



Roessingh
Research and
Development

Institute for Research in Rehabilitation Medicine and Technology

Personalised eHealth Technology for people with chronic conditions

Prof. Dr. Ir. Hermie Hermens

Head Telemedicine Research group University of Twente

Director Telemedicine Roessingh Research & Development

CSO eHealth InnovationSprint

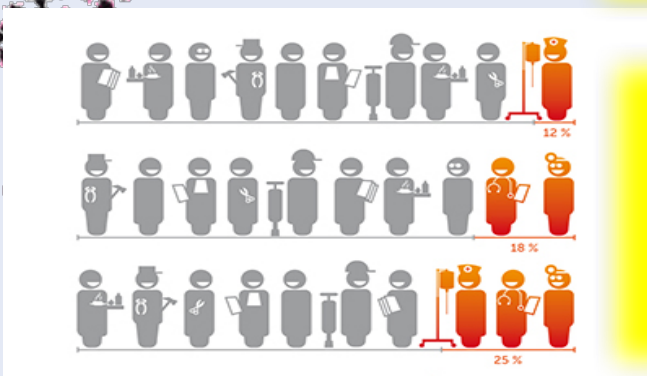
Director Technology, IMDI Center for Care Technology Research

Co-Coordinator, Center for Monitoring & Coaching UTwente

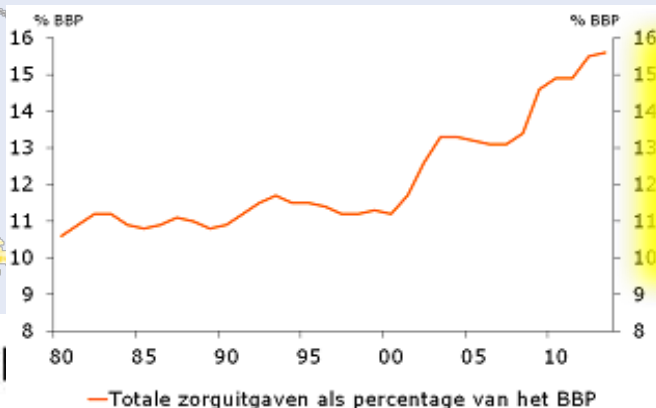
Demographic data and trends



**Increasing
demand for
care**



**Increasing
demand for
personnel**



**Increasing
Costs**





The challenges for Care

To provide people with chronic conditions:

- More healthy living years
- Delay chronic disease and prevent comorbidities
- Living independently in their own chosen environment

To decrease inflow in expensive healthcare

Our focus: Use technology to support them in:

- Independent living
 - Empowering self-management capacities
 - Monitor & Coach medical conditions, vitality and healthy behaviour
-
- Be **Personalised**, focusing on specific individual needs and personal goals and context

Strong relationship between Behaviour and Health

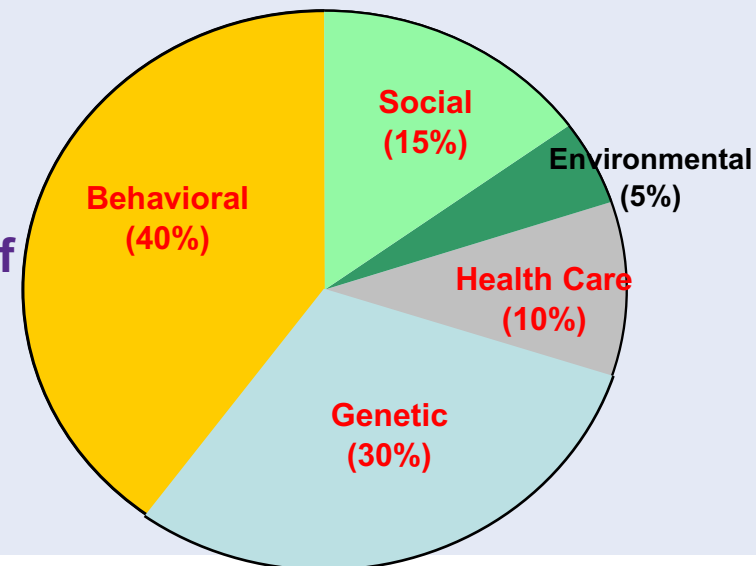
Strong relationship: lifestyle << >> chronic conditions

- Chronic conditions can be delayed (primary prevention)
- Consequences can be delayed (secondary prevention)
- People with a healthy lifestyle:
 - 50% less costs of healthcare (Pronk et al., 1999)
 - 14% higher life expectancy (Khaw, 2009)

