Hochschule Esslingen
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KORION
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Context-sensitive User-centered Scalability: An Introduction Focusing on Exergames and Assistive Systems in Work Contexts

Authors

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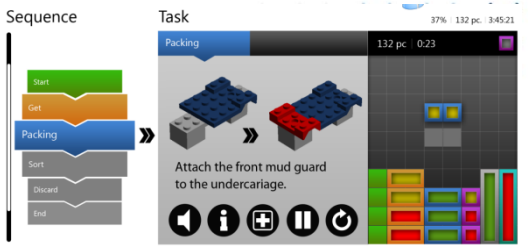

GameDays
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Overview

- we introduce an approach for implementing context-sensitive user-centered scalability (CSUCS) into interactive applications using motion recognition

- we discuss two prototypical implementations:

  - an “exergame” enriching sports exercises for the elderly

MOTIVOTION 60+

  - an assistive system using gamification elements to enrich the working experience of impaired and elderly persons

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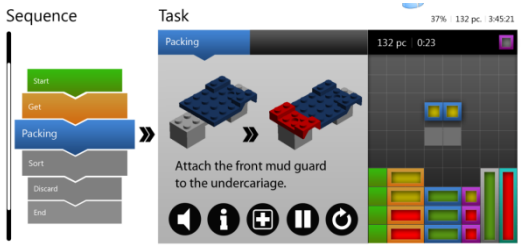


Motivation

- percentage of elderly persons in society and disabled employees grows
- these persons suffer from
  - general reduction of physical health, especially the loss of muscle, power balance and cardio-respiratory abilities [1]
  - reduction of short term memory [2]
  - decrease of learning abilities [3]

➔ assistive systems at the workplace and exergames at the residences are an efficient way to meet this demographic challenge

➔ assistive systems and exergames empower elderly persons and persons with disabilities and impairments to sustain an active lifestyle

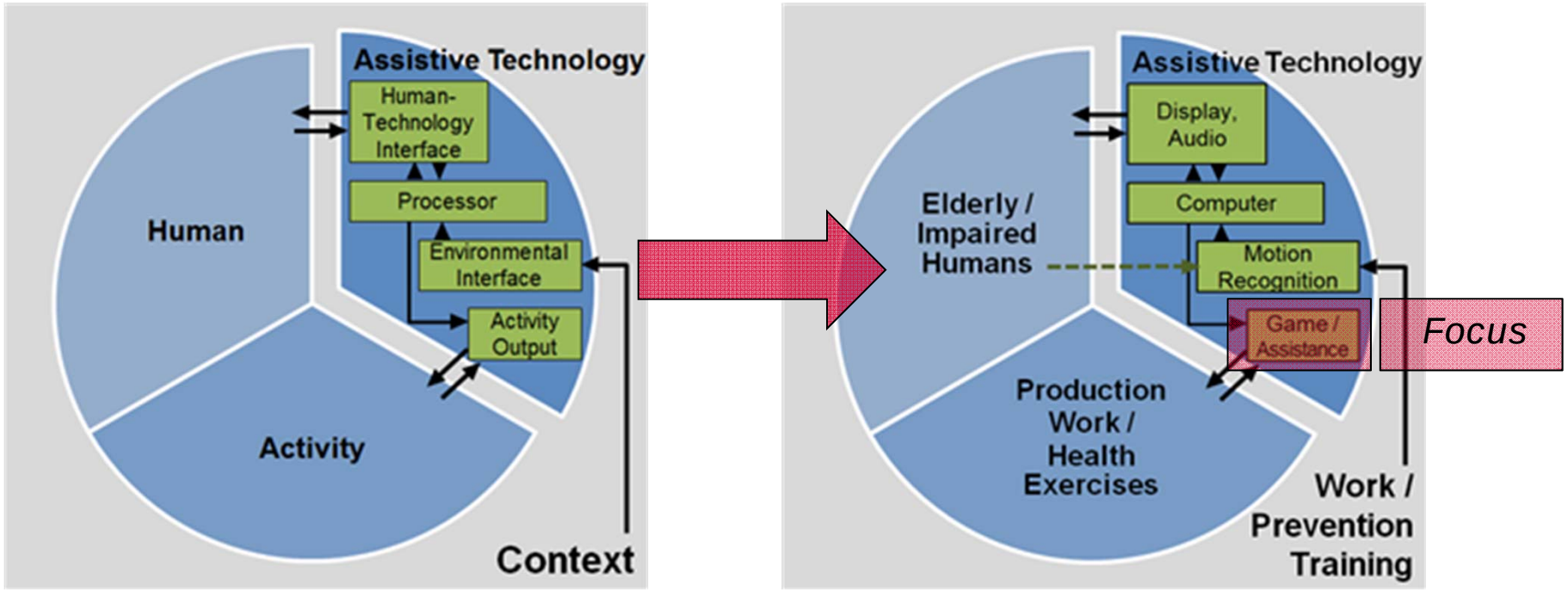
[1] Nelson, M.E.; Rejeski, W.J.; Blair, S.N.; Duncan, P.W.; Judge, J.O.; King, A.C.; Macera, C.A. & Castanda-Sceppa, C.: Physical Activity and Public Health in Older Adults. Recommendation from the American College of Sports Medicine and the American Heart As-sociation. Circulation, 116, 1094-1105, 2007

