IREHI 2017 LOME - TOGO
15 DECEMBER 2017

DESIGN OF TELEMEDICINE SERVICES: METHODS, BUILDING BLOCKS AND EXAMPLES.

Roessingh Research and Development

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University of Twente
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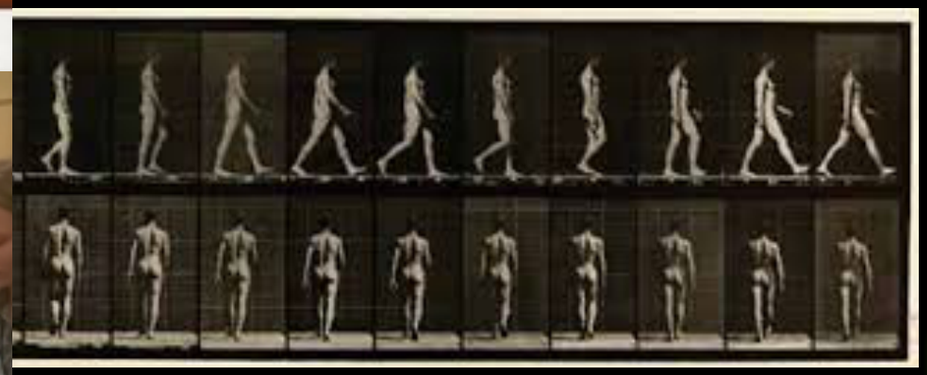
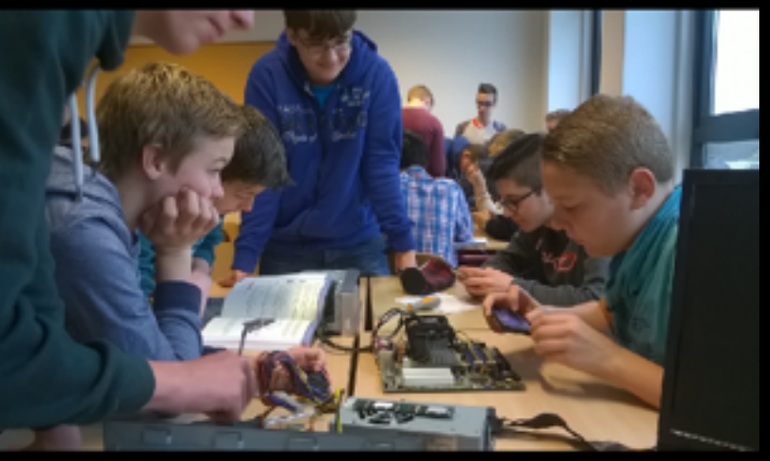



coco
COPD
Patiëntenoverzicht
overzicht
dagboek
training samenstellen
activiteit
Activiteit
Klik op een dag om het schema voor die dag te bekijken. De blauw gekleurde dagdele
oefenschema. Door oefeningen aan of uit te vinken past u het schema aan. Uw activ
Periode:
wo 24-09-2012
t/m
di 30-09-2012
zoom in op dag

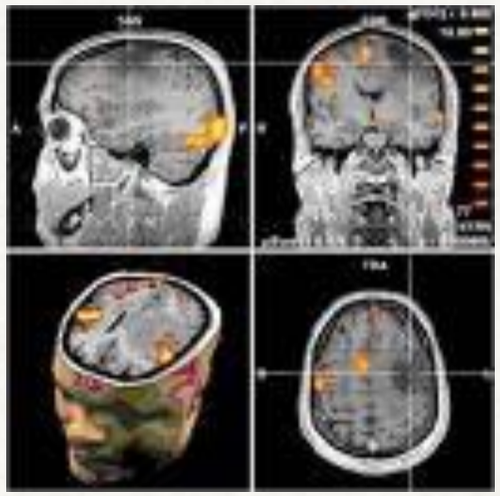

14:03
Activity Coach
ACTIVITEIT
GEWICHT
vandaag (woensdag 11 november)
Je huidige gewicht is
78,5 kg
Je BMI is
20,0
Gemeten op maandag 27 juli



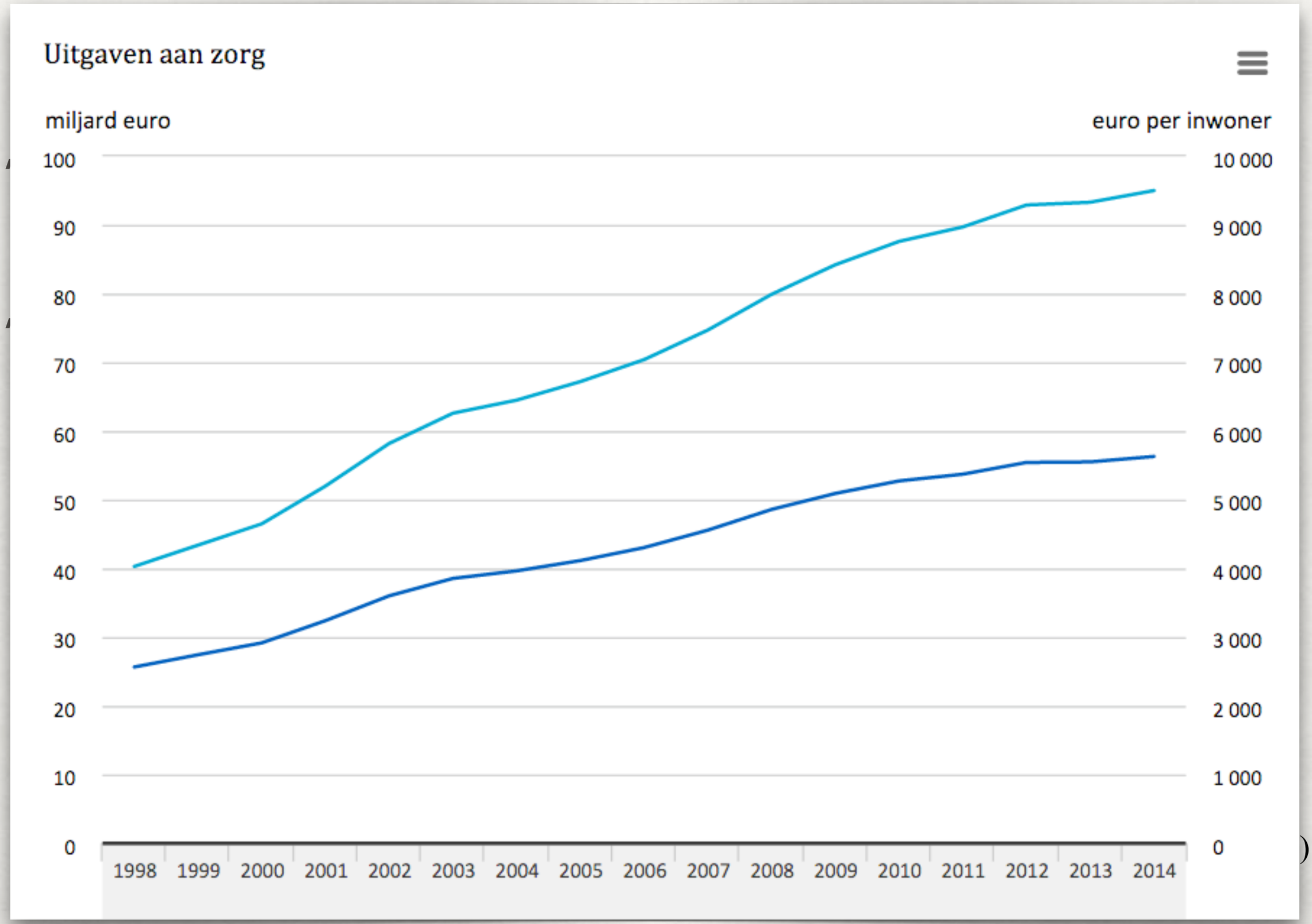
ReQuest
Screenings jvantkooster@rrd.nl
New screening ...
10-Meter looptest
10-Meter looptest
4 Domeinen
Analyse volgens de 4 domeinen
Beweegscanner
Beweegscanner tbv Life
BI
Barthel Index
Formulier activiteiten
Registratieformulier voor activiteiten tbv LIFE
GDS-15
Geriatric Depression Scale (GDS) - 15 items.
Gebraucherstudie: SDT + Version
Lage rugpijn casus
LIFE beweegscanner
MMSE
SAT

Login
About ReQuest
Features
Questions & more
Connect
Responsive
Create once, use many
Multilanguage
Sign up now!

ANNO NINETIES / ZEROS / TENTIES:
IMAGING, MONITORING INTRA & EXTRAMURAL



INCREASING DEMAND ON HEALTH CARE & DECREASED CAPACITY



CONTENTS

- **learning goals**
  - **context and issues of telemedicine services**
    - **design methods:**
      Traditional, Agile, User-based
      PACT-FICS-MVC
    - **architecture and building blocks:**
      high level architecture, UML diagrams for behaviour, functionalities, and data
      - **component judgement**
        impact value, MVP
        - cases & take away messages

LEARNING GOALS

- know how to come to a design of a service, w. end users
  - learn basic building blocks of telemedicine service
    - know how to decompose a service into building blocks
  - frequent architectures
    - actual project cases

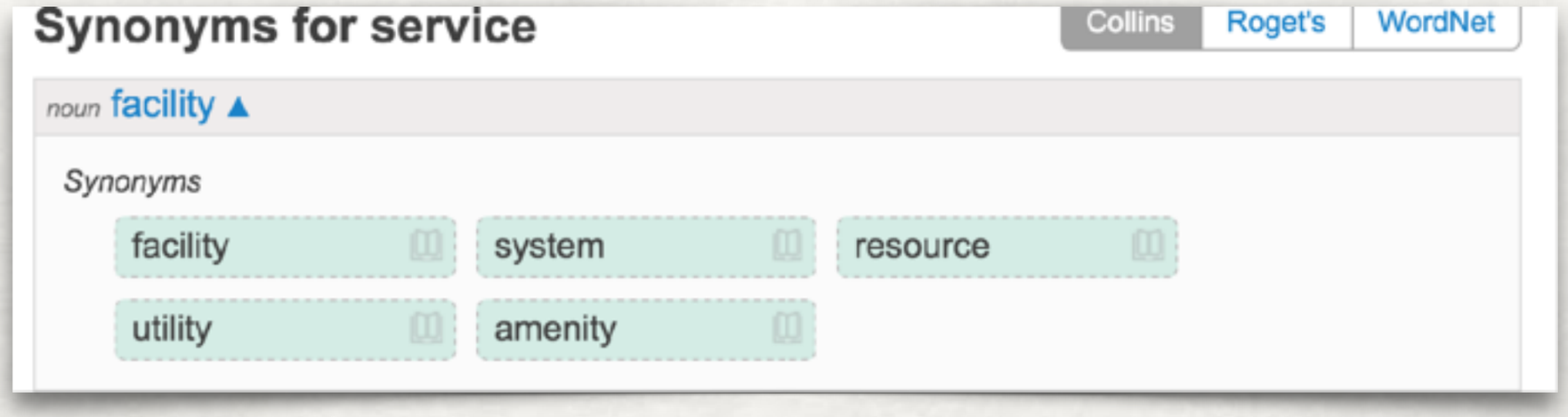
CONTEXT AND ISSUES OF TELEMEDICINE SERVICES

SERVICE DESIGN

- *what is a service?*

SERVICE DESIGN

- An act of assistance
  - Availability is key
- Non-physical component = inherent value
- ICT component is means to achieve above

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Currently
Seattle

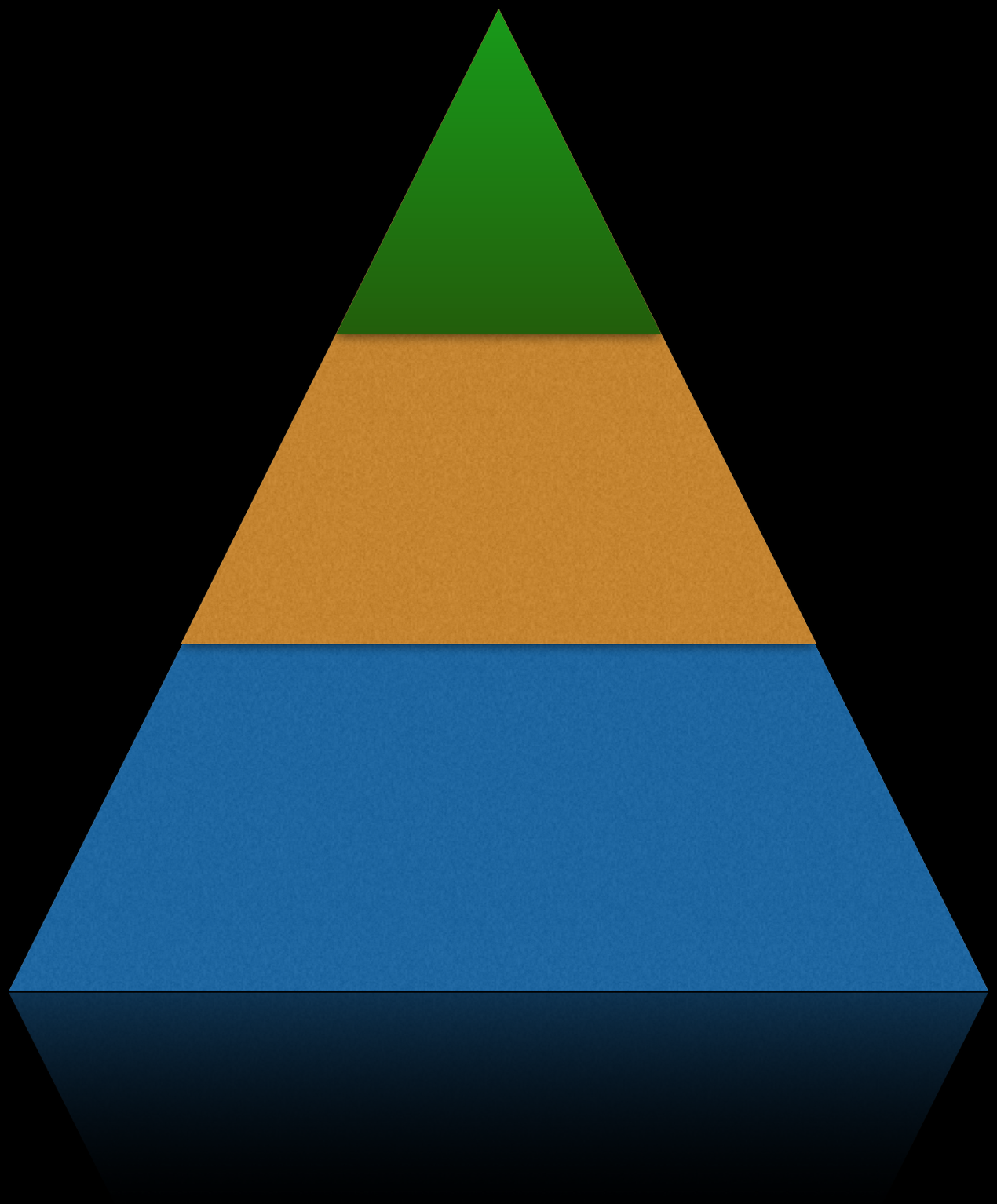

infolive


SONY
VAIO


facebook


ASUS


26
10:56



processes

applications

infrastructure

TELEMEDICINE

- Telemedicine: providing healthcare at a distance, supported by means of ICT technologies. Involving professional(s).
- The product designed becomes a service when provided as an availability (e.g. it is not yours). Its value moreover consists of non-physical parts.

Internet

UMTS/WiFi

Intranet

Smartphone

Sensors

Client

(bio)sensor data

feedback

Professional

TELEMEDICINE

- Telemedicine: providing healthcare at a distance, supported by means of ICT technologies. Involving professional(s).
- The product designed becomes a service when provided as an availability (e.g. it is not yours). Its value moreover consists of non-physical parts.
- Inspiration and foundations should be sound. These are found in actual established health frameworks and guidelines.