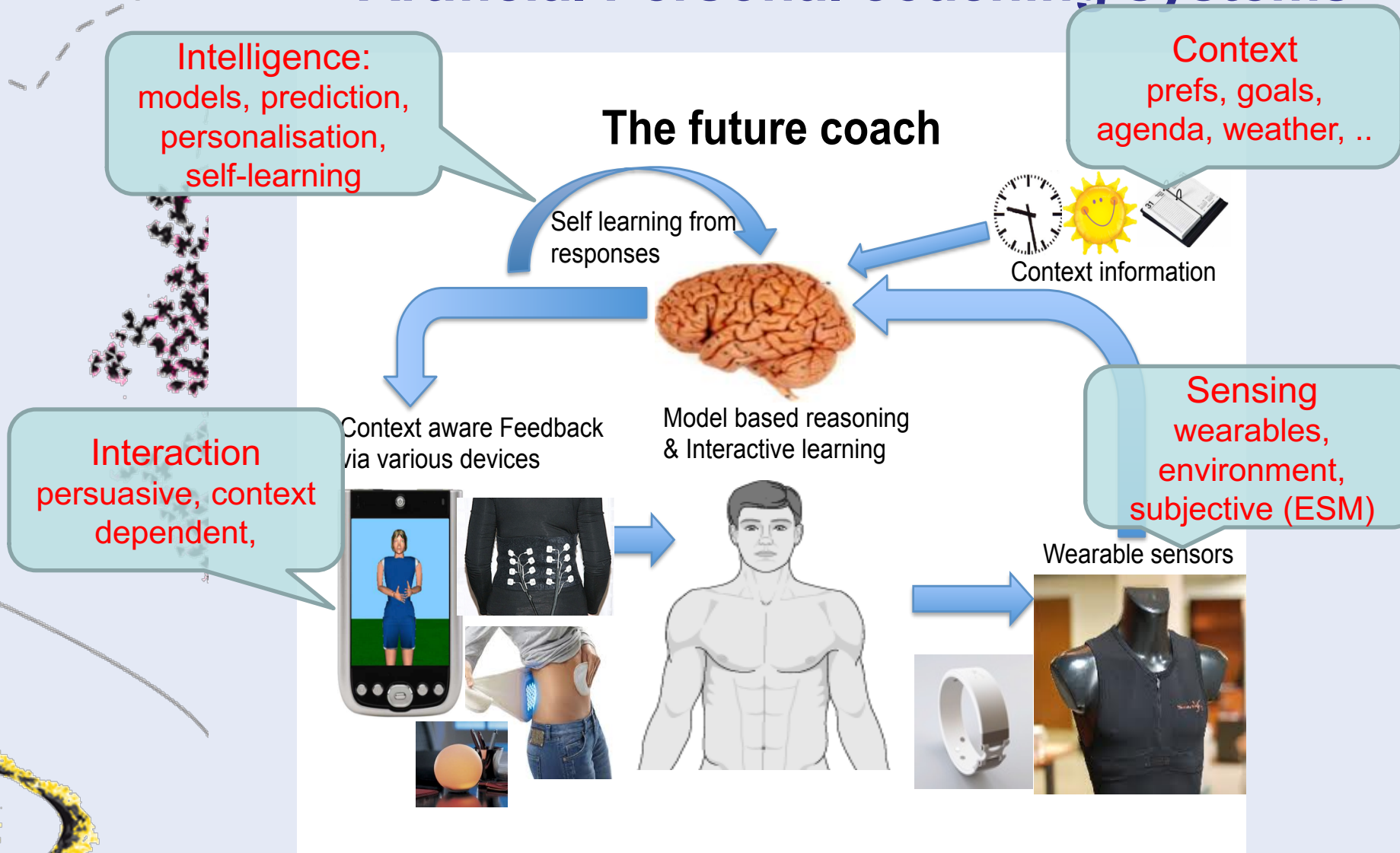
So, great need for healthy behaviour,

A coach could help ?