[2] Anders, T. R.; Fozard, J. L. and Lillyquist, T. D. 1972. “Effects of age upon retrieval from short-term memory”. In: *Developmental Psychology*, vol. 6, iss. 2, 214-217

[3] Satre, D.; Knight, B. G.; David, S. 2006: Cognitive behavioral interventions with older adults: Integrating clinical and Gerontological research. In *Professional Psychology: Research and Practice*, (37):489-498

Users

Adapted HAAT-model



HAAT: The Human Activity Assistive Technology Model as presented in: Cook, A. M. & Hussey, S. M.: Assistive Technologies: Principles and Practice, St. Louis, USA: Mosby, 1995

Mapping of our approach:
The assistive technology of the work contexts and the training contexts share several sub-components.

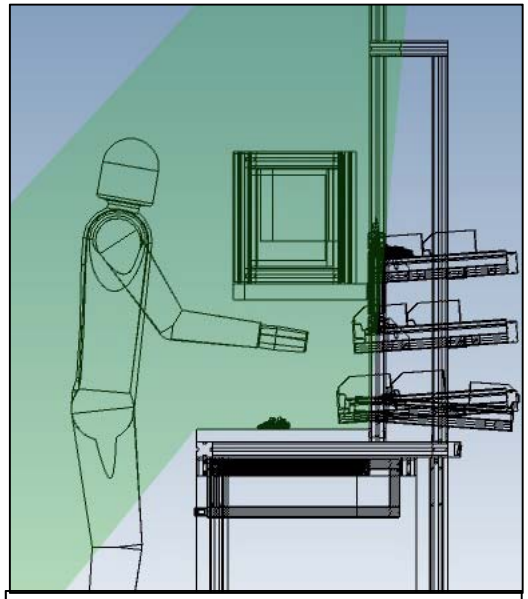
Two Prototypical Solutions

In both solutions…

- …the input side is realized by motion recognition
- …the user interface allows implicit interaction [1]
- …natural interaction is supported

The continuous interpretation of motion data allows real-time feedback and gamification

Exergame enriching sports exercises for the elderly



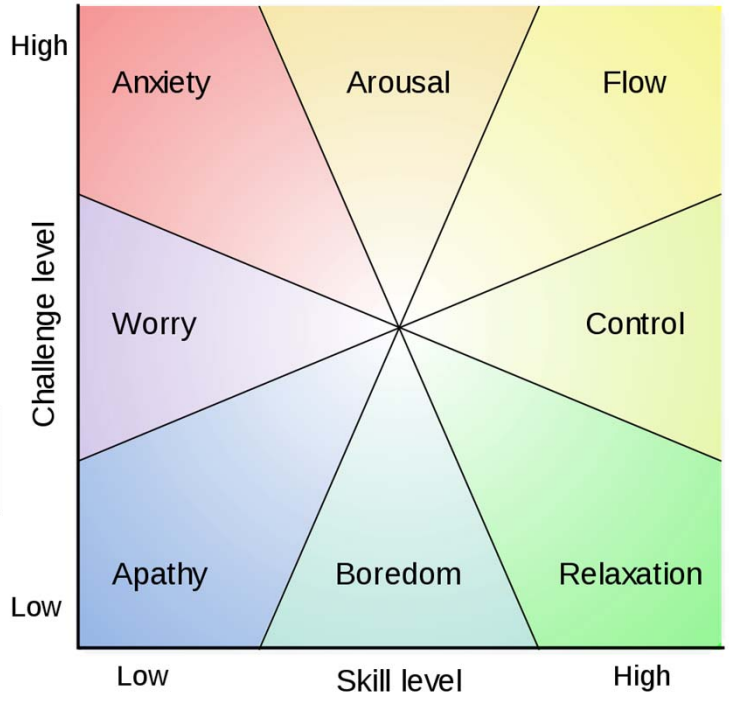
Assistive system using gamification elements