International Classification of Functioning, Health and Disability (ICF)

Functioning is an umbrella term for

Participation

Taking care of others

Activities

Manipulating objects

Body Functions

Mobility and stability of joints

Body structures

Joints

World Health Organization

Disability is an umbrella term for

Restrictions

Participation

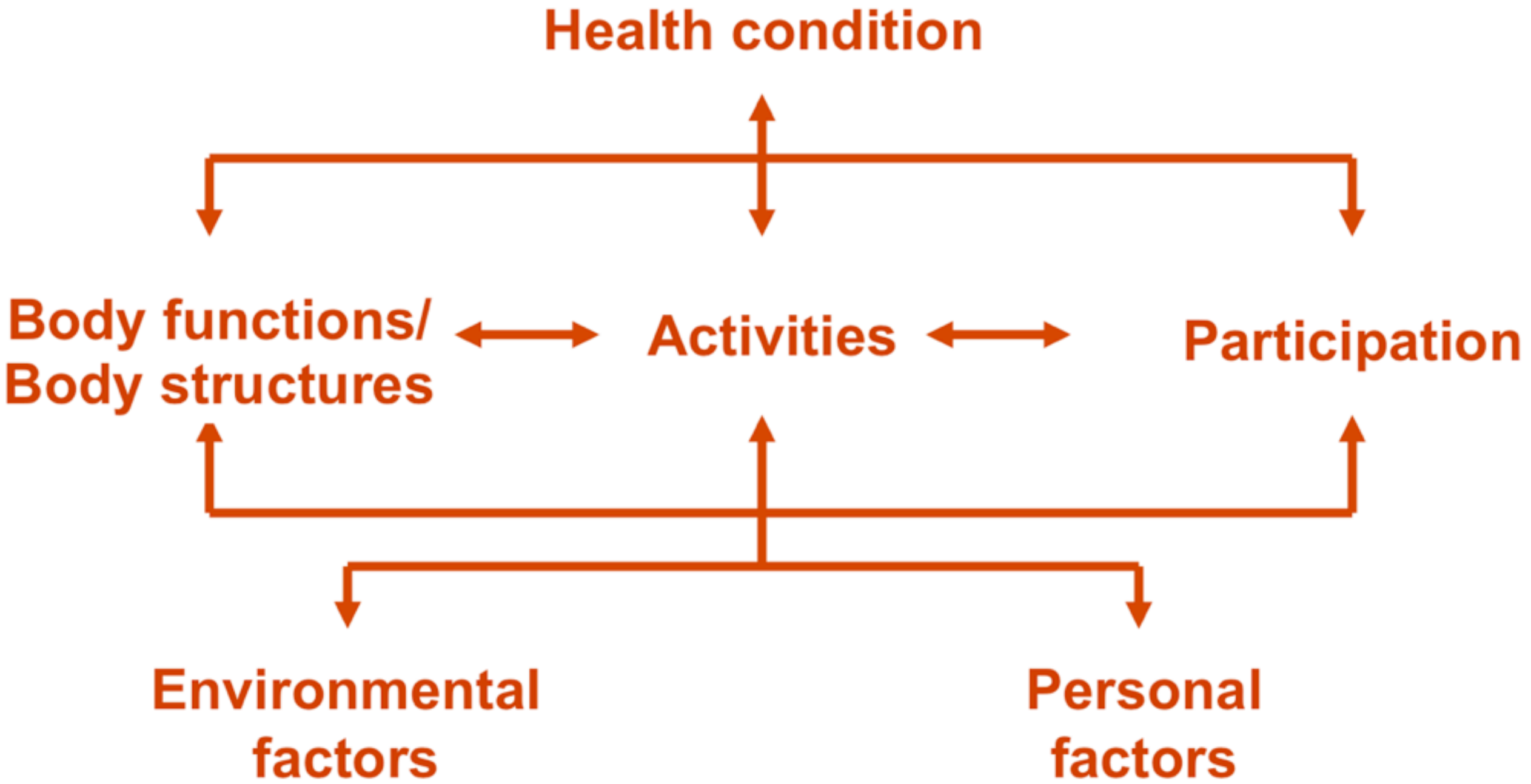
Limitations

Activities

Impairments

Body Functions

Body structures



Bio-psycho-social health model

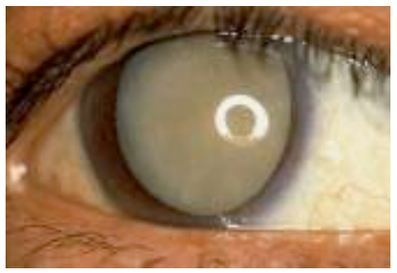
functioning and disability are multidimensional...

encompass human experience at levels of

body functions and structures,

activities

and participation



...and a continuum:

10/20

2/20

1/20

Mild-Moderate vision impairment:
Needs eye glasses, contact lenses…

Severe vision impairment:
Needs operation

Complete vision impairment (blind):
Needs assistance – pension, device, assistant environmental modifications

Goals

ICF

1. Establishes a **common language**

2. Provides a **systematic coding scheme**

3. Provides a **scientific and research basis** for understanding health

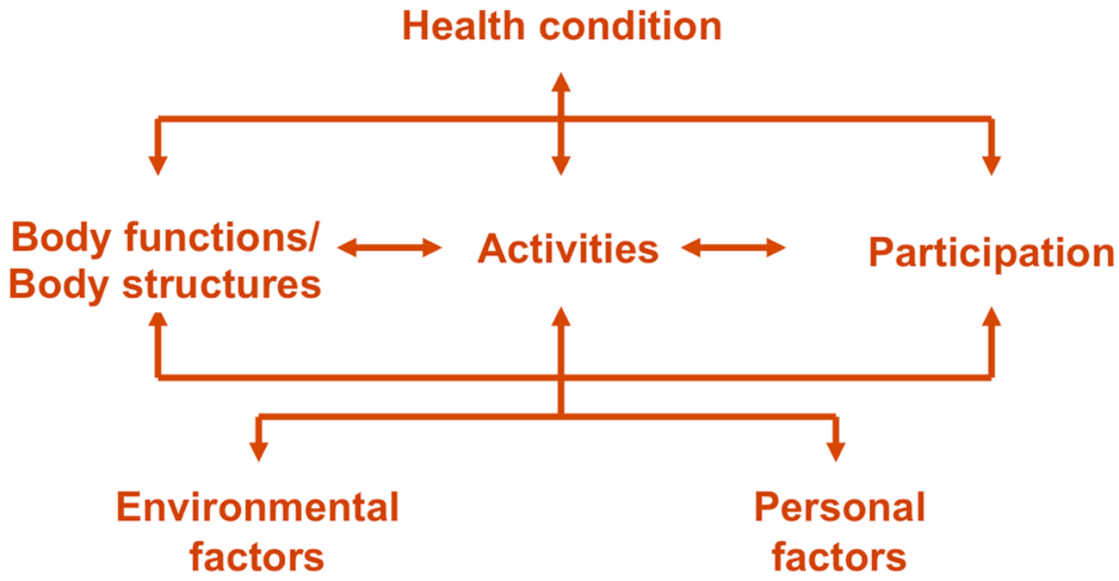
4. Enables **data comparison**

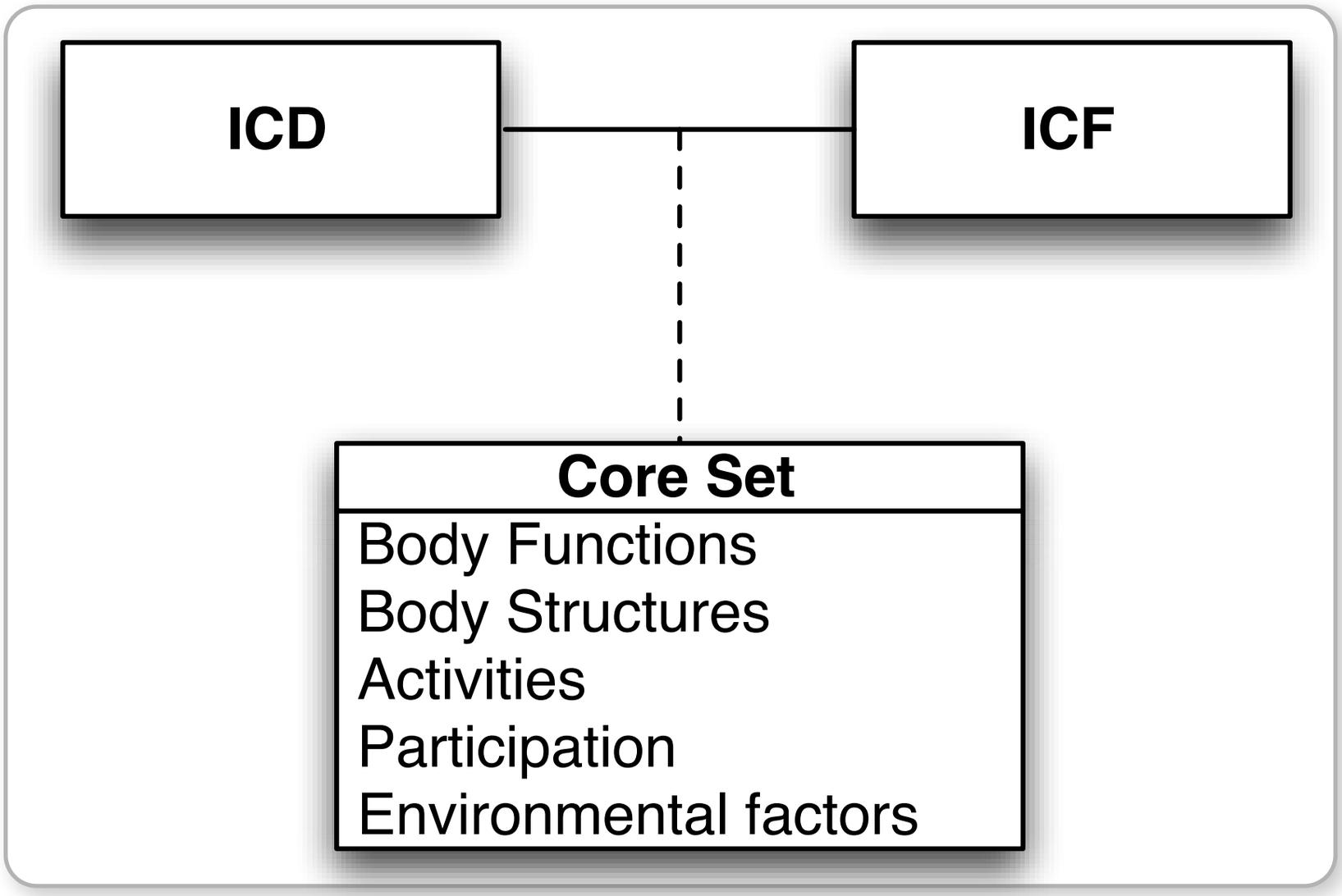
5. Stimulates the **development of services**

source: who-fic germany

J.W. van ‘t Klooster, B.J.F. van Beijnum, H.J. Hermens, “*Putting the Patient at the Centre: Making Telemedicine Services Personal Again*”, proc. PervasiveHealth 2009 , London, April 2009

ICD, ICF, CS


Health condition
Body functions/
Body structures
Activities
Participation
Environmental
factors
Personal
factors


ICD
ICF
Core Set
Body Functions
Body Structures
Activities
Participation
Environmental factors

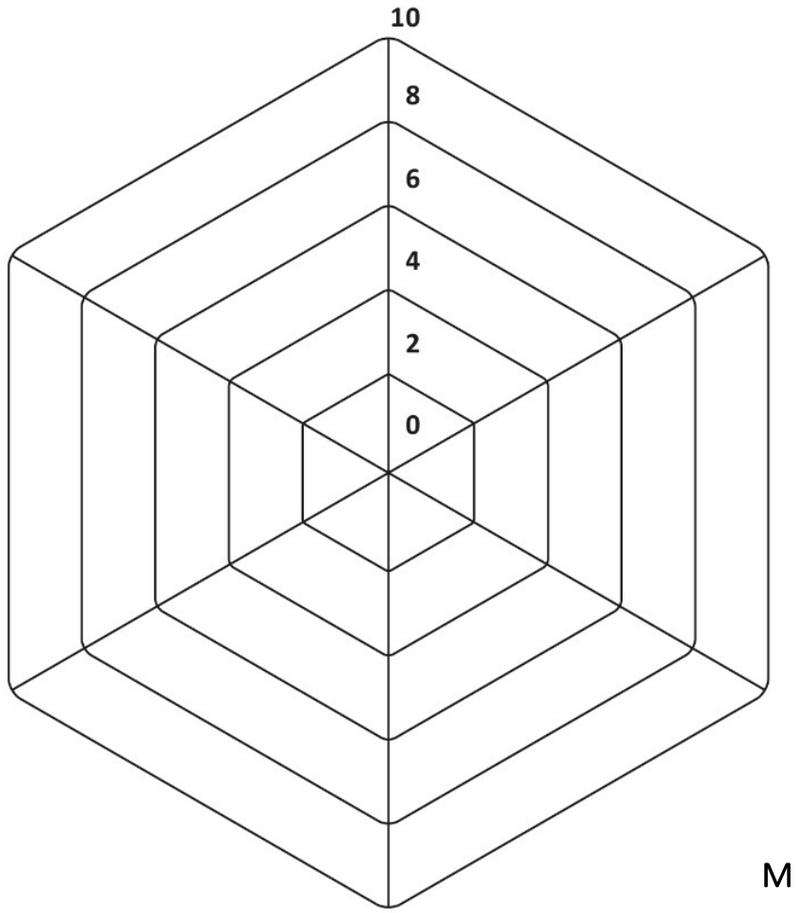
PILLARS FOR POSITIVE HEALTH

BODILY FUNCTIONS

- Medical facts
- Medical observations
- Physical functioning
- Complaints and pain
- Energy

DAILY FUNCTIONING

- Basis ADL (Activities of Daily Living)
- Instrumental ADL
- Ability to work
- Health literacy



MENTAL WELL-BEING

- Cognitive functioning
- Emotional state
- Esteem/self-respect
- Experiencing to be in charge/ manageability
- Self-management
- Understanding one's situation/ comprehensibility
- Resilience

SOCIAL - SOCIETAL PARTICIPATION

- Social and communicative skills
- Social contacts
- Meaningful relationships
- Experiencing to be accepted
- Community involvement
- Meaningful work/occupation

MEANINGFULNESS

- Purpose/meaningfulness
- Striving for aims/ideals
- Future prospects
- Acceptance

QUALITY OF LIFE

- Quality of life/well-being
- Experiencing happiness
- Enjoyment
- Perceived health
- Flourishing
- Zest for life
- Balance


SUCCESS
FAILURE

MISMATCH CAUSED BY ....

- Difficult to market and capitalize care innovations

- “Technicians do not understand clinical working practices”

- “Clinicians are usually not acquainted with all the technological solutions, are not used to specifying functional needs”

MISMATCH CAUSED BY ....

- “Technicians do not understand clinical working practices”

- “Clinicians are usually not acquaintant with all the technological solutions, are not used to specifying functional needs”

- “Think big, start small”

- (Berg, 1999, Broens, 2007)

METHODS

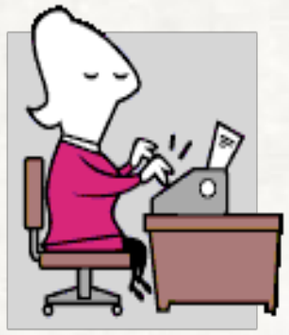
CHALLENGE IN USER NEEDS ASSESSMENT?

How to bridge ‘gap’ between clinical and technical expertise?

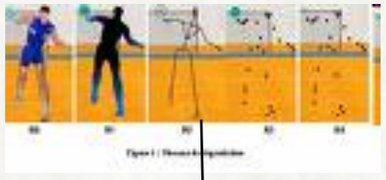
CHALLENGE IN USER NEEDS ASSESSMENT?

How to bridge ‘gap’ between clinical and technical expertise?

DESIGNING TELEMEDICINE SERVICES
= MULTIDISCIPLINARY COLLABORATION!



DESIGNING TELEMEDICINE SERVICES
= DIFFERENT LEVELS OF TECHNICAL FAMILIARITY



Clinicians versus Technicians

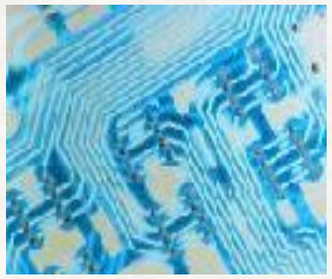
DESIGNING TELEMEDICINE SERVICES
= AVOIDING MISCOMMUNICATION!

Clinicians, technicians, assessors speak different ‘languages’

SYSTEM DESIGN

- Philosophy
- Push/pull
- 3 Methodologies

TRADITIONAL DESIGN PHILOSOPHY



Technology

Product

Solution

Meaning

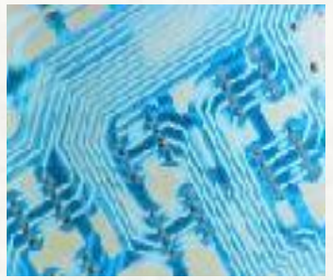
Traditional innovation route:
Technology first, meaning second

SOCIOTECHNICAL DESIGN PHILOSOPHY

Meaning

Solution

Product

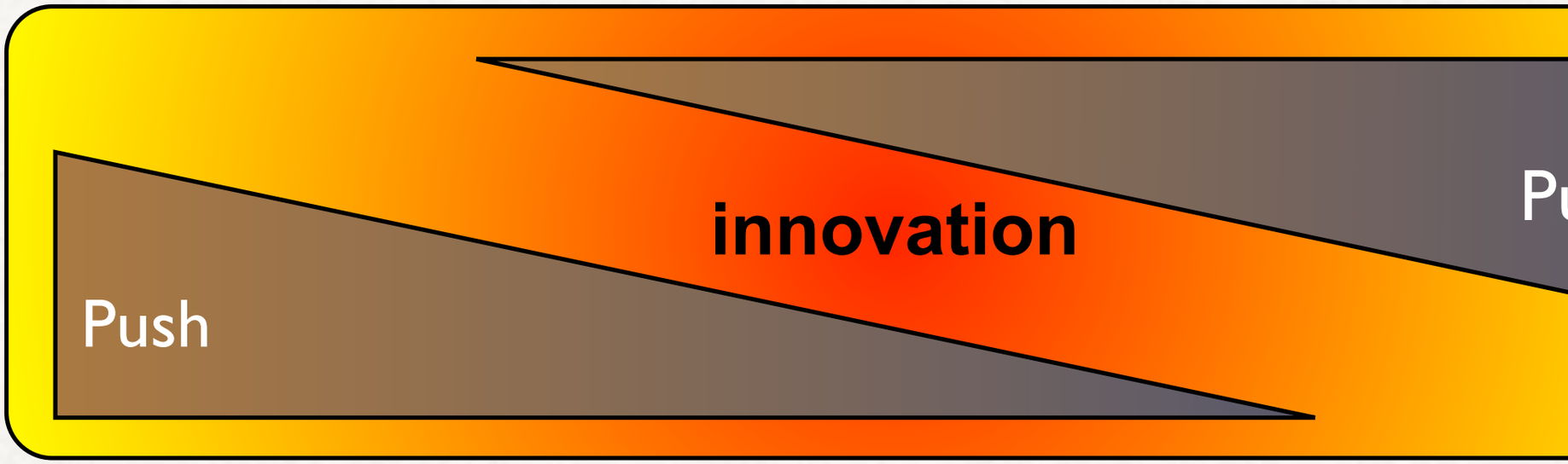


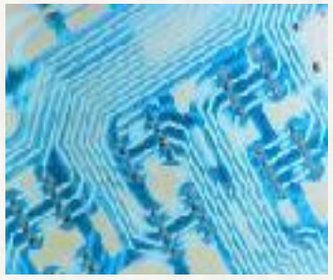
Technology

Sociotechnical centered innovation route

→ Understanding nature of health care practices should be the starting point of design (Berg, 1999)