Determinants of
health status

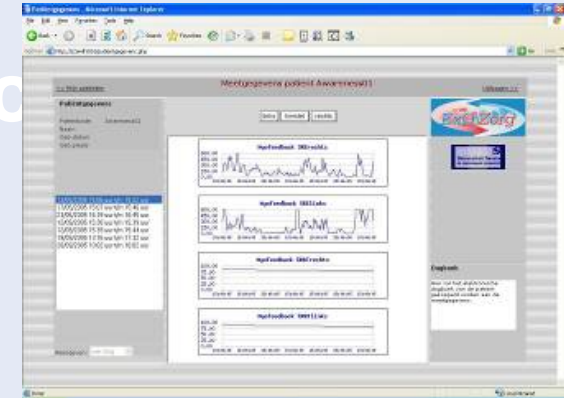


Artificial Personal coaching systems

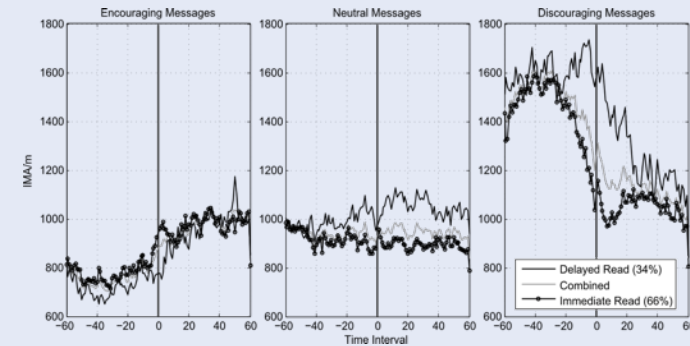


Creating artificial coaches Coaches

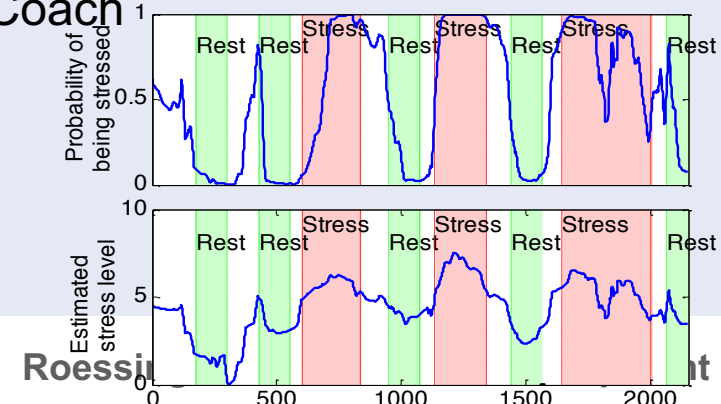
Neck/shoulder pain Coach



Physical activity Coach



Stress management Coach

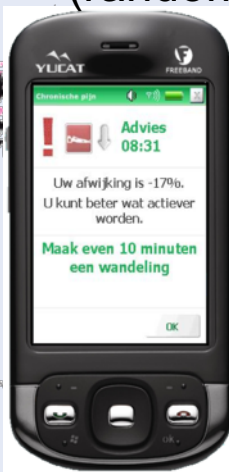


Creating a personal activity coach



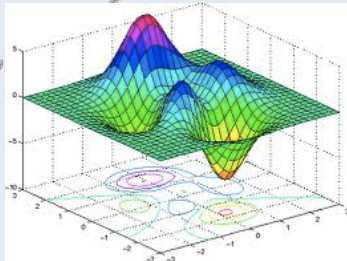
- Set desired pattern/goal
- Calculate difference
- Select message category (+ 0 -)

- Show graph
- Give advice (random selection)



Measure amount and timing of activity using inertial sensor (3D accel.)

Second generation activity PCS



Prediction
best timing



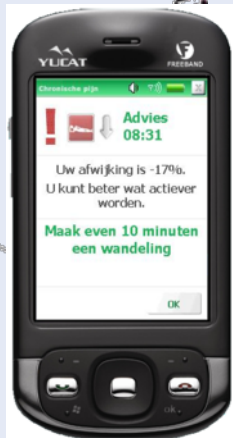
Chose personally
preferred content



Context information



Context aware
reasoning



Personalised
advices

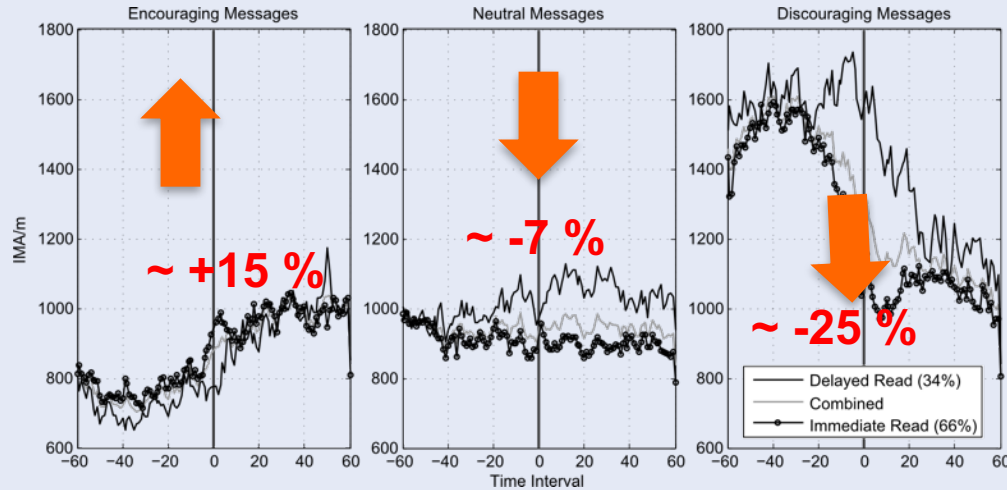


Predicting timing: 68% accurate for group; 86% for individuals)