[1] Schmidt, A., Implicit Human Computer Interaction Through Context. *Personal Technologies*, vol. 4, no. 2&3, pp. 191-199, 2000

Gamification, Flow and the Need for Scaling

- We consider gamification as a means to achieve "flow" [1], a mental state in which a person:
  - feels fully immersed in an activity
  - experiencing energized focus
  - and believing in the success of the activity

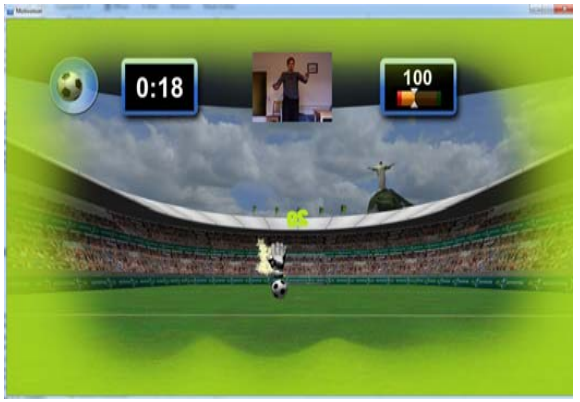
- Four conditions are necessary for flow:
  - clear set of goals
  - good balance between perceived challenges and perceived skills — *Focus*
  - clear and immediate feedback
  - activity is intrinsically rewarding, perceived effortlessness of action



[1] Csikszentmihalyi, M.; Abuhamdeh, S.; Nakamura, J. 2005: Flow. In Elliot, A. (ed.): *Handbook of Competence and Motivation*, New York, USA, 598-69

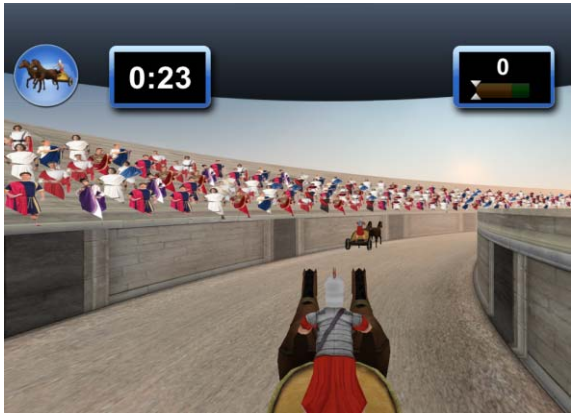
Prototype 1: Flow & Scaling in Exergames

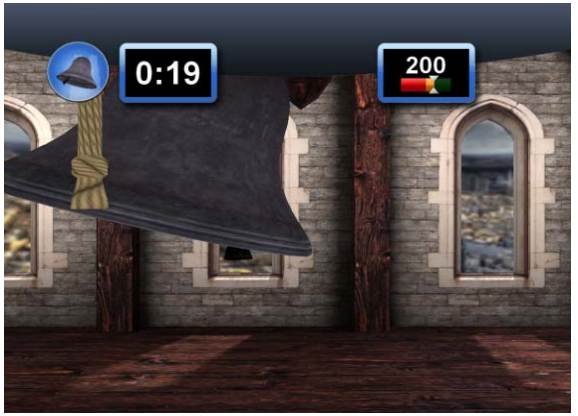
- Realization of seven mini-games for seniors mapping different sports exercises, linked by a virtual journey to foreign cities
- When a user starts the exergame, the difficulty is always set to the lowest level to prevent early frustration
- During the exergame the user receives points for successful activities (like catching a ball or grabbing a coin) and sometimes lose points (e.g. by failing to catch a ball)
- These points are the product of the user's level and a constant. Obvious and motivating visual feedback guides the seniors
- This consistent visualization keeps the scaling process transparent and motivates the user