TECHNOLOGY PUSH VS. DEMAND PULL





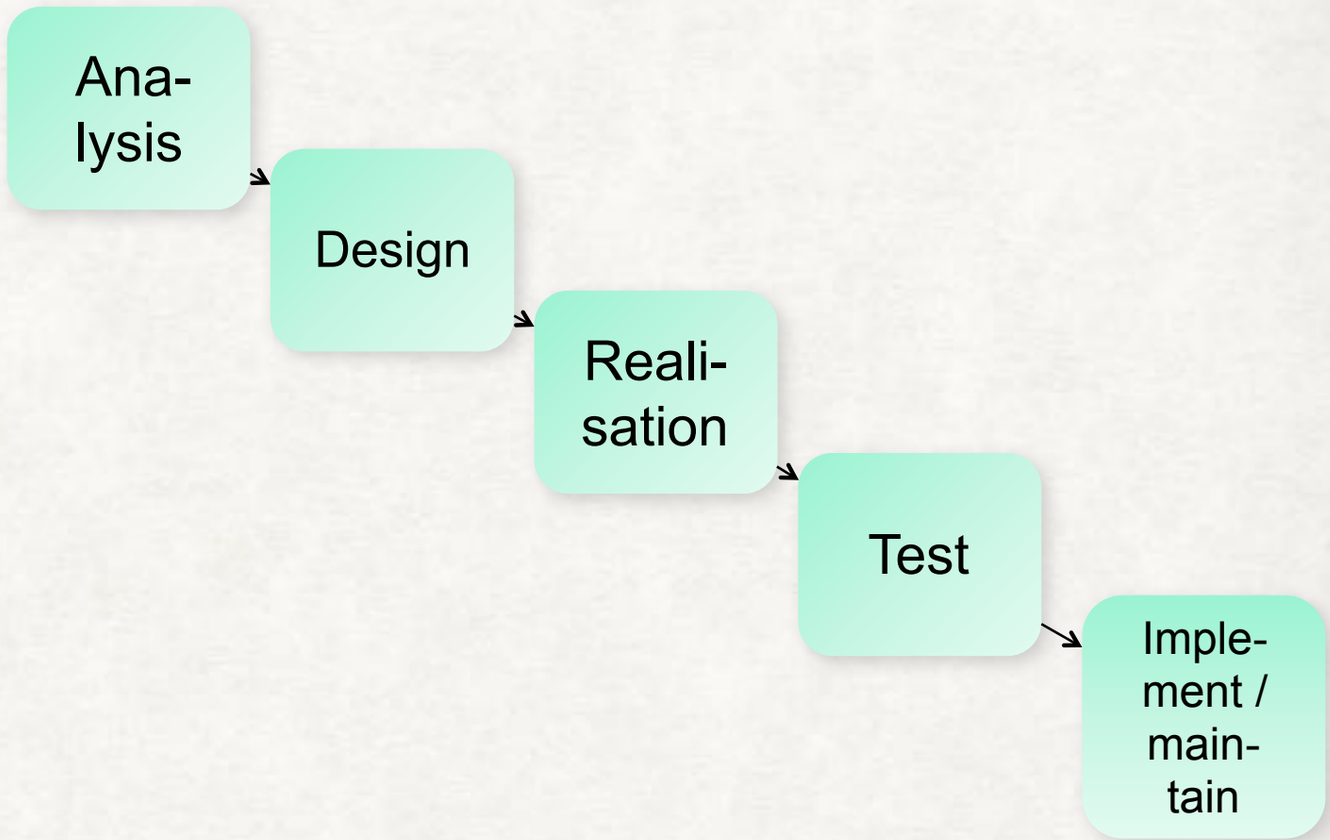
W.A. Smit en E.C.J. van Oost (1999) *De wederzijdse beïnvloeding van technologie en samenleving. Een Technology Assessment benadering,* Coutinho, Bussem.

DESIGN METHODOLOGIES – AN OVERVIEW

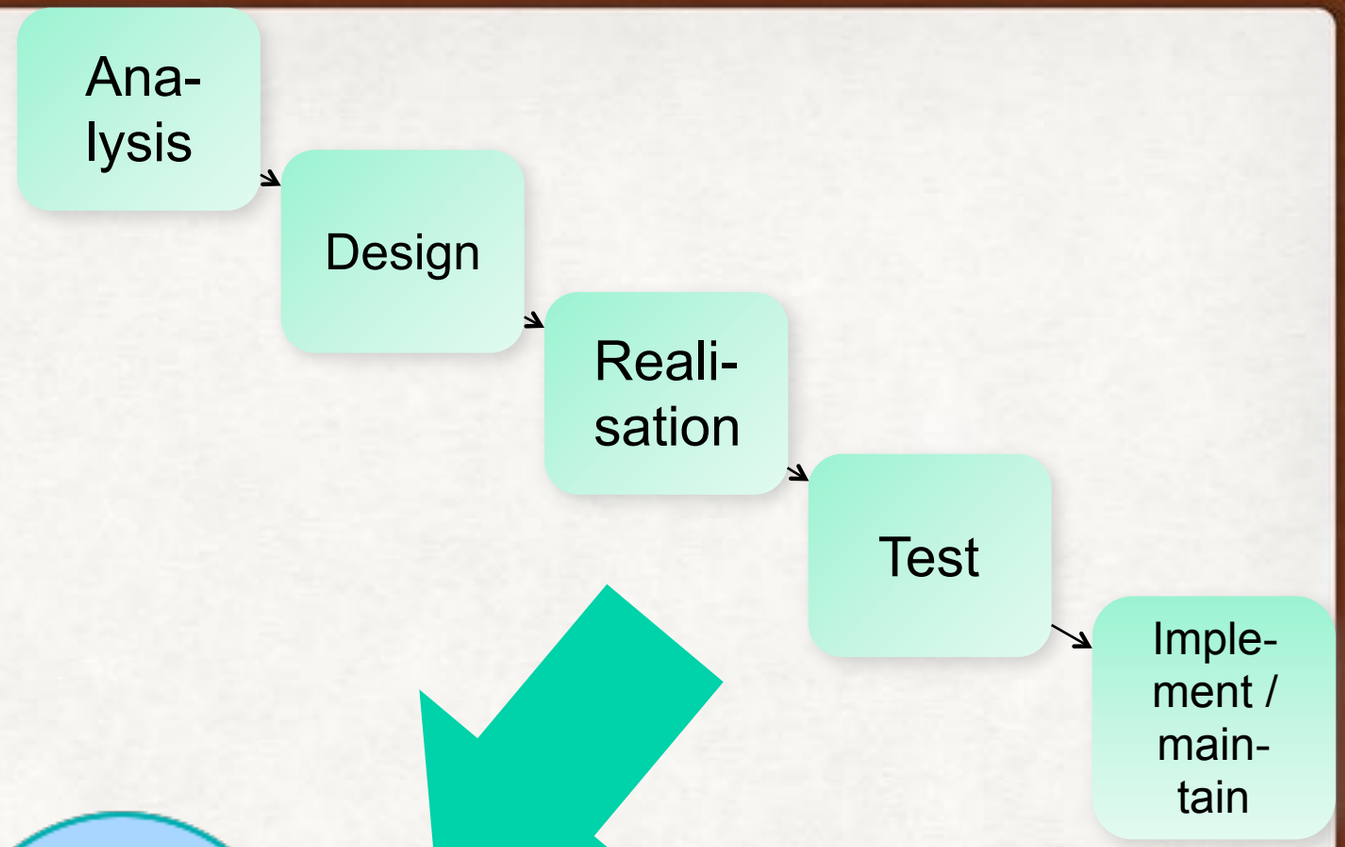
1. Traditional
2. Agile
3. User Based

1 - ‘TRADITIONAL’ DESIGN METHOD

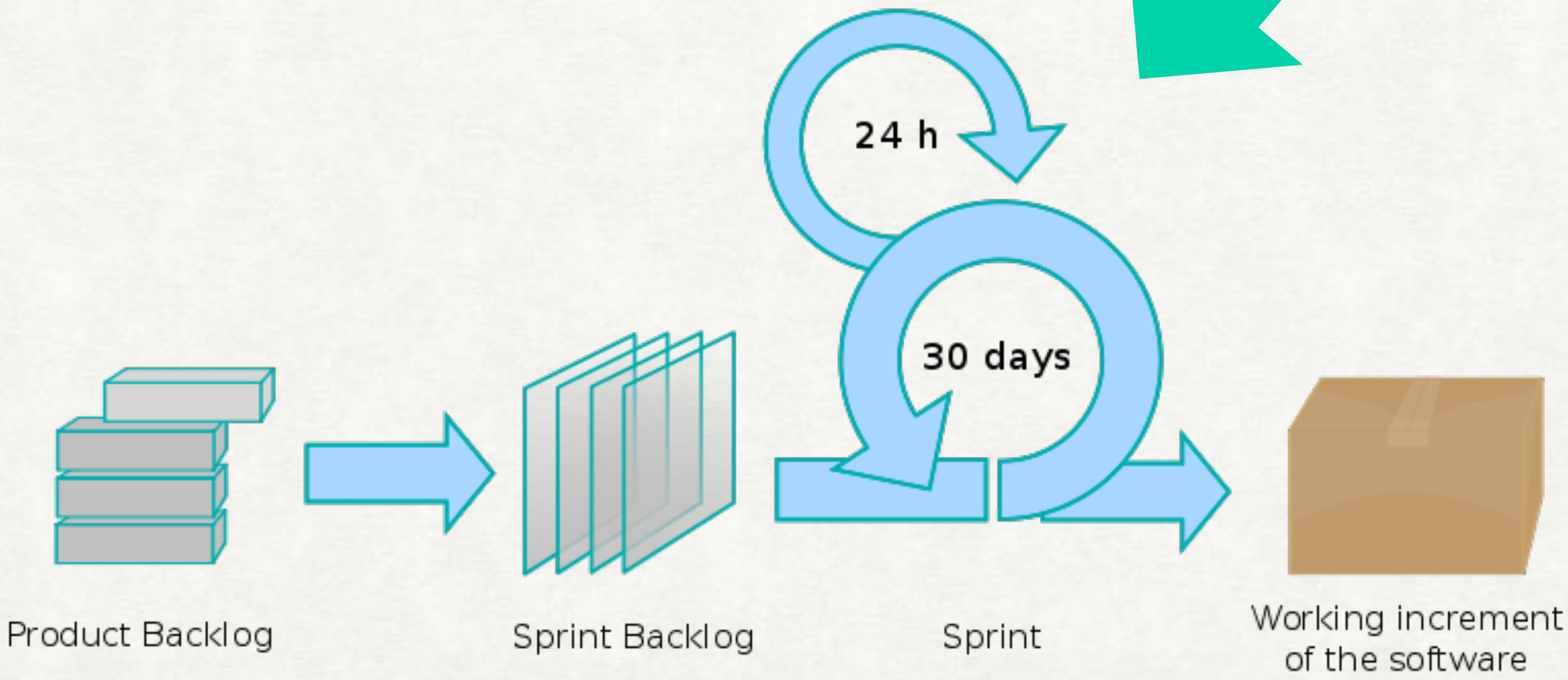
- Domain analysis
- Req.s analysis
- Architectural Design
- Realisation
- (Acceptance) Testing
- Implementation & Maintenance



2 - AGILE



- Eg. ‘Scrum’
- product owner essential



3 - MORE USER INVOLVED, 'SOCIOTECHNICAL DESIGN' APPROACHES

Participatory Design (PD)

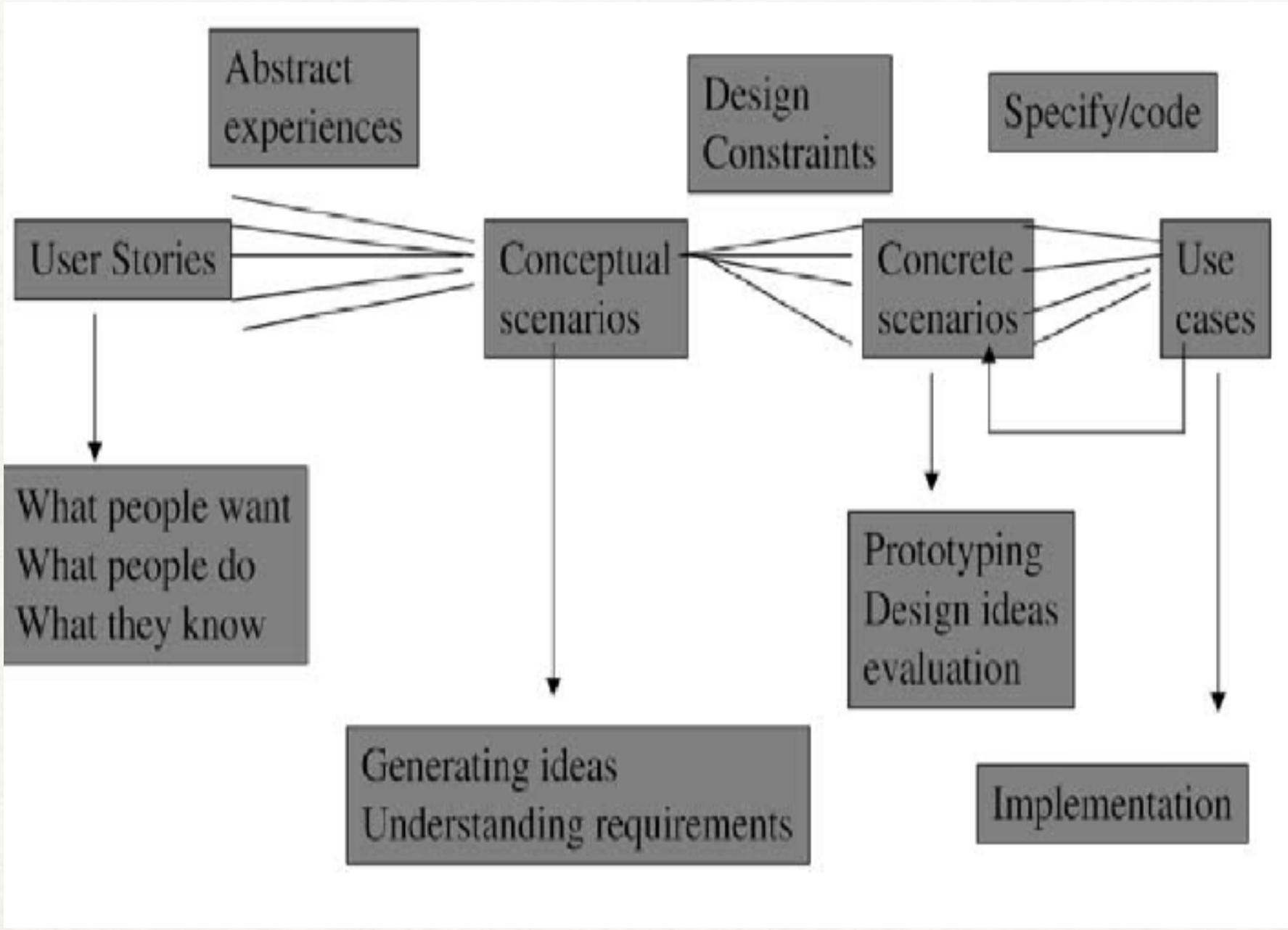
User Centered Design (UCD)

Cooperative design (CD)

Empathic design: imagine your are a end-user

- Greenbaum&Kyng (eds): Design At Work - Cooperative design of Computer Systems, Lawrence Erlbaum 1991
- Schuler&Namioka: Participatory Design, Lawrence Erlbaum 1993 and chapter 11 in Helander's Handbook of HCI, Elsevier 1997
- Beyer&Holzblatt, Contextual Design, Kaufmann 1998

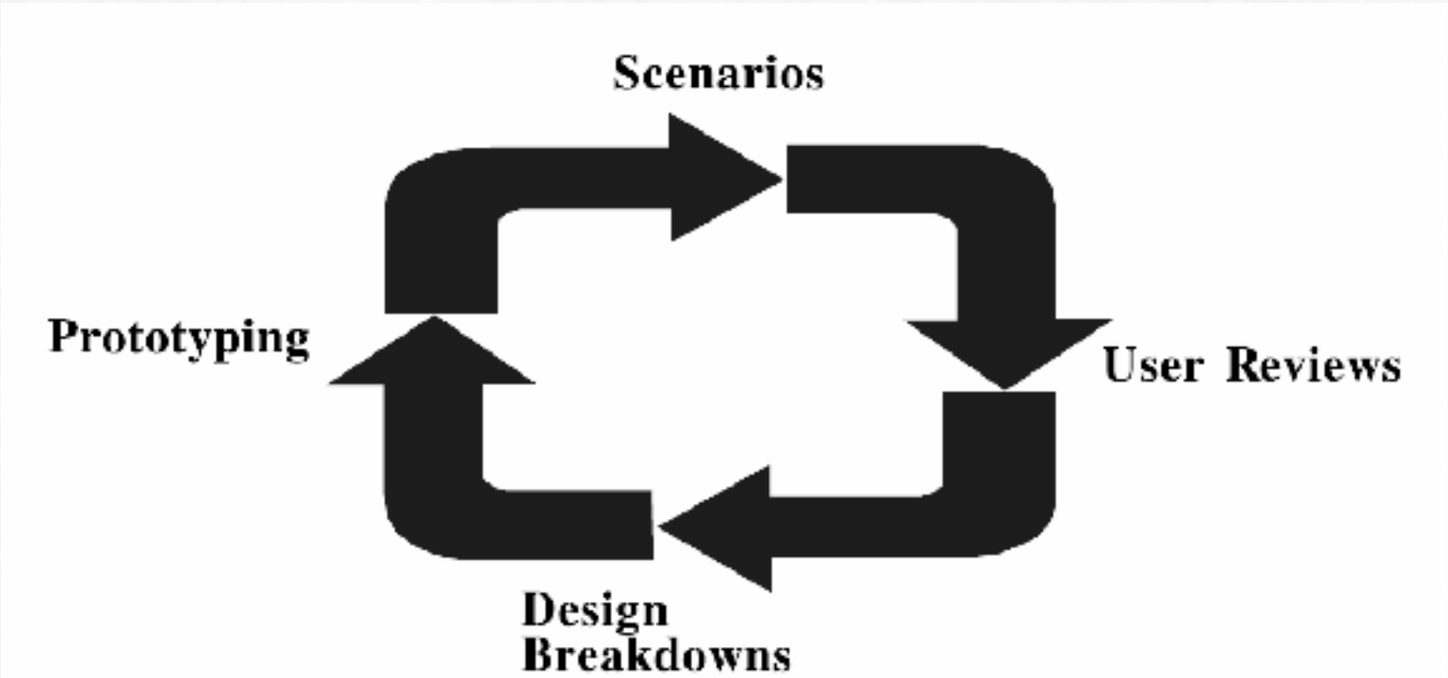
USAGE OF SCENARIOS



Beynon D., Macaulay C., *Scenarios and the HCI-SE design problem*, Interacting with Computers, Volume 14, pages 397 – 405, 2002.