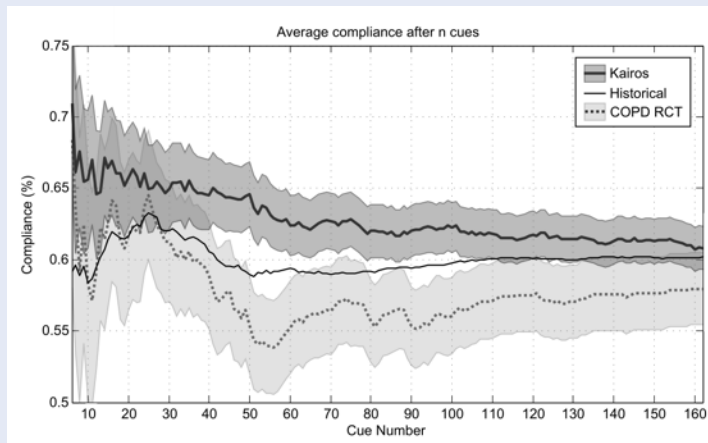


3D inertial sensor

Can we change activity patterns?



Yes and smarter systems work better, but effects decrease in time



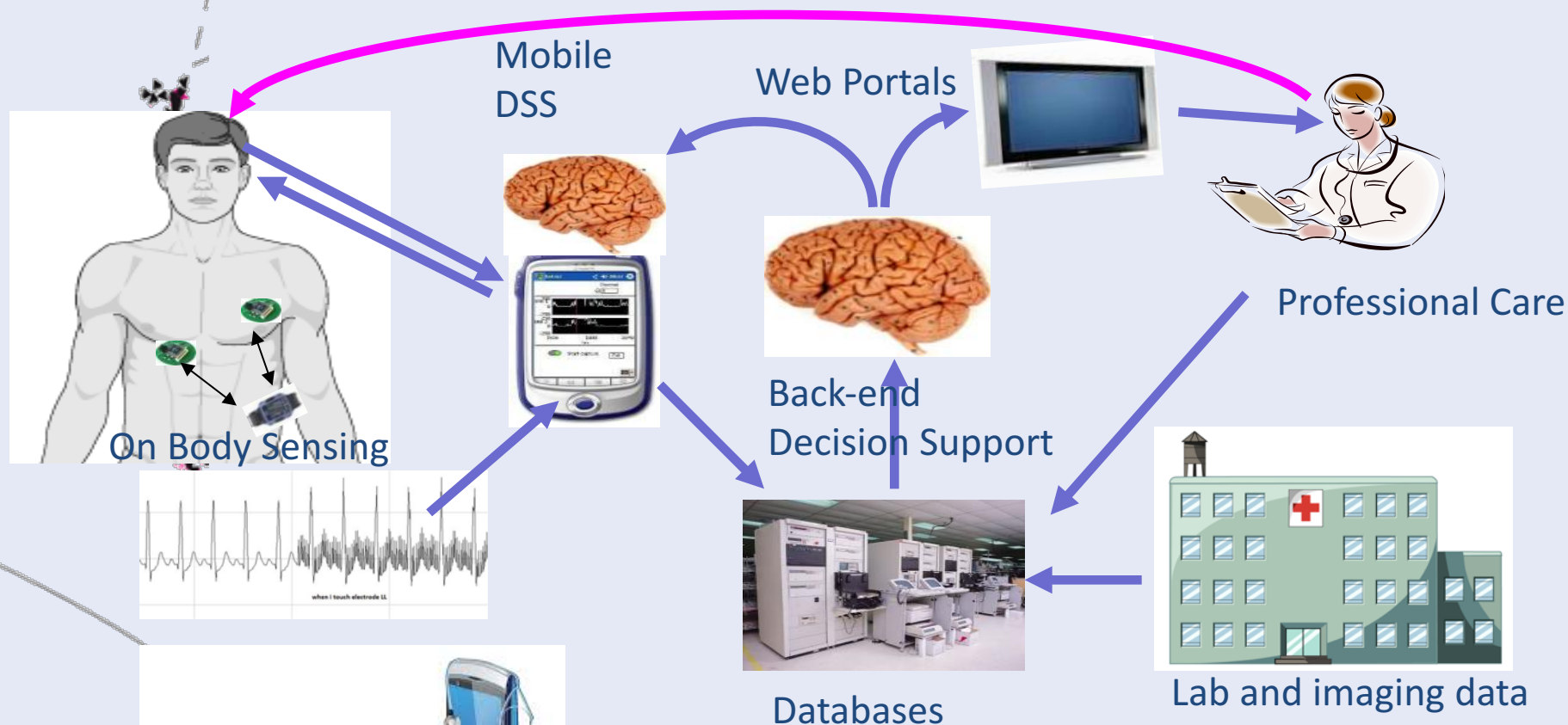
Papers of H.opdenAkker, M.Tabak

Roessingh Research and Development

First generation autonomous coaching

- Focusing on one component
- Limited intelligence; reasoning on one/few aspects
- Many stranded in pilot phase
 - Exception of activity coach
 - Market not ready
 - Immature business cases

