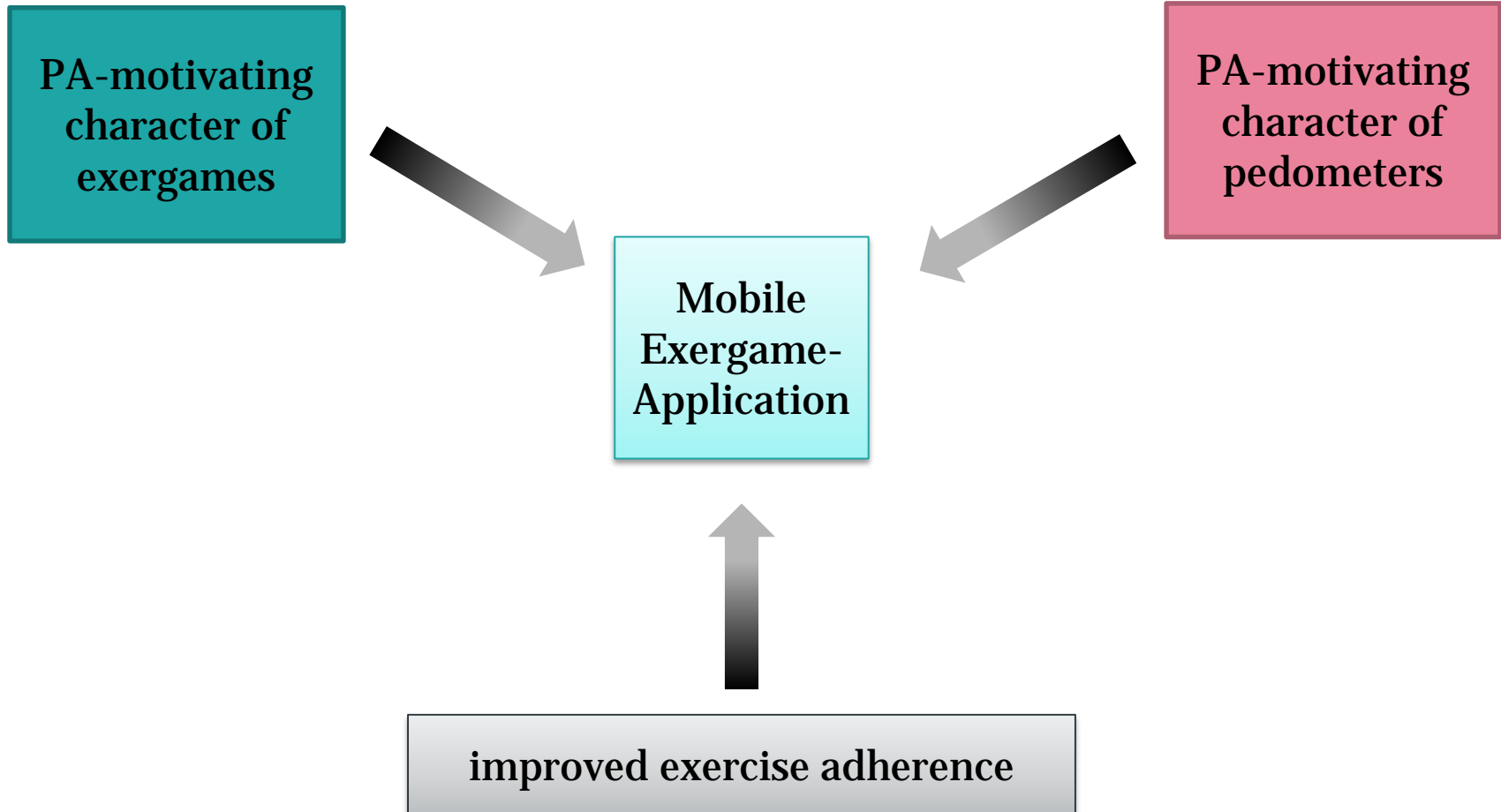
^[12] Pal, S., Cheng, C., Egger, G., Binns, C., & Donovan, R. (2009). Using pedometers to increase physical activity in overweight and obese women: a pilot study. *BMC Public Health*, 9, 309.

^[13] Diedrich, A., Munroe, D. J., & Romano, M. (2010). Promoting physical activity for persons with diabetes. *The Diabetes Educator*, 36(1), 132–140.

Mobile Exergame-Application



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Mobile Exergame-Application



- Cooperation with Novartis, Promotion Software and RMIT University
- Developed for inactive target group with chronic diseases
- Contains individualized trainings, adapted to the fitness level of the player
- Smartphone App -> can be played everywhere and anytime
- Uses sensor tracking to assess daily physical activity and to monitor execution of in-app trainings
- Motivates players to be regularly physically active by making the trainings part of the game's story line

Mobile Exergame-Application



Every activity counts!

In-App Trainings

- Strength exercises
- Endurance exercises
 - Walking
 - Aerobics
- Flexibility exercises
- Balance exercises

Daily PA

- Walking
- Jogging
- Hiking
- Biking

Other activities

- Swimming
- Dancing
- Housework/chores
- Etc.

Sensor tracking

Manual tracking

- Fitness assessment of players through baseline tests
 - 6 Minute Walk Test
 - 1 min Sit-to-Stand Test
- Option to switch off unwanted exercises (i.e. due to health restrictions)
- Clear instructions for all exercises including a video
- Choice of up to 3 tracking methods depending on strength exercise (camera, motion sensor, sound recognition)
- Walking exercises tracked via GPS and accelerometer
 - Recognition of different walking speeds
- Subjective rating of perceived exertion after each exercise -> tailoring of intensity

Conclusion



- Exergames and Self-Tracking can increase exercise adherence
- Combination of both in a smartphone application is a novelty
 - Use of various different sensors to track PA
 - Use of baseline tests to assess fitness level and to tailor exercises
 - Progress in the story line dependent on exercise adherence



Intervention study currently collecting data

- 24 weeks intervention
- Participants:
 - Type 2 Diabetes
 - BMI $\geq 25\text{kg}/\text{m}^2$
 - 45-70 years
 - Low physical activity
- Primary Outcome:
 - daily physical activity in steps per day



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Thank you
for your attention.

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