USAGE OF SCENARIOS

FROM SCENARIOS TO FUNCTIONAL REQUIREMENTS: A CRITICAL REFLECTION

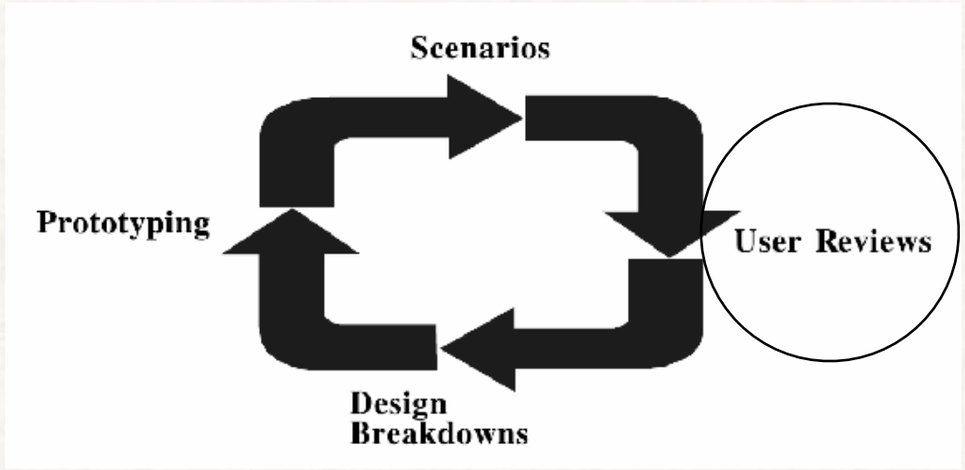


The reflective cycle (Beynon-Davies, 2002)

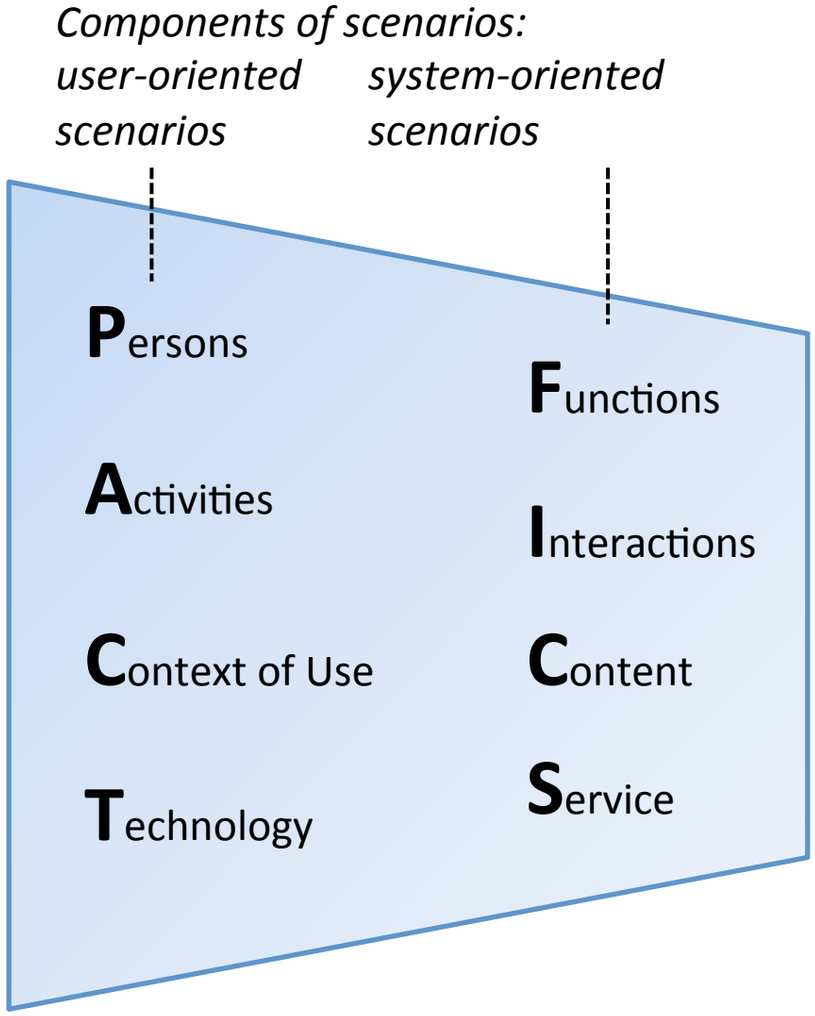
Beynon D., Macaulay C., *Scenarios and the HCI-SE design problem*, Interacting with Computers, Volume 14, pages 397 – 405, 2002.

FROM SCENARIOS TO FUNCTIONAL REQUIREMENTS: USER REVIEWS

- Primary end-users
  - Patients
  - Therapists
  - …
- System developers
  - Biomedical engineers
  - ICT engineers
  - …



USER-BASED SERVICE DESIGN…



From **Scenario corpus** to **Service decomposition**

Beynon & Macaulay 2002,Widya 2009, van 't Klooster 2012

SCENARIO CONTENT/INGREDIENTS

User perspective

PACT approach

- People
- Activities
- Context of use
- Technology

Context approach

Early stages Dev. Cycle

Designer perspective

FICS approach

- Functionalities
- Interactions
- Content
- Service

System approach

Later stages Dev. cycle

Beynon D., Macaulay C., *Scenarios and the HCI-SE design problem*, Interacting with Computers, Volume 14, pages 397 – 405, 2002.

- **Qualitatively** = refine on the motivations of end-users with respect to design choices, input, possible similar innovations, test for consistency, plausibility etc.

- **Quantitatively**= if possible quantify/illustrate consequences of the innovation (type of sensors needed, amount of data to be collected, amount of data to be send)

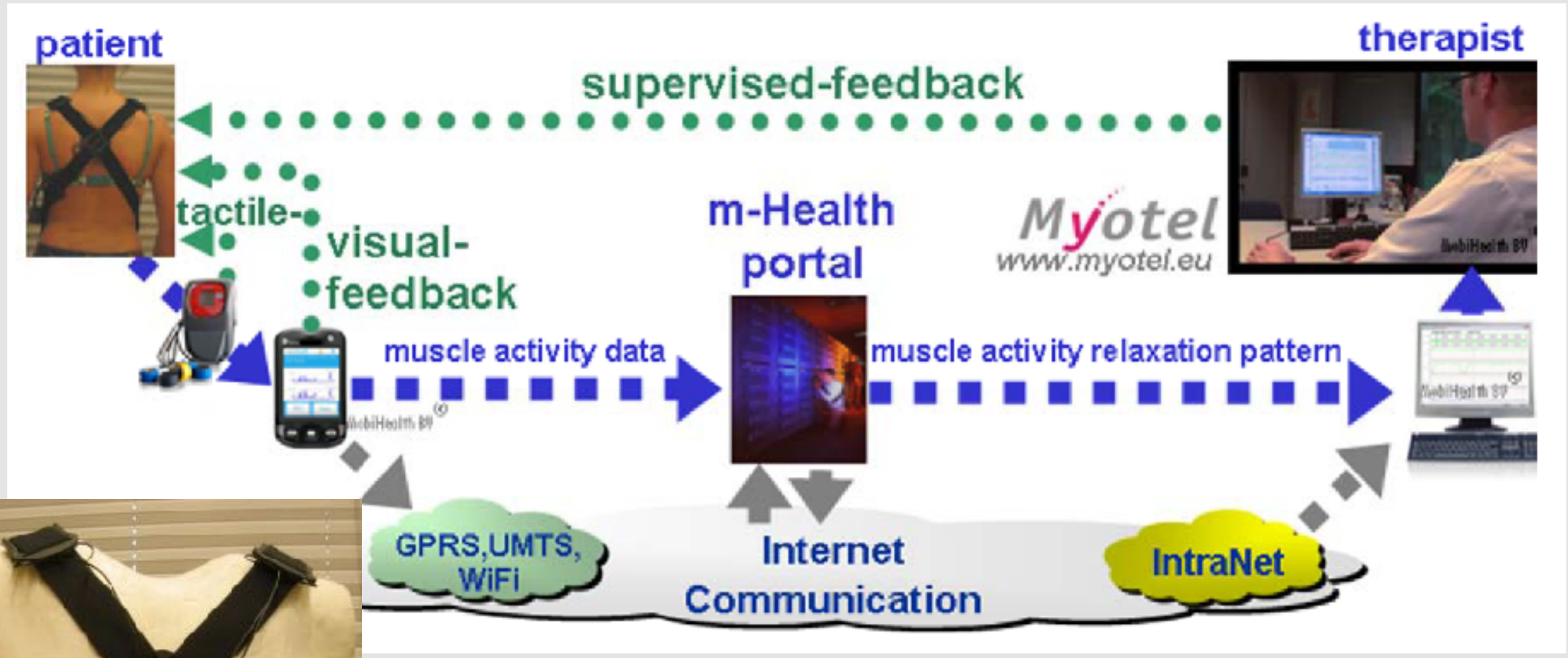
Scenario content: check your PACT & FICS

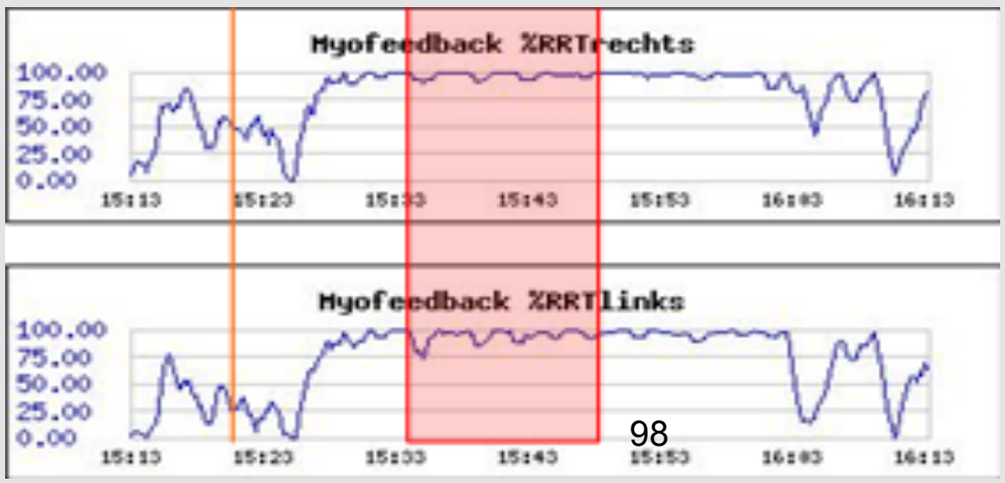
Story line (=> beginning – end!)	*Problem*
Lisa is 35 years old patient. She is working at a large administrative company. She suffers from neck-shoulder pain which is, to Lisa's opinion related to the computerwork she performs. Because of this, she was allowed to have a new treatment approach; the MyoTel myofeedback treatment service that allows her to be treated at the workplace without the attendance of a therapist. By means of the MyoTel service subjects are taught to relax their neck-shoulder muscles (so-called trapezius muscle). Therefore, she wears a garment during work that registers her muscle activation. Every week she has a teleconsultation with the myofeedback therapist to discuss the progress.	***"future" service*** ***People*** ***Roles*** ***Activities*** ***Functionalities*** ***Interaction*** *Context of use*

Scenario content: check your PACT & FICS

Story line (=> beginning – end!)	***Problem***
Lisa *is 35 years old* ***patient****. She is* ***working*** *at a large administrative company****. She suffers from neck-shoulder pain*** *which is, to Lisa's opinion related to the computerwork she performs. Because of this, she was allowed to have a* ***new treatment approach; the MyoTel myofeedback treatment service that allows her to be treated*** ***at the workplace*** ***without the attendance of a therapist.*** *By means of the MyoTel service subjects* ***are taught to relax their neck-shoulder muscles*** *(so-called trapezius muscle). Therefore, she* ***wears a garment*** *during work that* ***registers her muscle activation****. Every week she has a* ***teleconsultation*** *with the* ***myofeedback therapist*** *to* ***discuss the progress****.*	***"future" service*** ***People*** ***Roles*** ***Activities*** ***Functionalities*** ***Interaction*** *Context of use*

Example — Myotel system

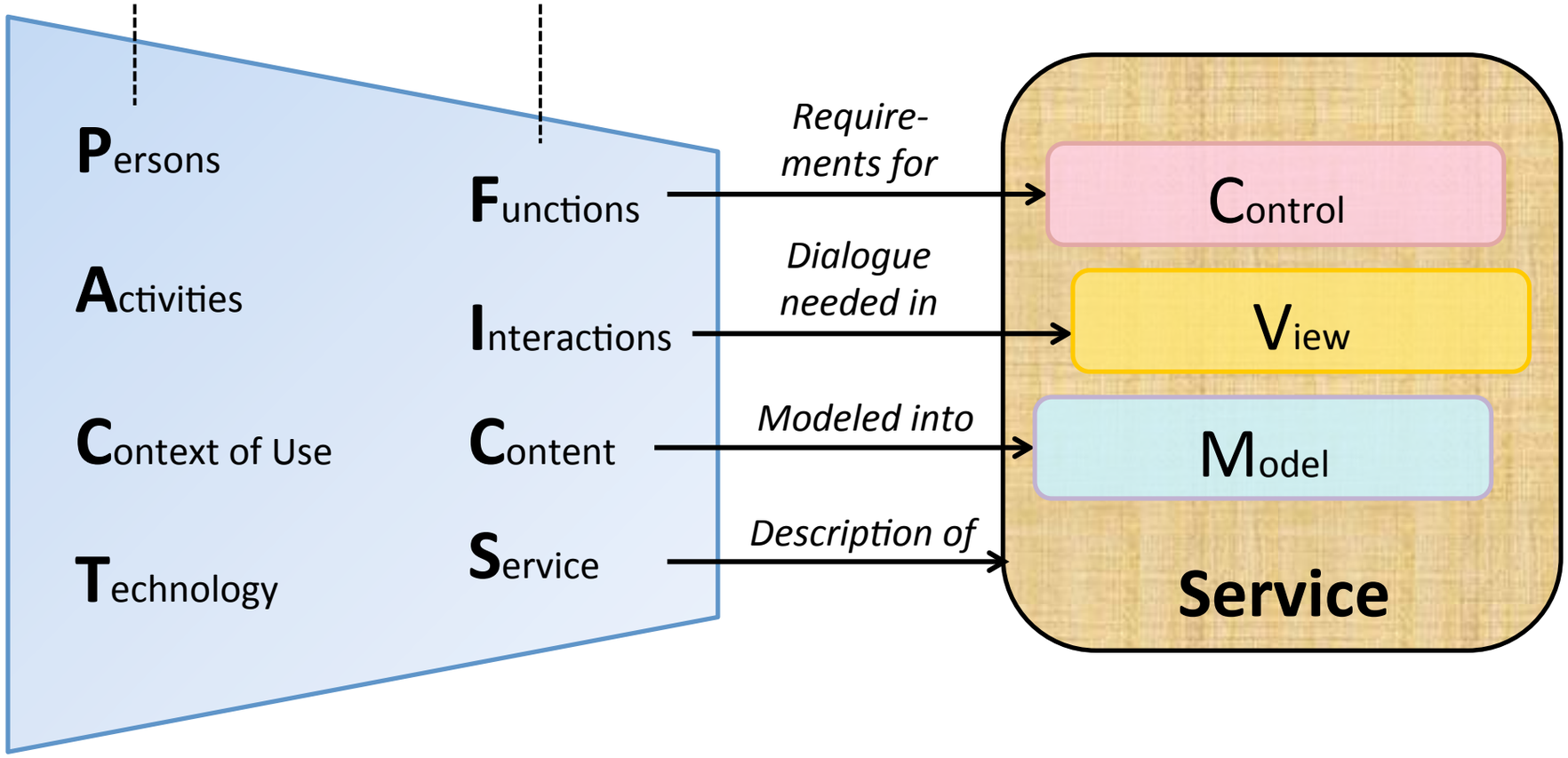




…MVC!