Distributed decision support & coaching system based on medical guidelines & multimodal (streaming) datasets



MobiGuide
Guiding patients anytime everywhere

**Demonstrated in atrial fibrillation
and diabetes pregnancy**

Hermens, 2010

Supporting physical exercising at home

- Great need to support vitality
- Low tech approach for entering the market
 - Using videos and a training scheme set up by caregiver
 - Clinical studies: as effective as traditional training
 - More efforts >> better results
 - Scalable

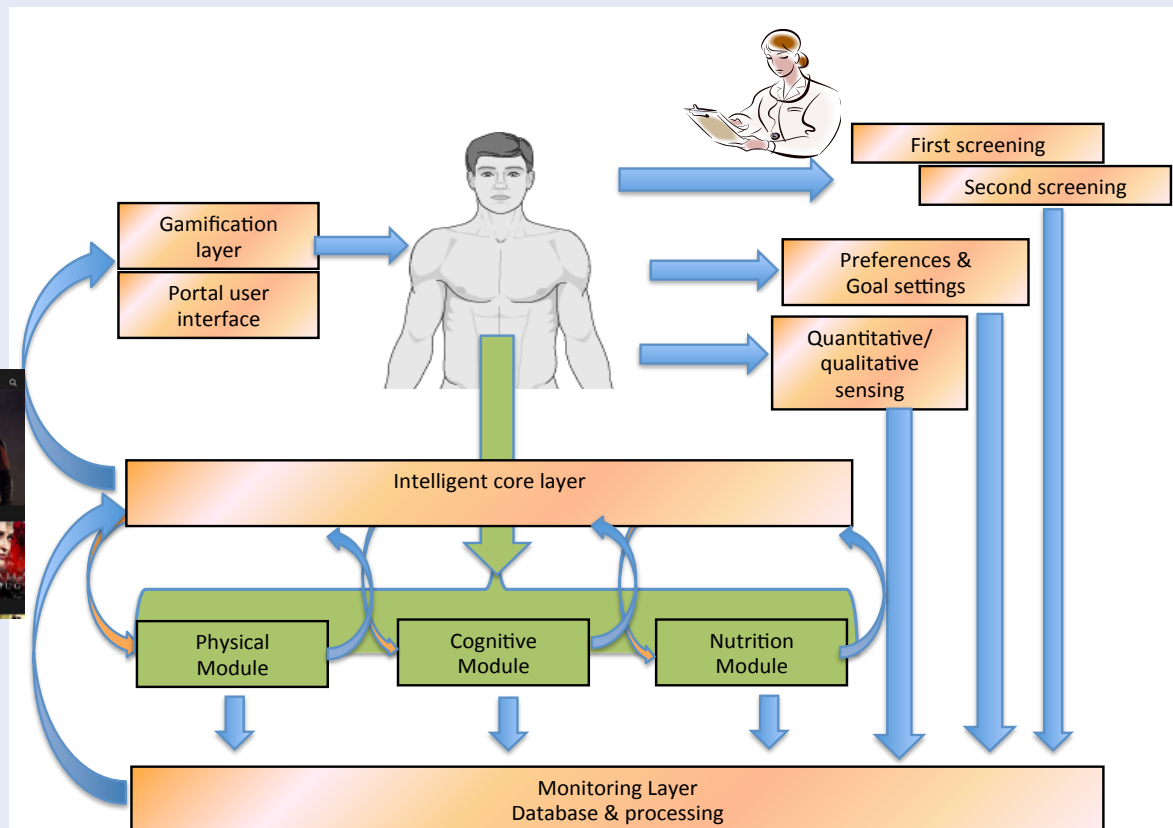


1000 patients were treated



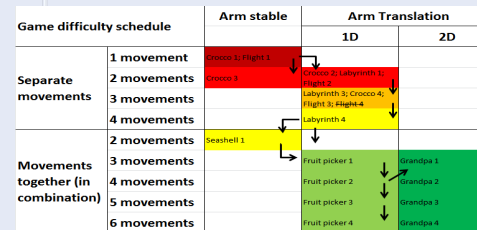
Personalising multimodal exercising

- Starting from personal preferences, goals and screening
- Offering physical, cognitive and nutrition training
- Recommender system to adapt settings and exercises