Prototype 1: Flow & Scaling in Exergames

- Apart from the dynamic visualization there is a results screen after each exercise
- Substantial improvements or degradations resulting from the performance are commented in a friendly and humorous manner and recorded in the database immediately
- The difficulty level then scales according to the user's current performance to prevent underchallenge or overexertion
- Although the user is informed about these changes, their swiftness in both ways makes it easier to accept degradation on a bad day
- Thus auto-adjustment prevents demotivation.





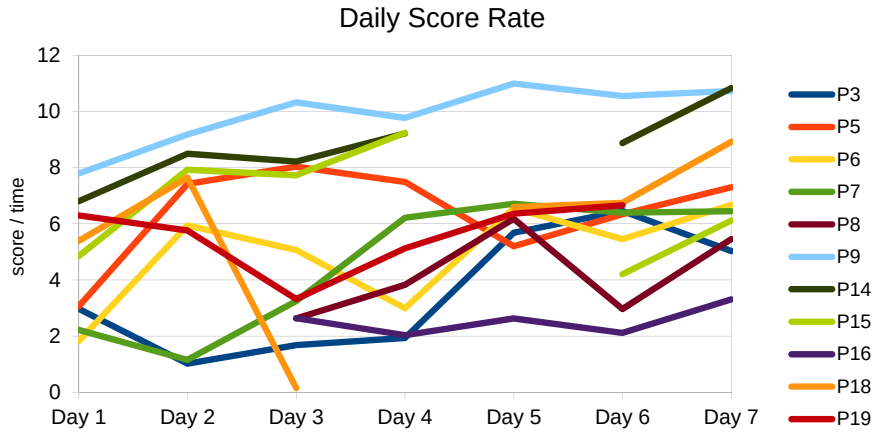
Prototype 1: Flow & Scaling in Exergames
First Results from a Quantitative Study

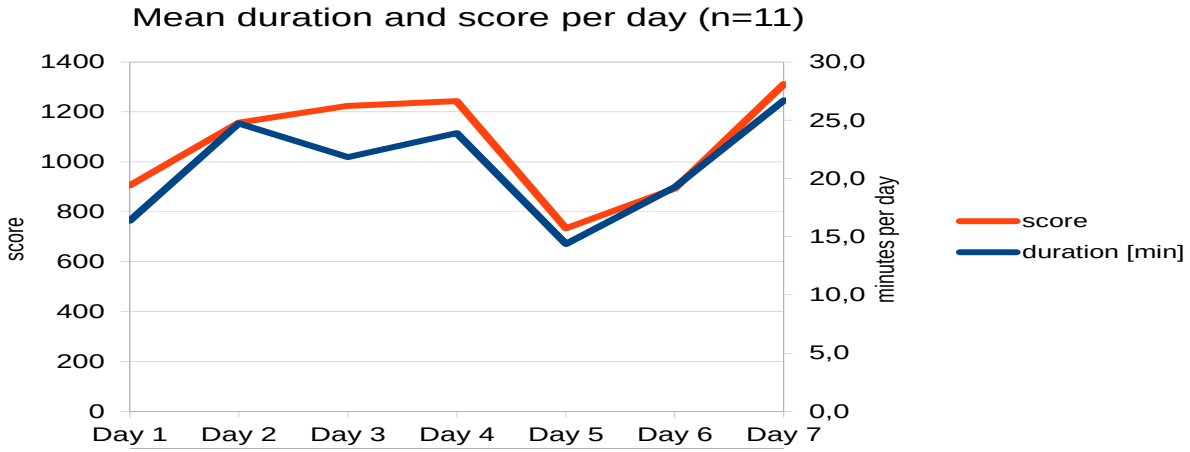
Study Design:

- data just recorded (2 weeks ago)
- 19 players aged 60-93, average age 76
- 7 days

First results:

- 11 players (ca. 58%) played 6 of 7 days





Prototype 1: Flow & Scaling in Exergames
First Results from a Quantitative Study

Analysis of individual levels:

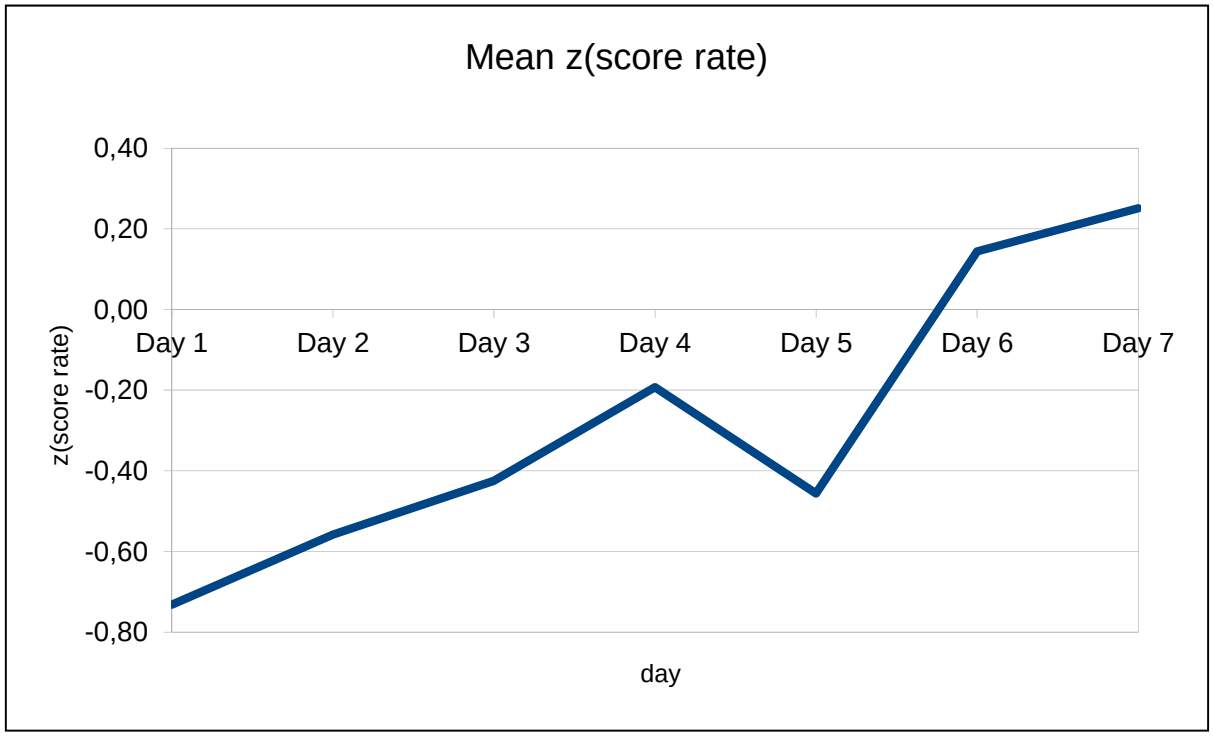
- Z-Transformation
- Z = (X-mean) / SD

First results:

- duration and score have a positive correlation

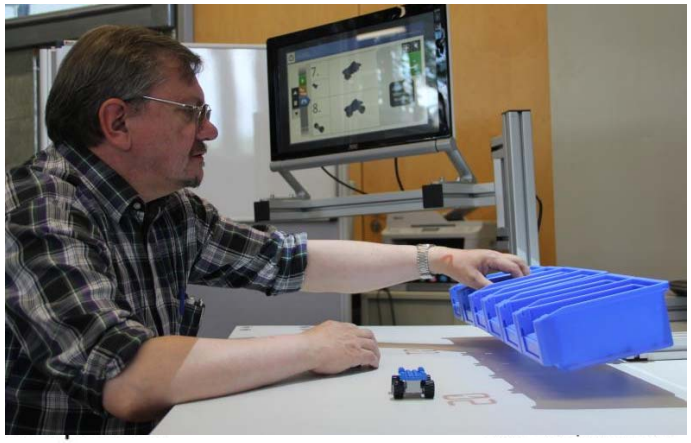
Future analysis:

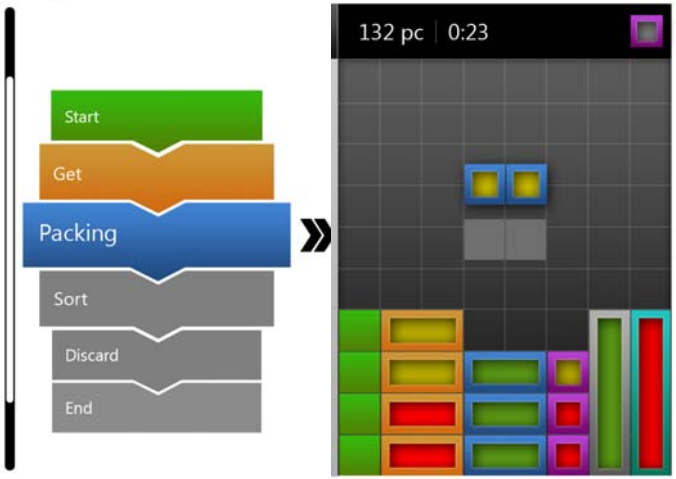
- considering individual pathways and training configuration
- within and between sessions



Prototype 2: Flow & Scaling in Work Contexts

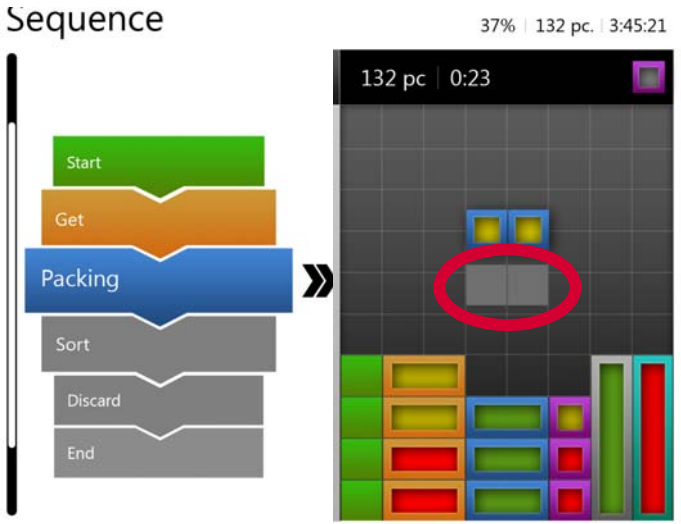
- Gamification is implemented in an assistive system supporting manual assembly
- in the prototype of the assistive system's gamification component, each work process is visually represented by a brick in a puzzle game resembling Tetris
- during the work process the brick's color changes from green to red
- the duration of this color change cycle is directly derived from a users' average process durations and scales accordingly





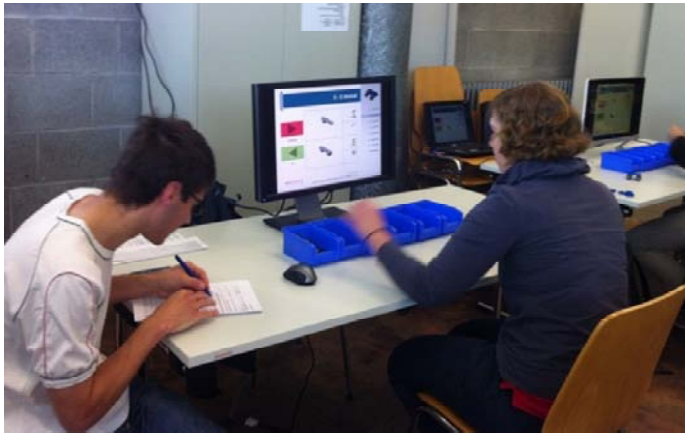
Prototype 2: Flow & Scaling in Work Contexts

- the “normal” speed of the individual user is shown by a transparent grey stone (“shadowing”)
- thus the worker always knows if he or she is doing well – compared to the personal average



Next Step:

- quantitative evaluation study measuring the impact of and gamification on work process times and the users’ motivation



Thanks for your attention!

Questions?

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