Components of scenarios:
user-oriented scenarios
system-oriented scenarios

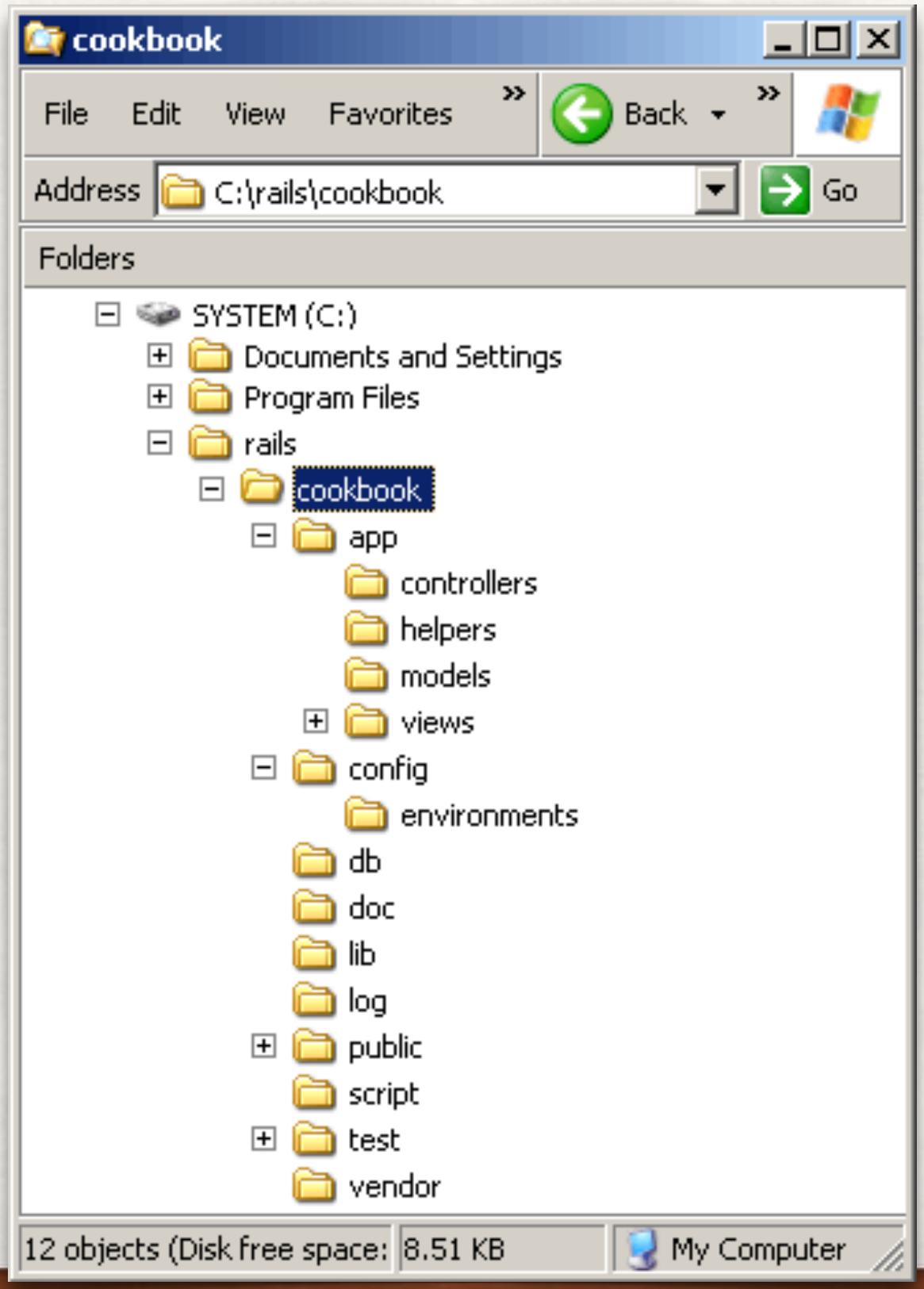
Service decomposition in terms of data model (model), user interface (view), algorithmic (control)



From **Scenario corpus** to **Service decomposition**

Beynon & Macaulay 2002,Widya 2009, van 't Klooster 2012

PROOF: MVC - IN RAILS

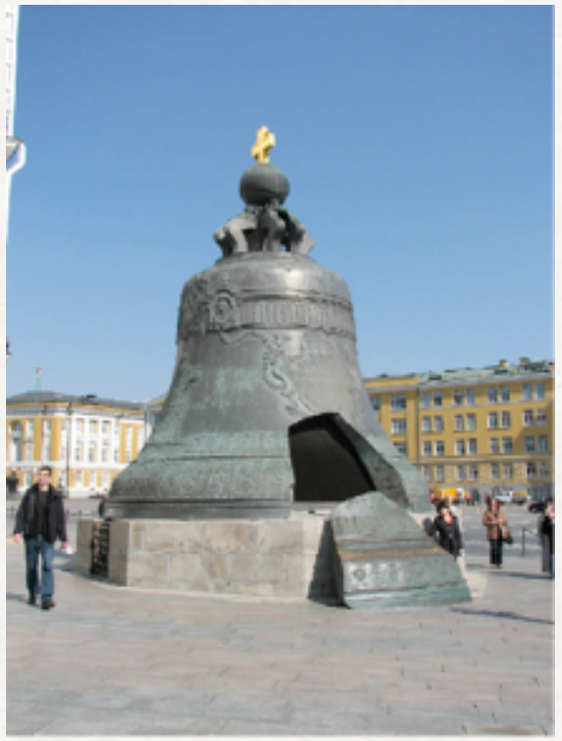


PROOF: MVC - IN RAILS

SERVICE DESIGN (RECAP)

MOSCOW

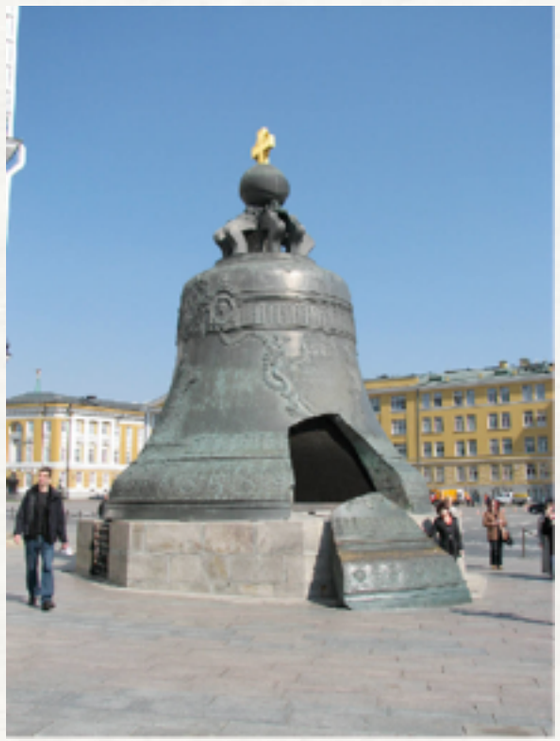
- *Which requirements to actually develop?*



SERVICE DESIGN (RECAP)

MOSCOW

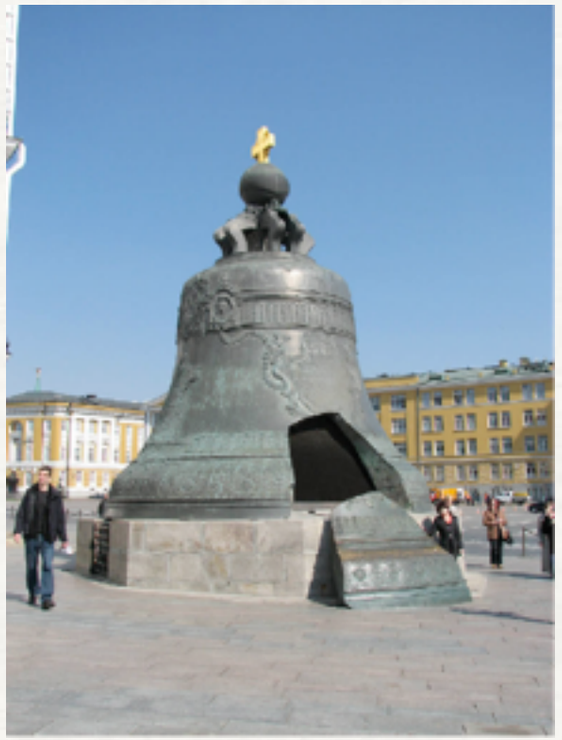
- Must Have
- Should Have
- Could Have
- Won’t Have (this time / this sprint)



- **prioritise** & make sure (N)FRs are **traceable**

REQUIREMENTS (RECAP)

Requirement #: 3	**Requirement type:** functional
Value: easy access	**Attribute:** one stop portal for information
Description: The system provides access to all (types of) information via one interface.	
Rationale: Nurses spend a lot of time gathering information from different (types of) sources while performing their antibiotic-related tasks. When all information can be accessed from one interface, one starting point, searching for information is facilitated.	
Source: Focus group 1 & 2, fragment 1,2,3,10,13	
Fit criteria **1. Acceptance testing:** not applicable **2. Usability testing:** The application allows participants to find the desired information within one minute. Note: time frame to be adjusted upon inspection of the high-fidelity prototype. **3. Summative evaluation:** Participants feel they have to spend less time on searching information via the app. Searching for information via the app results in an increase in success and a decrease in time, in comparison with searching for information in the traditional way.	
Priority: High	**Conflicts:** possible conflict with mobility and real time access and synchronization requirements because access to these databases at all places via the interface may be impossible due to limitations in wireless connections and security options.
History: Created on March 9 2012, adjusted on May 8 2012	



SEVERAL TECHNIQUES TO ASSESS THE NEEDS OF PATIENTS AND PROFESSIONALS TO GET THE CONTENT FOR YOUR SERVICE

Use of (semi-) qualitative techniques:

- Workshops/seminars
- Observational studies
- Focus groups
- Semi-structured/open interviews
- Questionnaires
- Brainstorm in mind maps
- Empathic design

- And ...

SDT (+) version. Recommendation page:

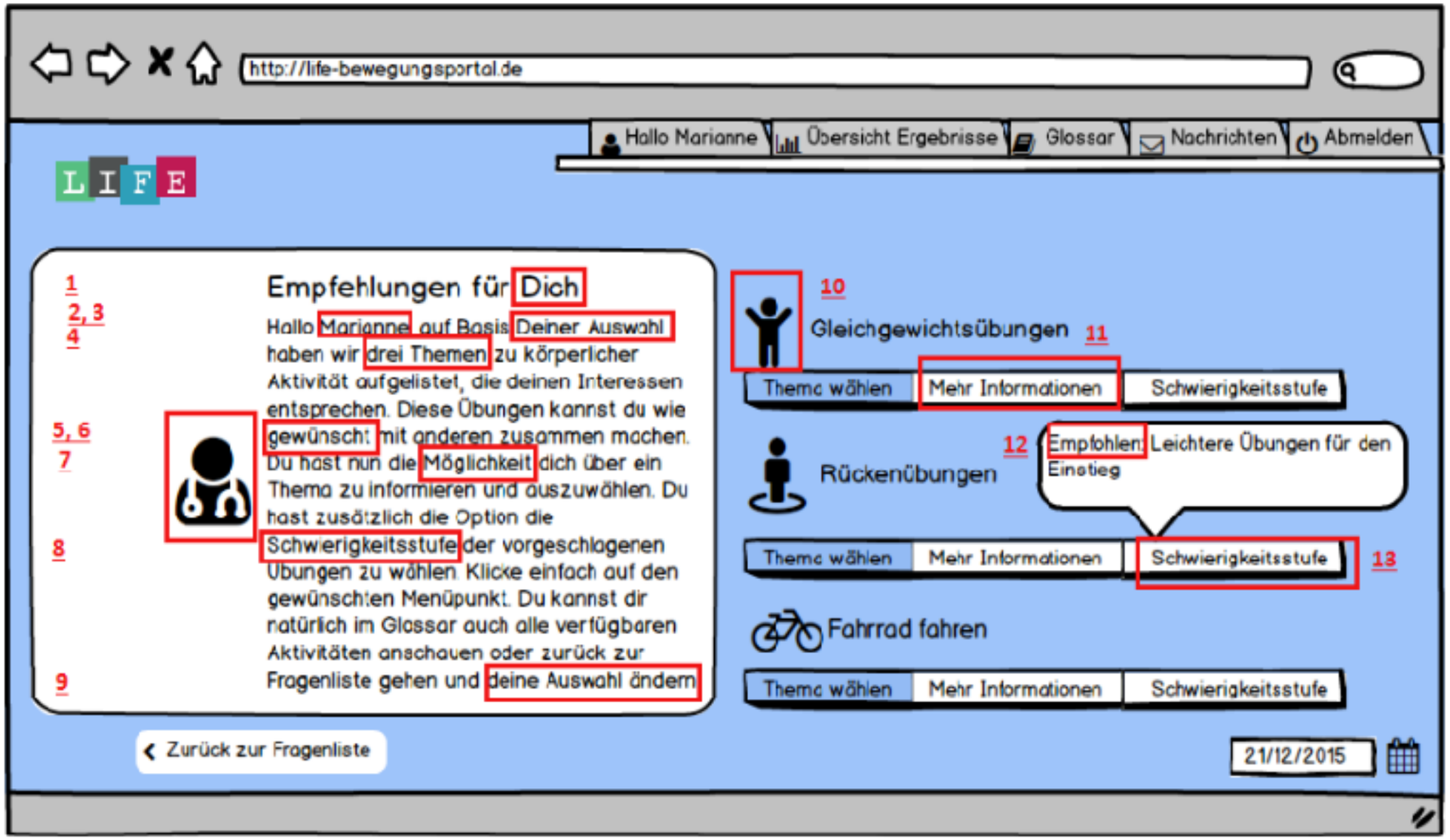


Figure 4: Screenshot of the recommendation page in the SDT (+) prototype

- SDT + A: Abbreviation for self – determination construct supporting autonomy
- SDT + C: Abbreviation for self – determination construct supporting competence
- SDT + R: Abbreviation for self – determination construct supporting relatedness

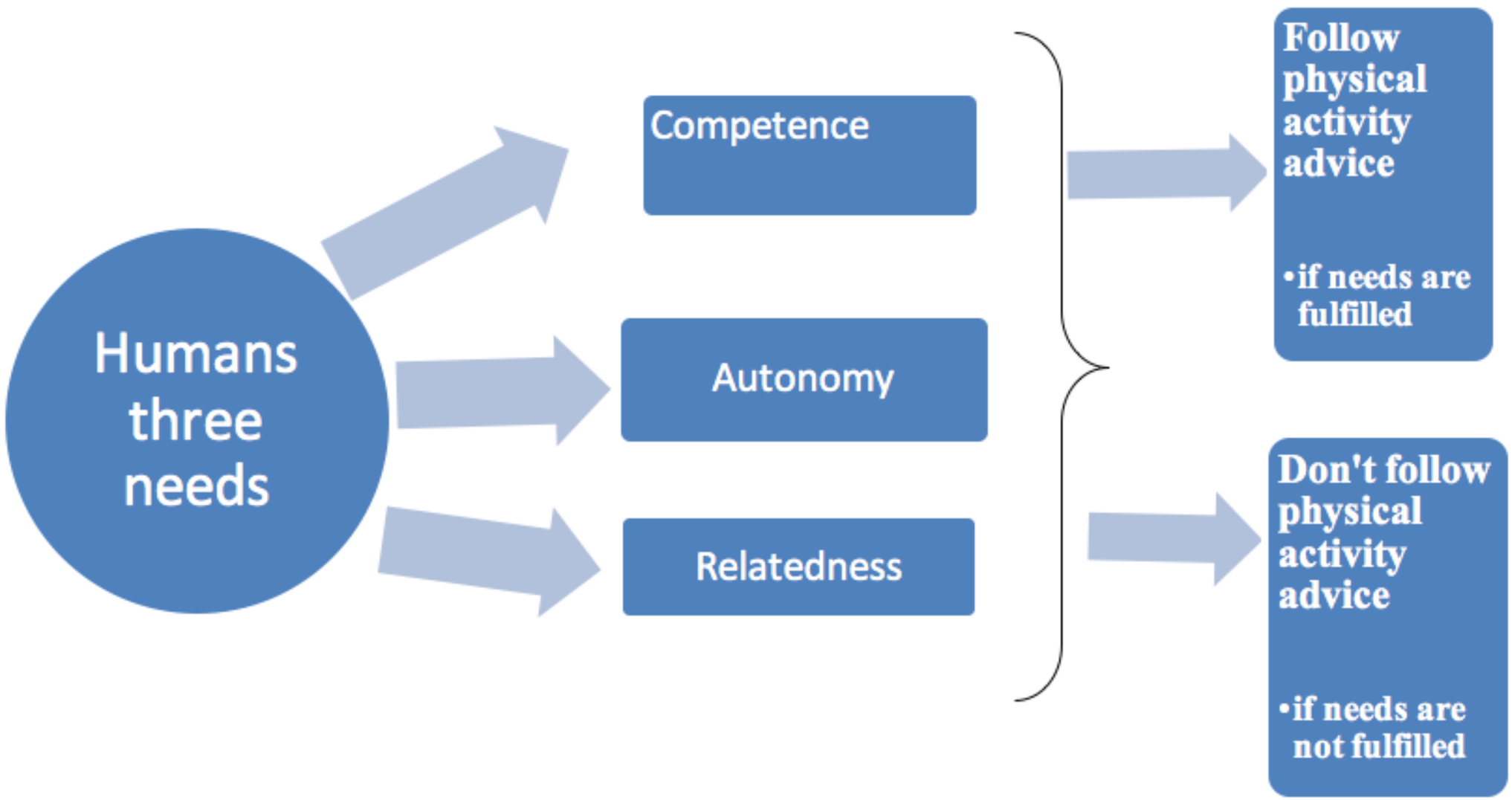
1.) SDT + R → strategy: affection. User is addressed directly. Dialogue support: Liking.