Hermens 2015

SCRIPT

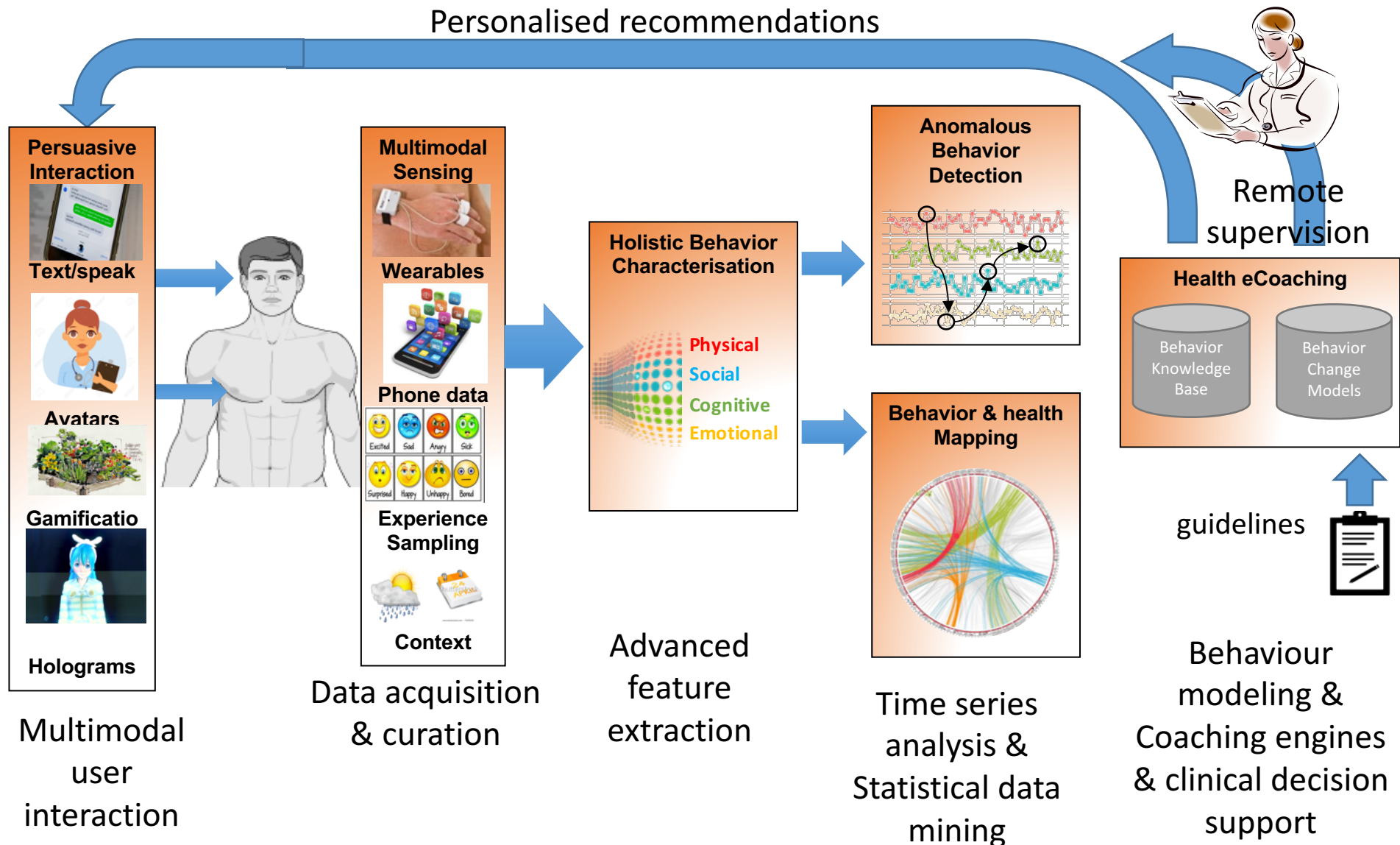




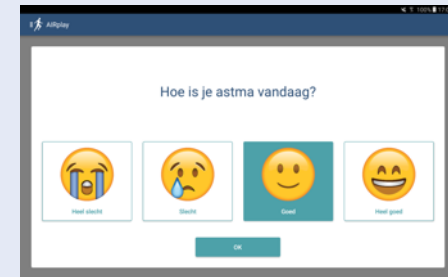
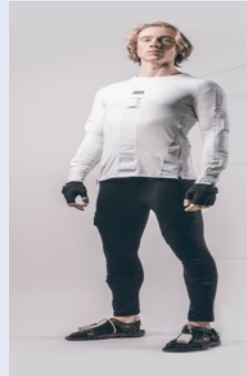
The next generation ehealth Technology

- Smarter, more personalised
- Enabled by rapid changes in technology:
 - comfortable wearable sensors
 - cheaper IT, 5G
 - Intelligence
- New concepts
 - Using holistic concepts of of sensing
 - Data driven hybrid modeling
- Making beyond pilots scaling up possible

The next generation Monitoring and Coaching



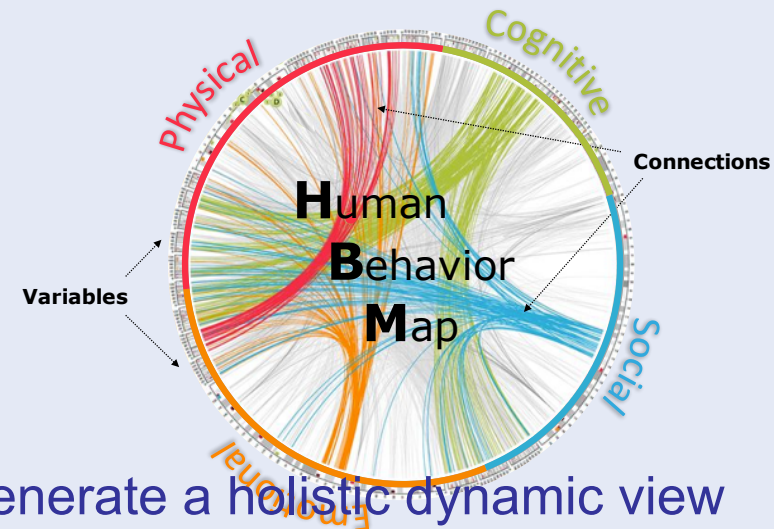
Towards holistic sensing in real life



Health data + Wearables + social data + Experience data

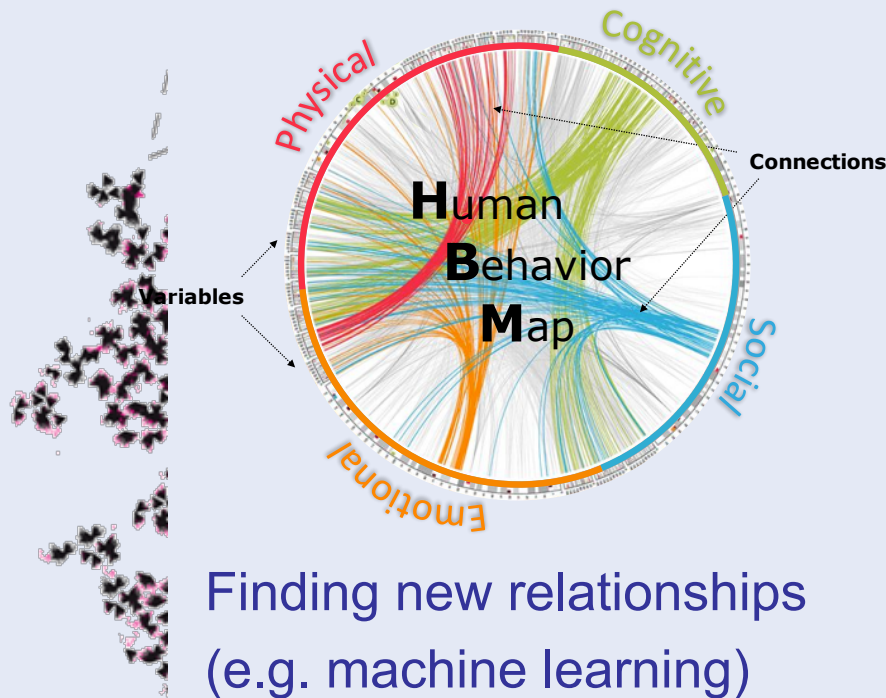


+ new sensors

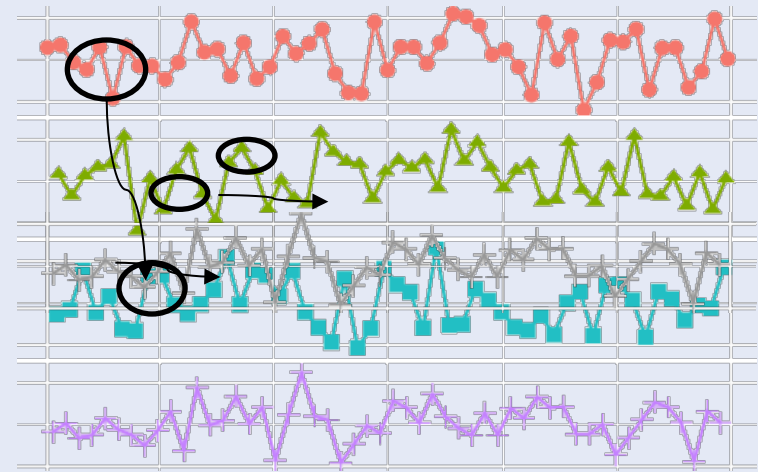


to generate a holistic dynamic view

Data driven modeling and mining



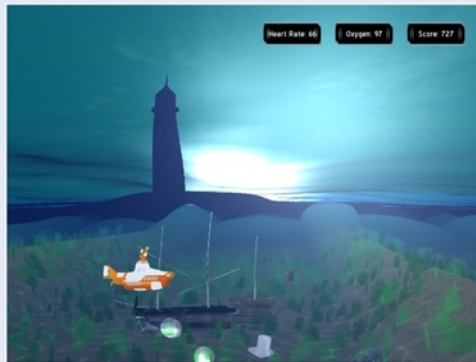
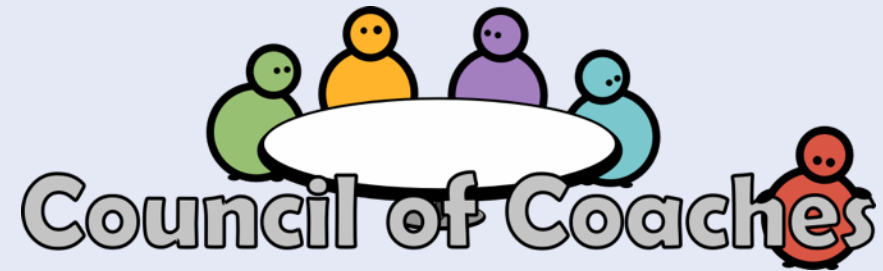
Finding new relationships
(e.g. machine learning)



Detecting changes in time
(complex event detection)

- To generate new knowledge on behaviour <> health
- To create personally tuned models
- To detect linked changes in time for multi targeted coaching

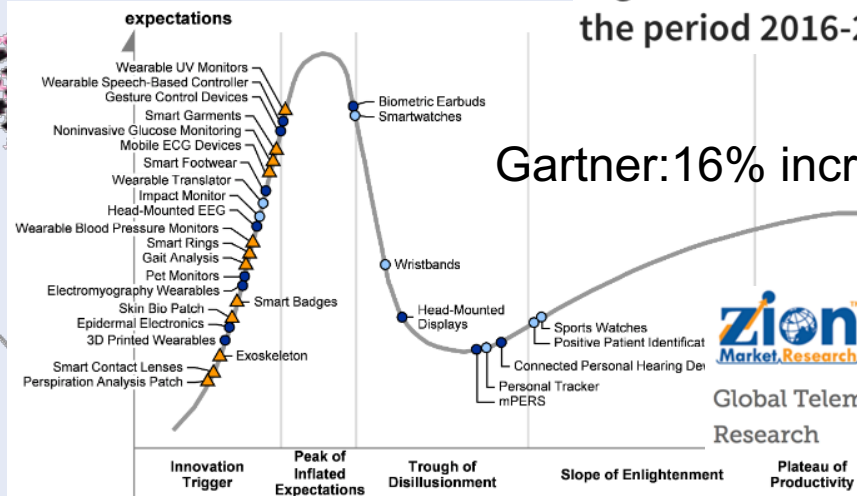
Towards more Persuasive user interactions



On the eve of a fast growth of the next generation persuasive coaching?