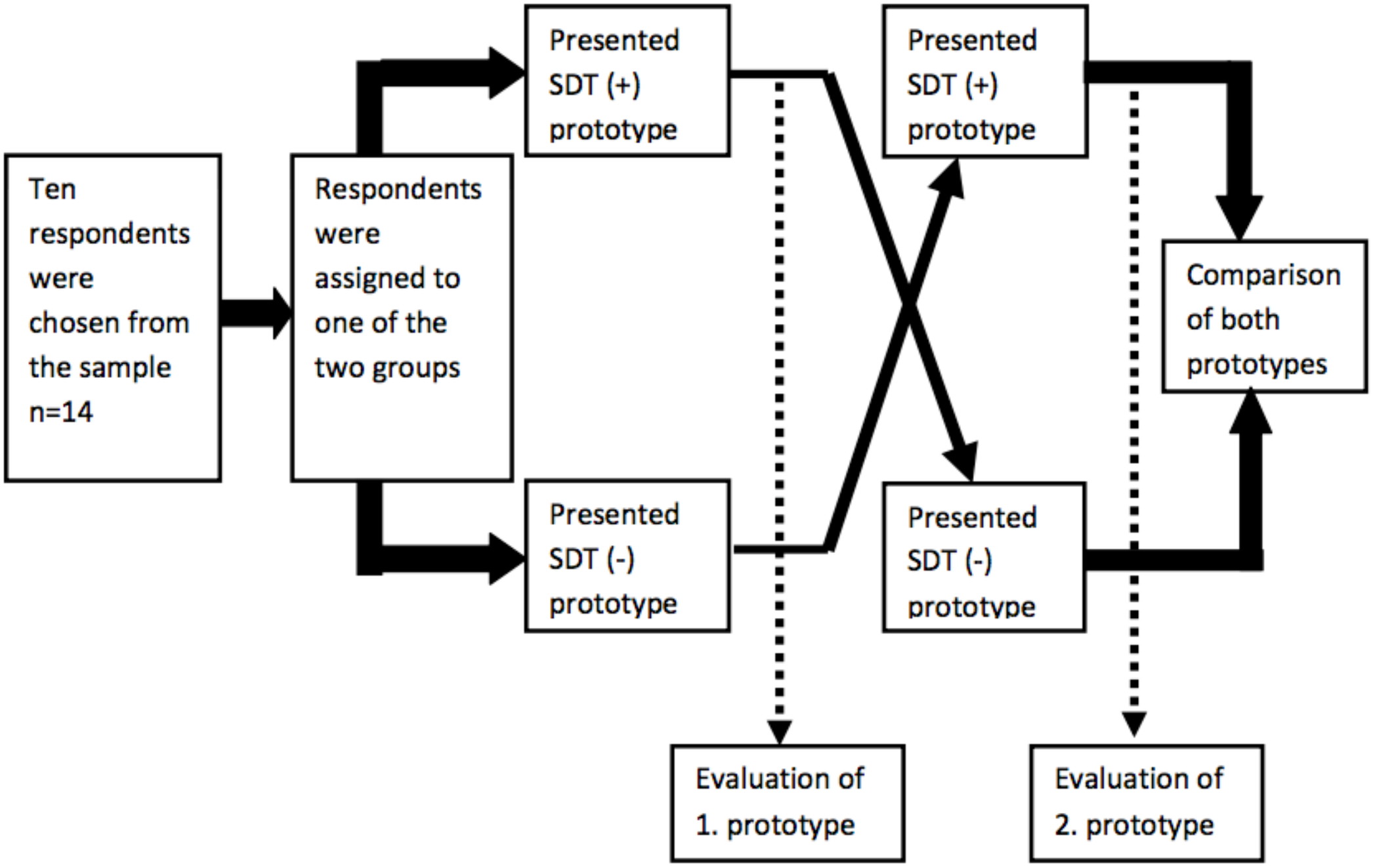
2.) SDT + R → strategy: affection. User is addressed directly. Dialogue support: Liking

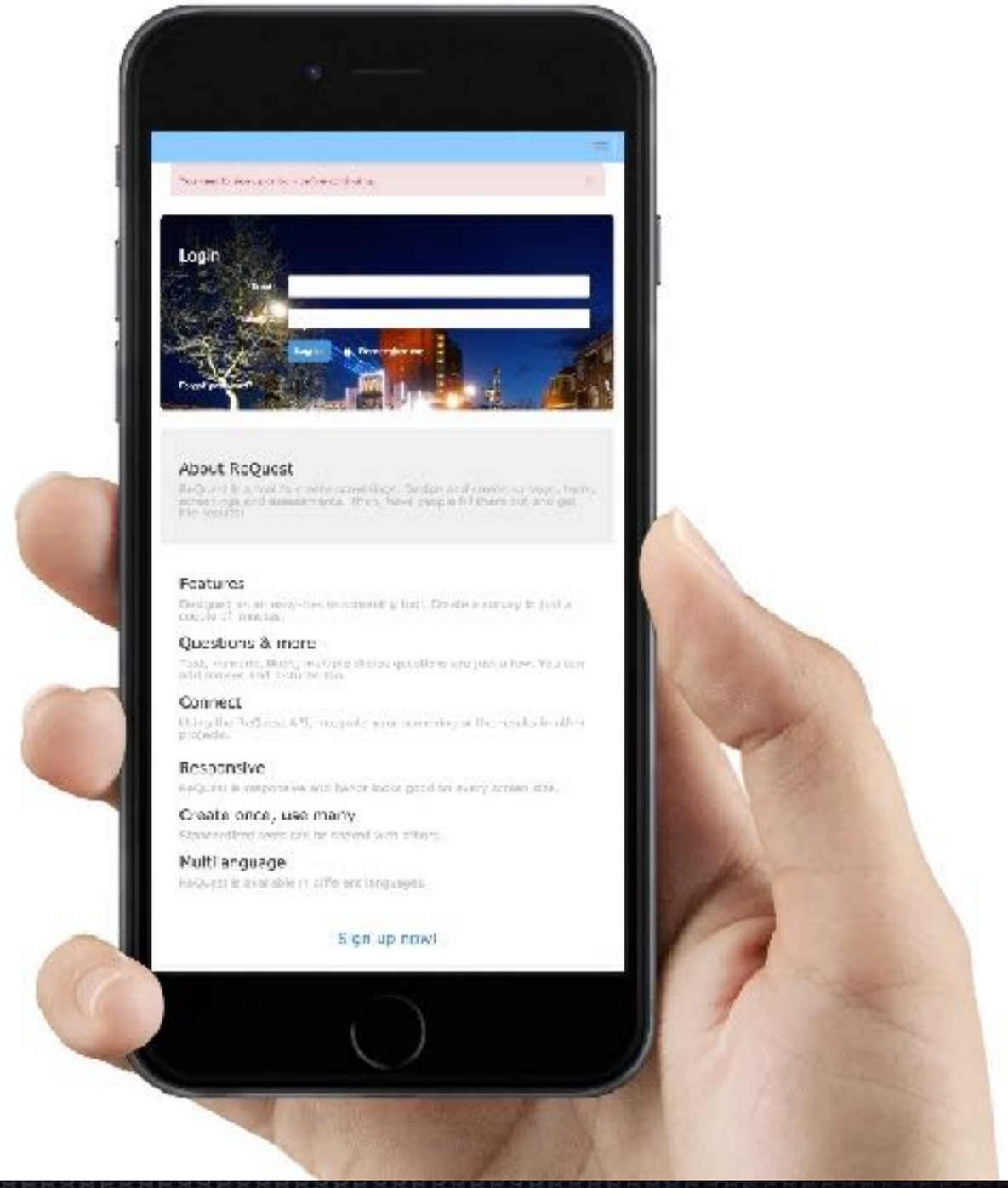
3.) Primary task support: Tailoring. User is reminded that the advice is based on his interests he

How can physical activity advices be designed to the needs of elderly

Figure 2.: Self – determination theory in relation to physical activity advises




Ten respondents were chosen from the sample n=14
Respondents were assigned to one of the two groups
Presented SDT (+) prototype
Presented SDT (-) prototype
Presented SDT (+) prototype
Presented SDT (-) prototype
Comparison of both prototypes
Evaluation of 1. prototype
Evaluation of 2. prototype

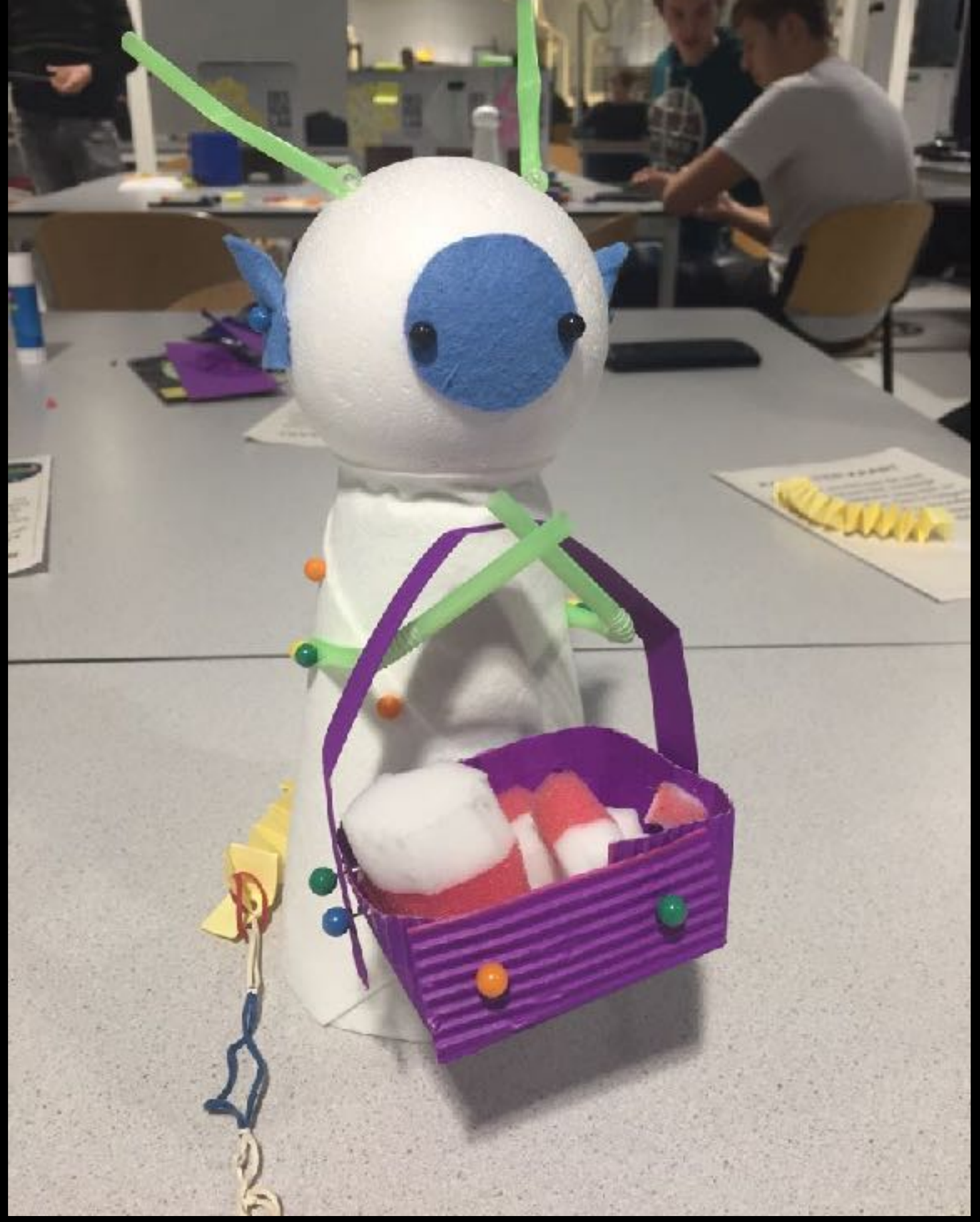

Login
About RoQuest
Features
Questions & more
Connect
Responsive
Create once, use many
Multi language
Sign up now!

SEVERAL TECHNIQUES TO ASSESS THE NEEDS OF PATIENTS AND PROFESSIONALS TO GET THE CONTENT FOR YOUR SERVICE

Use of (semi-) qualitative techniques:

- Workshops/seminars
- Observational studies
- Focus groups
- Semi-structured/open interviews
- Questionnaires
- Brainstorm in mind maps
- Empathic design

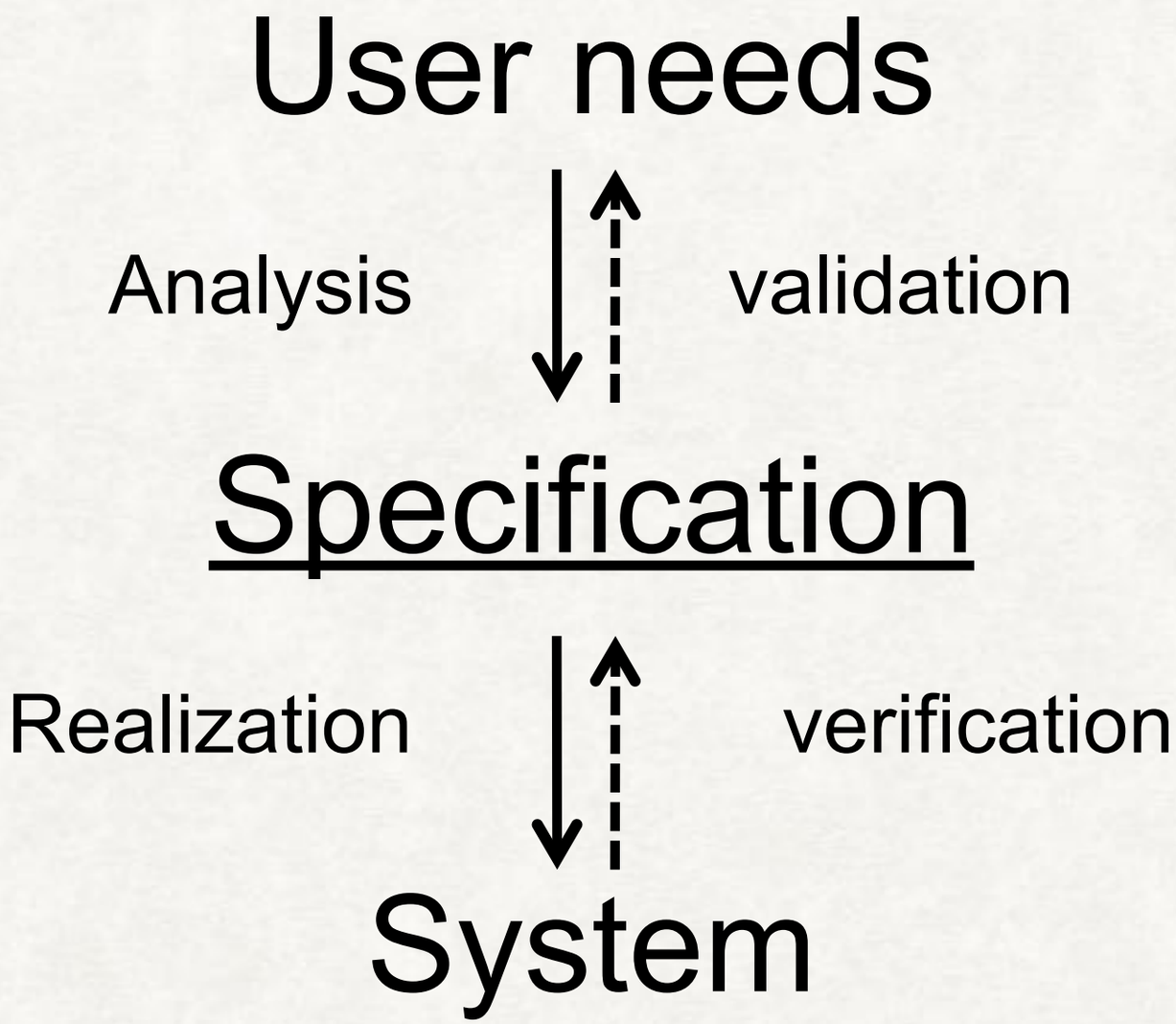
- And ...



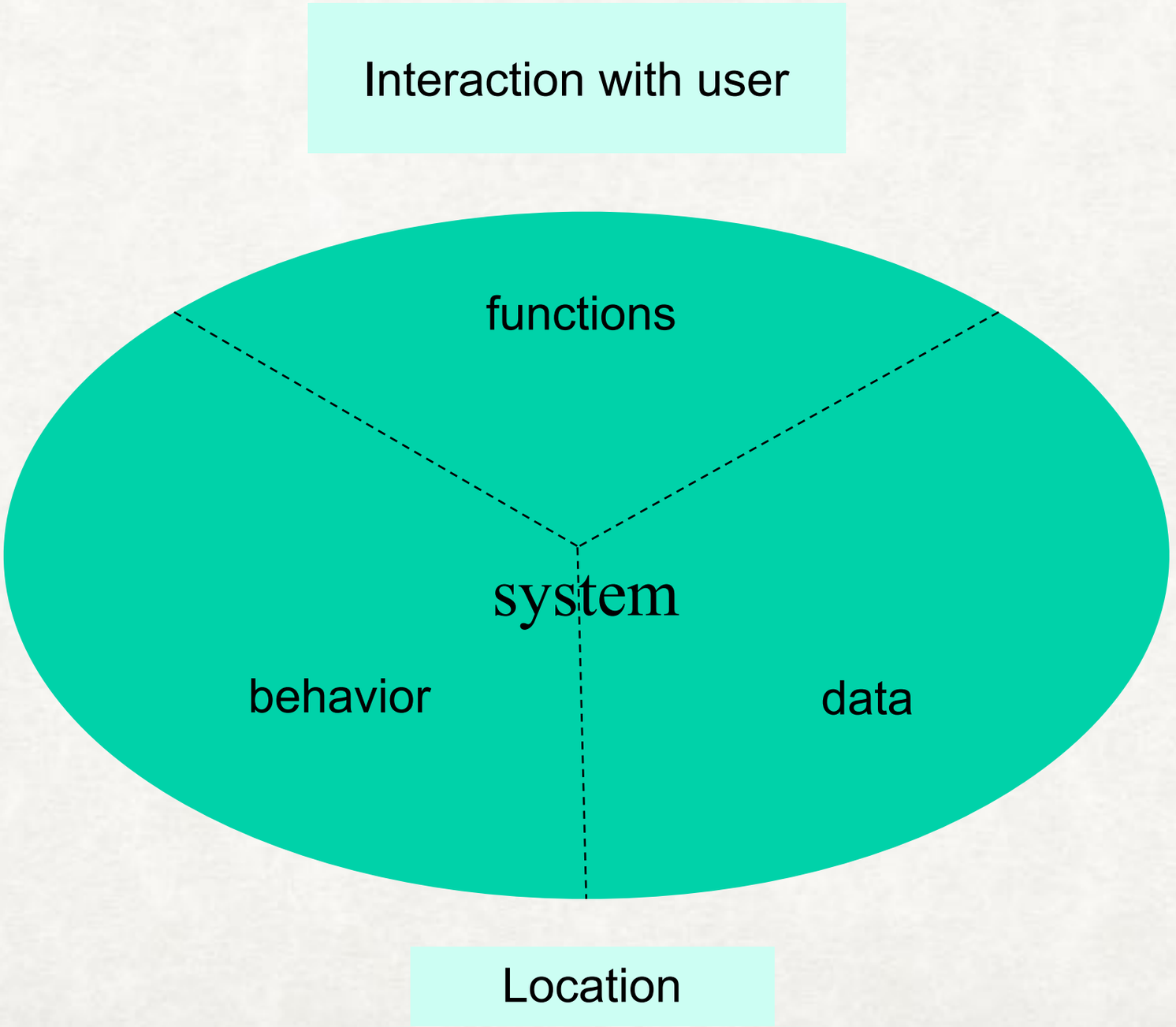

LAB


DES
IGN
LAB

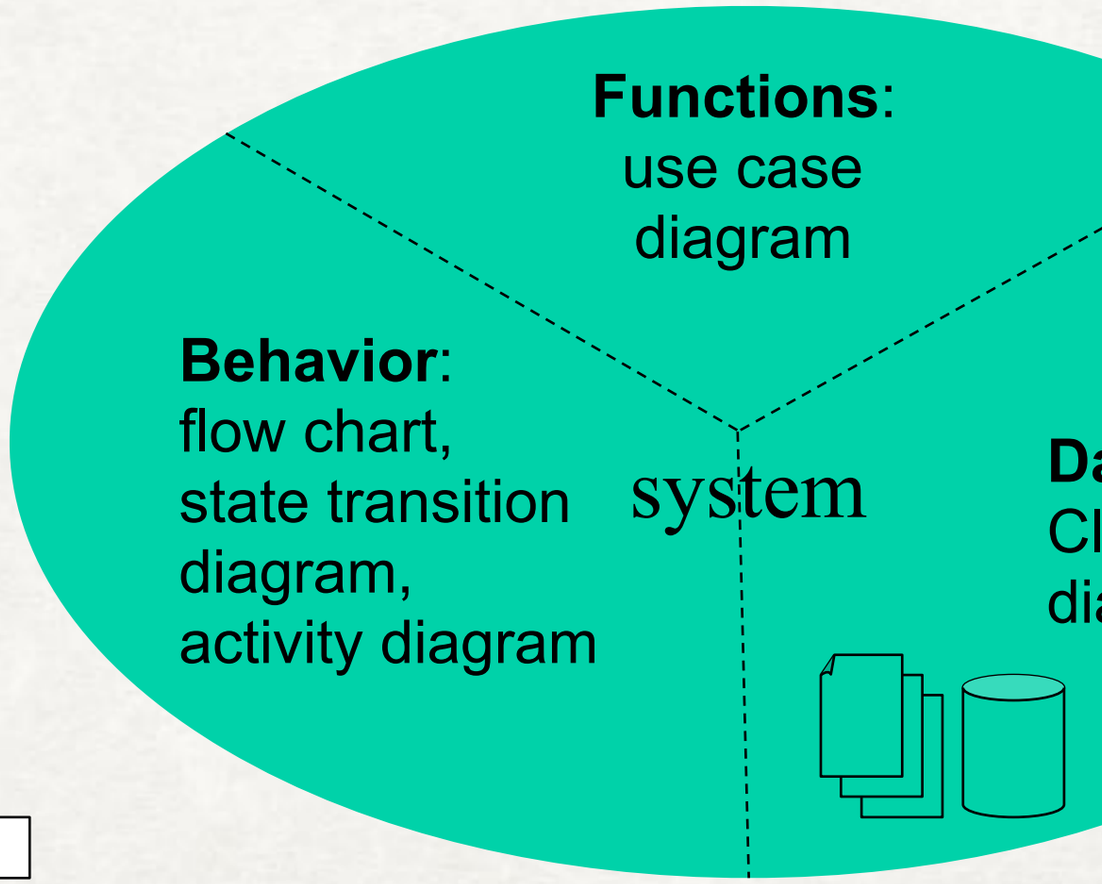
SPECIFICATION OF USER NEEDS TO EASE SYSTEM REALIZATION

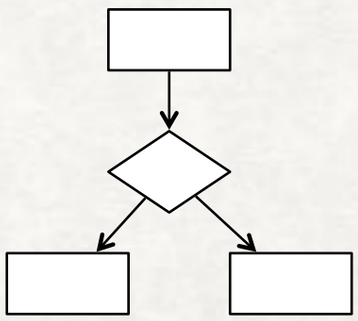


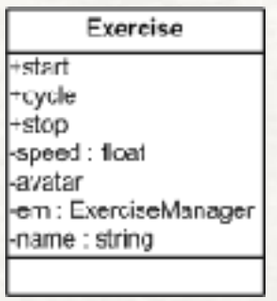
LOGICAL MODELLING OF SYSTEM AS-A-WHOLE AND SUBSYSTEMS DISTINGUISHES 5 ASPECTS:



UNIFIED MODELLING LANGUAGE (UML)

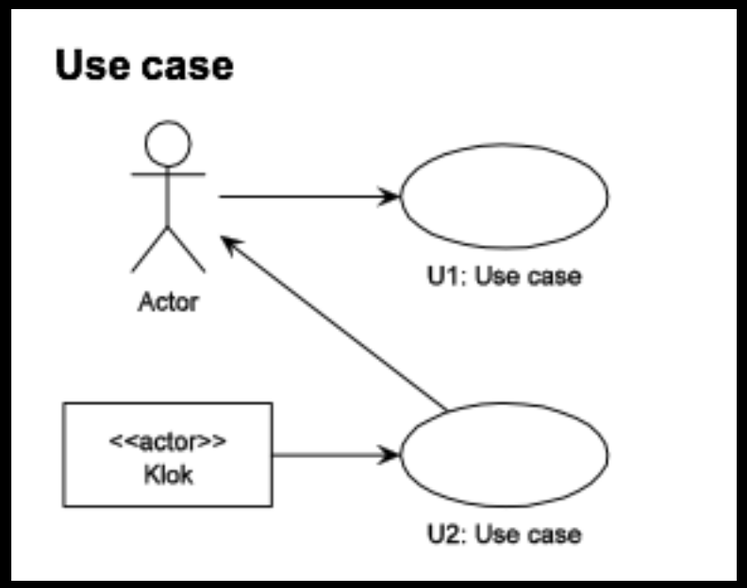




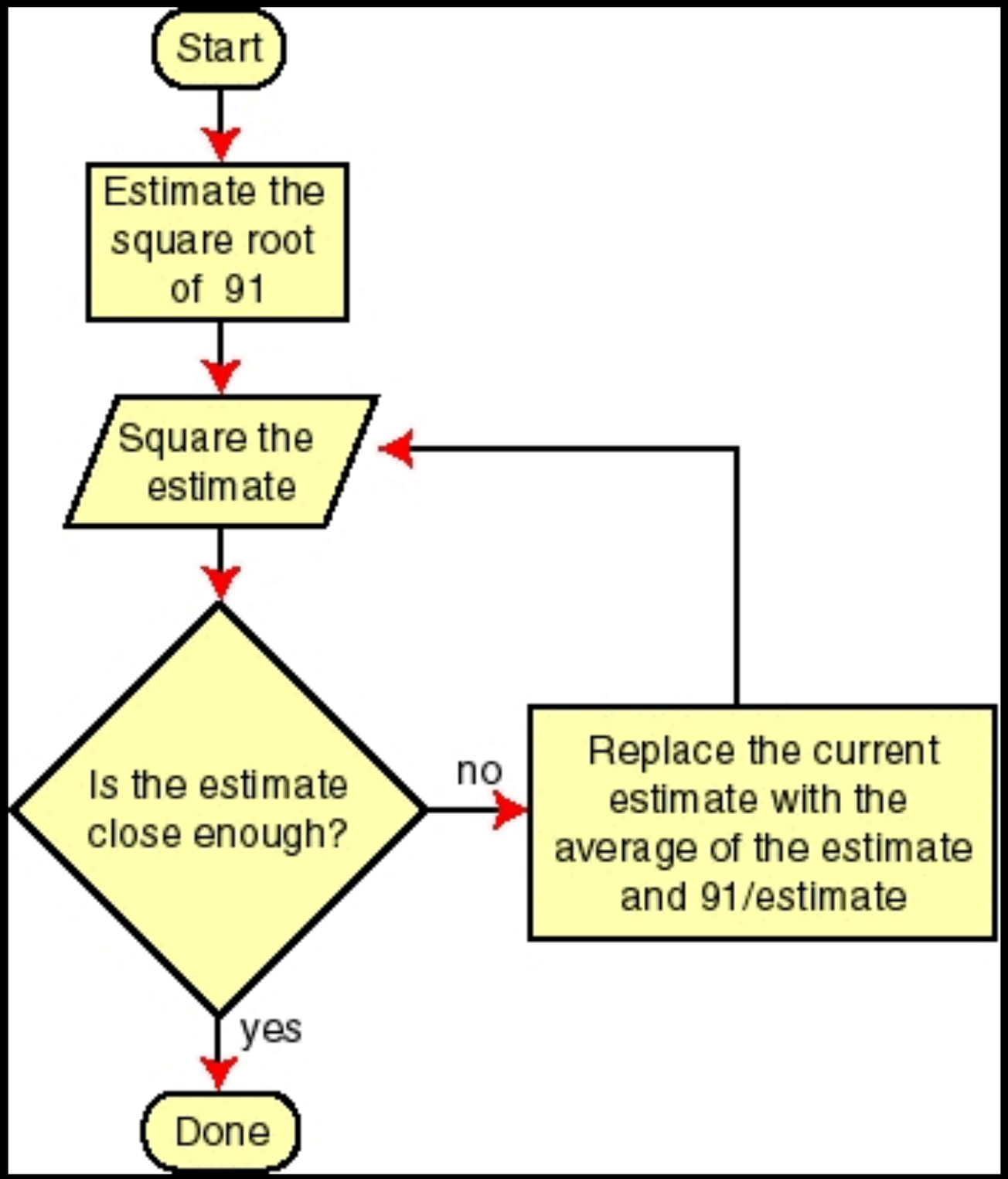


110

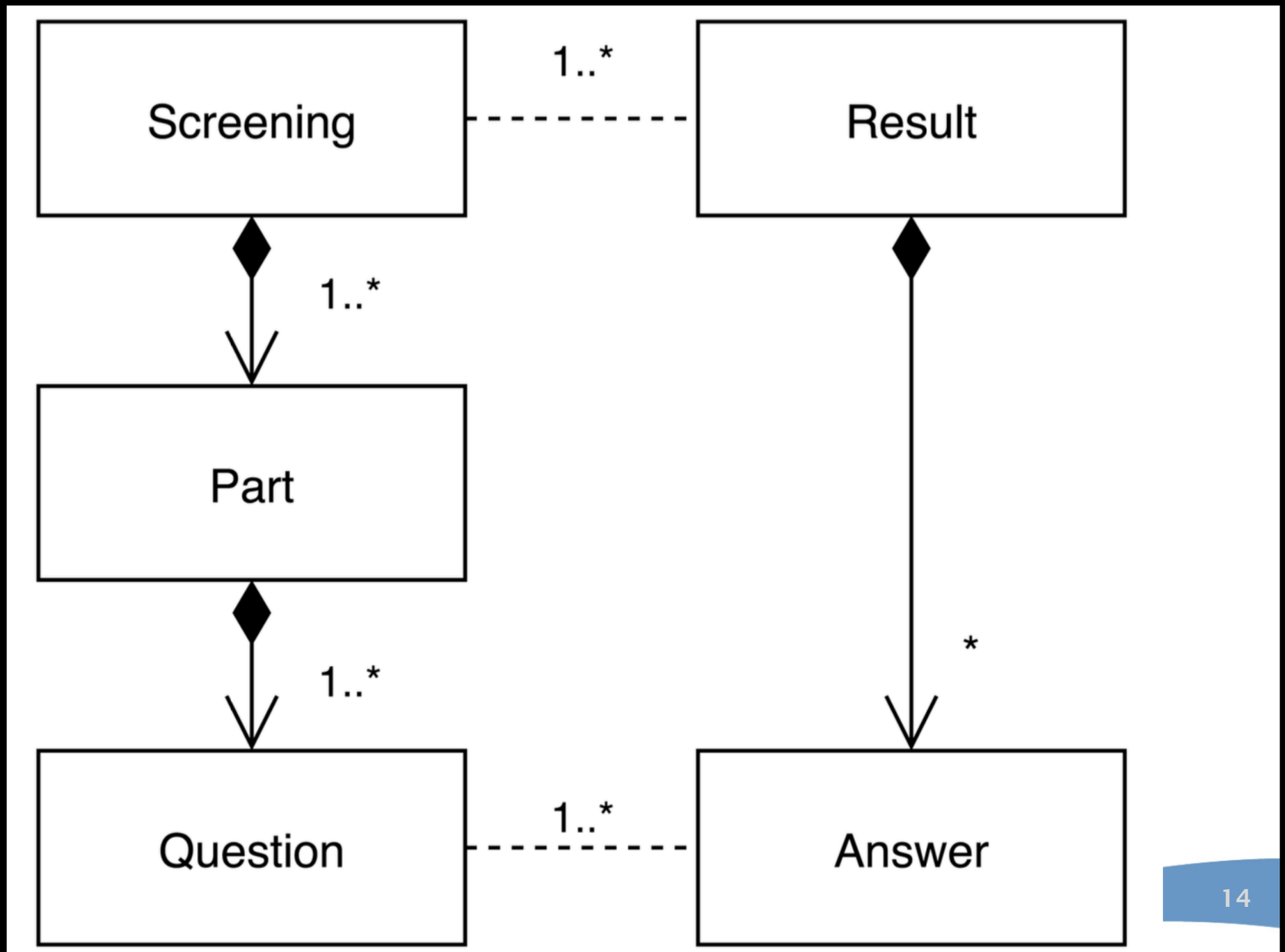
Use Case Diagram



Flow chart


Start
Estimate the square root of 91
Square the estimate
Is the estimate close enough?
no
Replace the current estimate with the average of the estimate and 91/estimate
yes
Done