- Faster market growth, due to wearable tech ?
- All growth predictions Telemedicine show double digits
- P15 call will boost the next generation personalised coaching
 - Council of Coaches: multiple interacting coaches. **Talk Harm**
 - Holobalance: virtual physical therapist
 - Vcare: virtual coaching for elderly
 -

Digital Health Market to Grow at a CAGR of 25.9 % during the period 2016-2024



Gartner: 16% increase of wearables in 2017 vs 2016



Global Telemedicine Market will reach USD 38.00 Billion by 2022: Zion Market Research

With many thanks to:

- Miriam Vollenbroek
- Bert-Jan van Beynum
- Oresti Banos
- Val Jones
- Lex van Velsen
- Monique Tabak
- Harm op den Akker
- Stephanie Kosterink
- Thijs Tonis
- Jan-Willem van het Klooster
- Marit v. Weering
- Leendert Schaake
- Simone Boerema
- Lamia Elloumi
- Reinoud Achterkamp
- Nekane Larburu Rubio
- Nick Fung
- + Many students



Project partner in: Clear, Myotel, Copd.com, Hello-Doc, Awareness, Smart Surroundings, NEW, CoCo, U-Care IS-Active, Senior, ExoZorg, Script, Interacion, P7, P15 Health-Navigator, NavMem, Mobiguide, E-Wall, Persillaa,

Couch
INNOVATION
SPRINT