Class Diagram



MOCKUPS, INTERACTIVE SCENARIOS

BUILDING BLOCKS

Internet

UMTS/WiFi

Intranet

Smartphone

Sensors

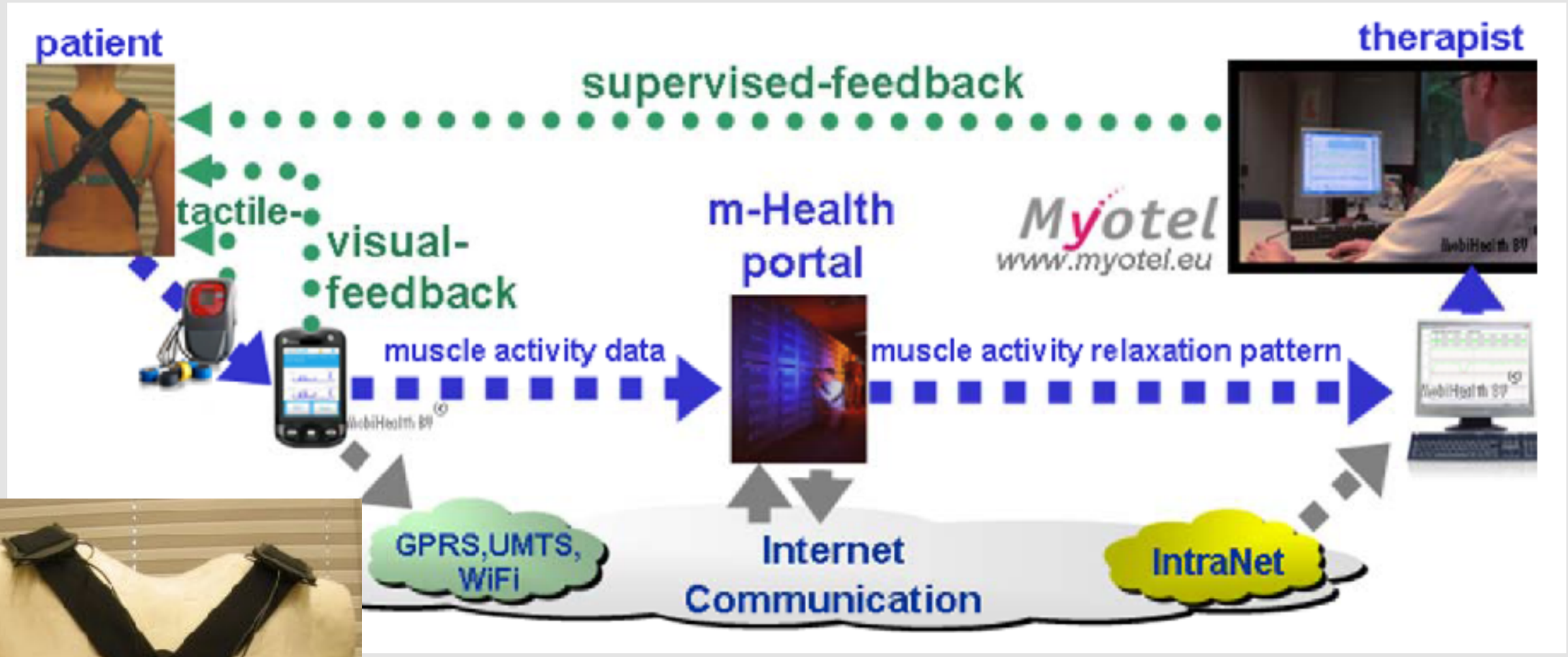
Client

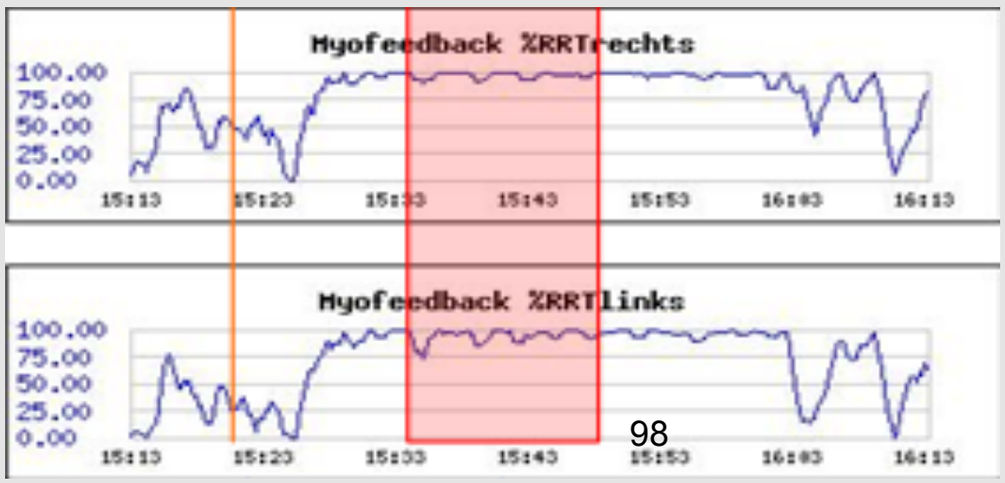
(bio)sensor data

feedback

Professional

Technical architecture





Medical process management

Social activities management

Caregiver Tailoring Interface

Execution

Adapters

Reasoning

Web Service

Persistence Tier

Web Service Client

Integration Tier

Client Tier

Application Tier

Persistence Tier

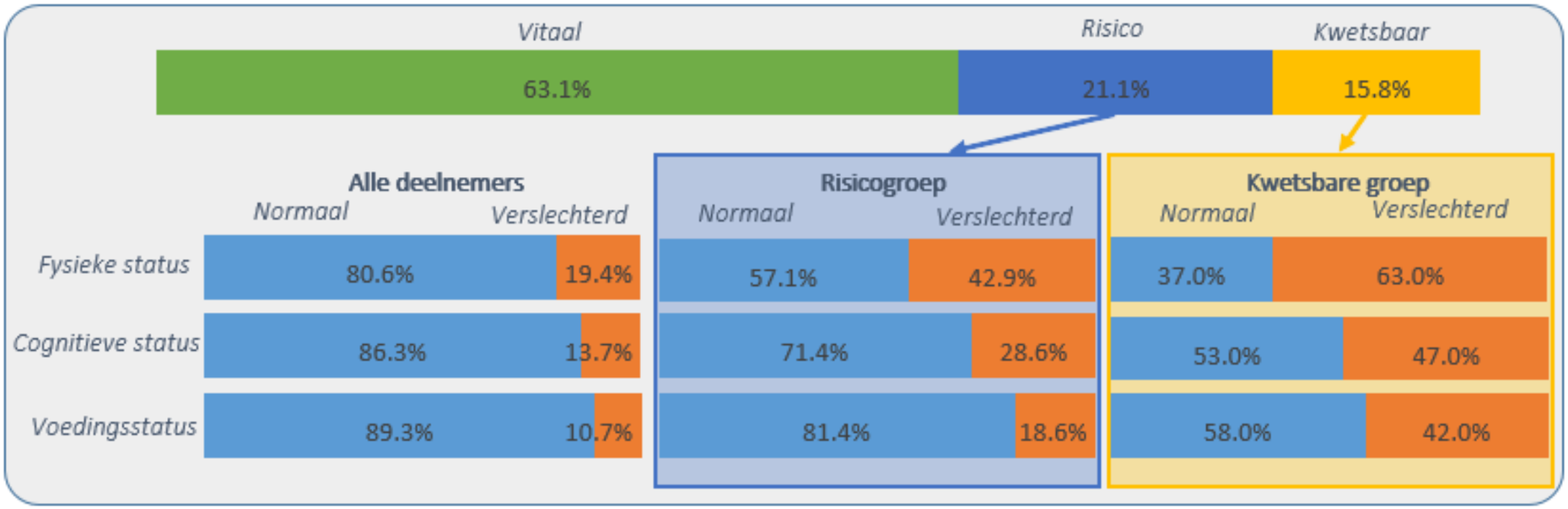
Telecare System

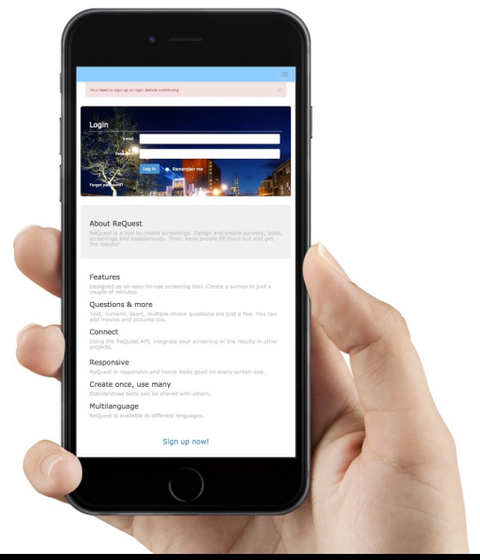
EXAMPLE CASES

E-HEALTH / SENSING / SELF-MANAGEMENT


Dossier
Documenten
Agenda
Mutaties
Opslaan
Acties
Uitgeven
Wie is in de buurt?
Cliënt samenvoegen
Brieven versturen
Taken en signaleringen
IBC openstaand
M&M
Laatst bezochte cliënten
Mw. P de Bruin
Mw. A de ZZP - Mesquita
Mw. A van Kastanje - H...
Mw. D Bont
Dhr. KWM van Kesteren
Laatst bezochte locaties
ZBC
WZC

Valorisation of screening and coaching






STAGE


LIFE
Een fysiek actief levensstijl
Voor nu en later

LIFE

progress: exercise 1 of 5

Head movements

Execution

- Stand straight or sit down and look straight ahead
- Slowly turn your head to the right, as far as you can
- Then turn your head to the left, as far as you can

Number of repetitions
Repeat this exercises 5 times for both sides.

Start time: 07:19:21 | Duration: 00:03:00

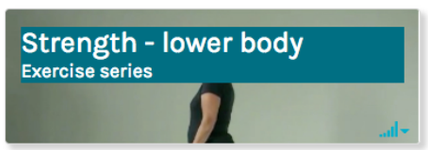
Stop training | Exercise done

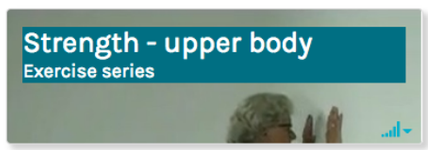
GoLiveHealth

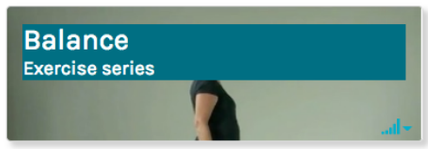
Succesfully signed in.

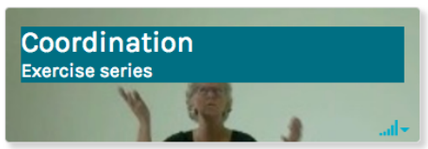
Exercise program

Specific programs

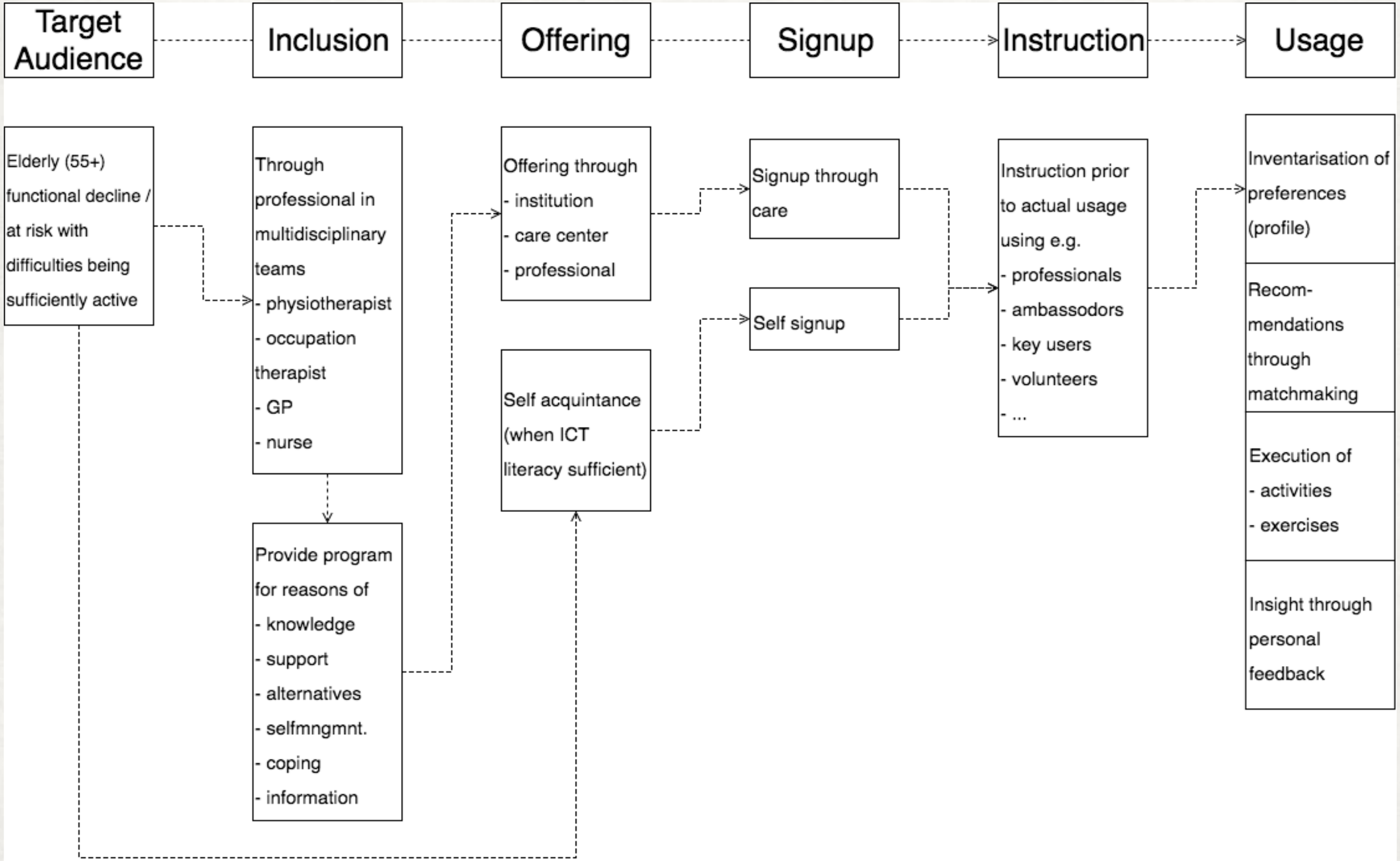


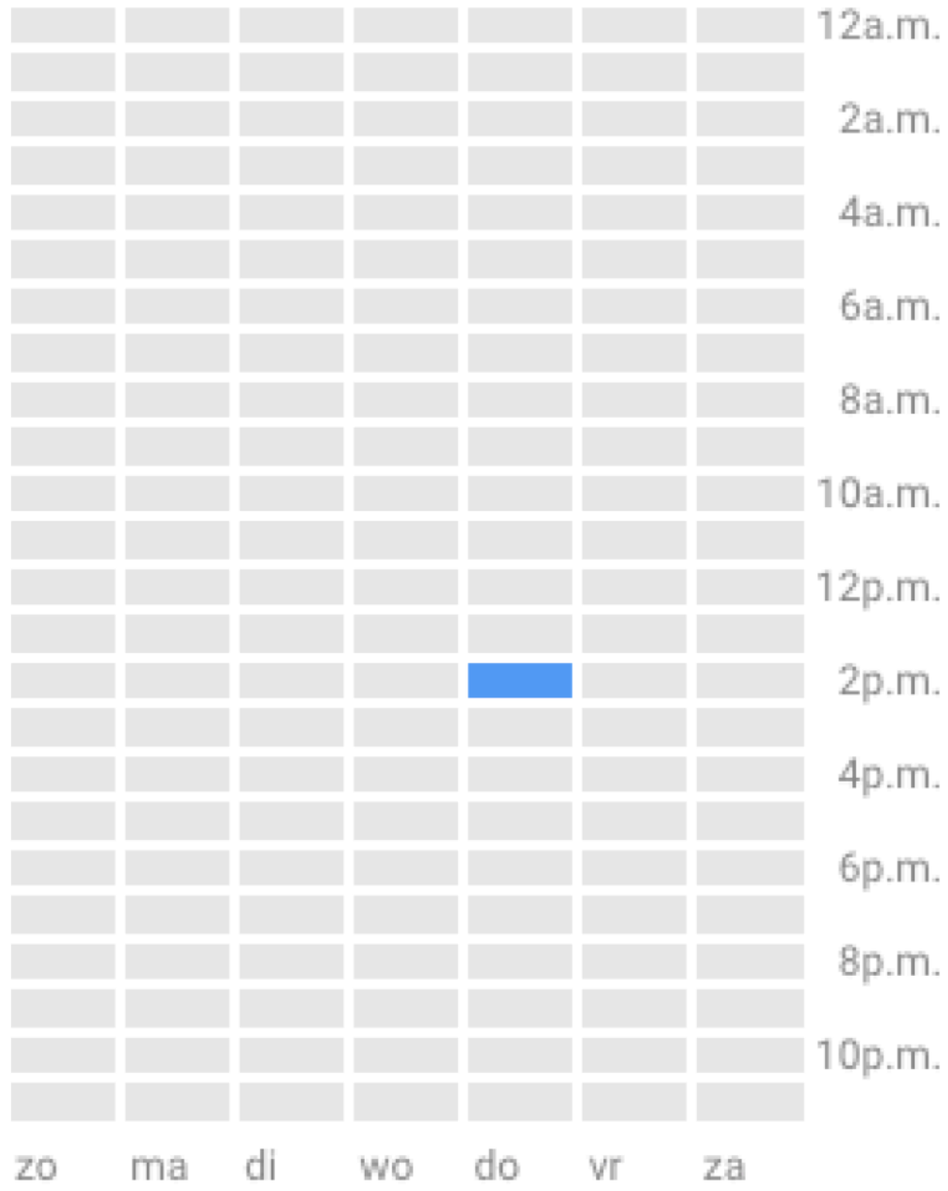






LIFE


Target Audience
Inclusion
Offering
Signup
Instruction
Usage
Elderly (55+) functional decline / at risk with difficulties being sufficiently active
Through professional in multidisciplinary teams
- physiotherapist
- occupation therapist
- GP
- nurse
Provide program for reasons of
- knowledge
- support
- alternatives
- selfmngmnt.
- coping
- information
Offering through
- institution
- care center
- professional
Self acquintance (when ICT literacy sufficient)
Signup through care
Self signup
Instruction prior to actual usage using e.g.
- professionals
- ambassodors
- key users
- volunteers
- ...
Inventarisation of preferences (profile)
Recom-mendations through matchmaking
Execution of
- activities
- exercises
Insight through personal feedback


12a.m.
2a.m.
4a.m.
6a.m.
8a.m.
10a.m.
12p.m.
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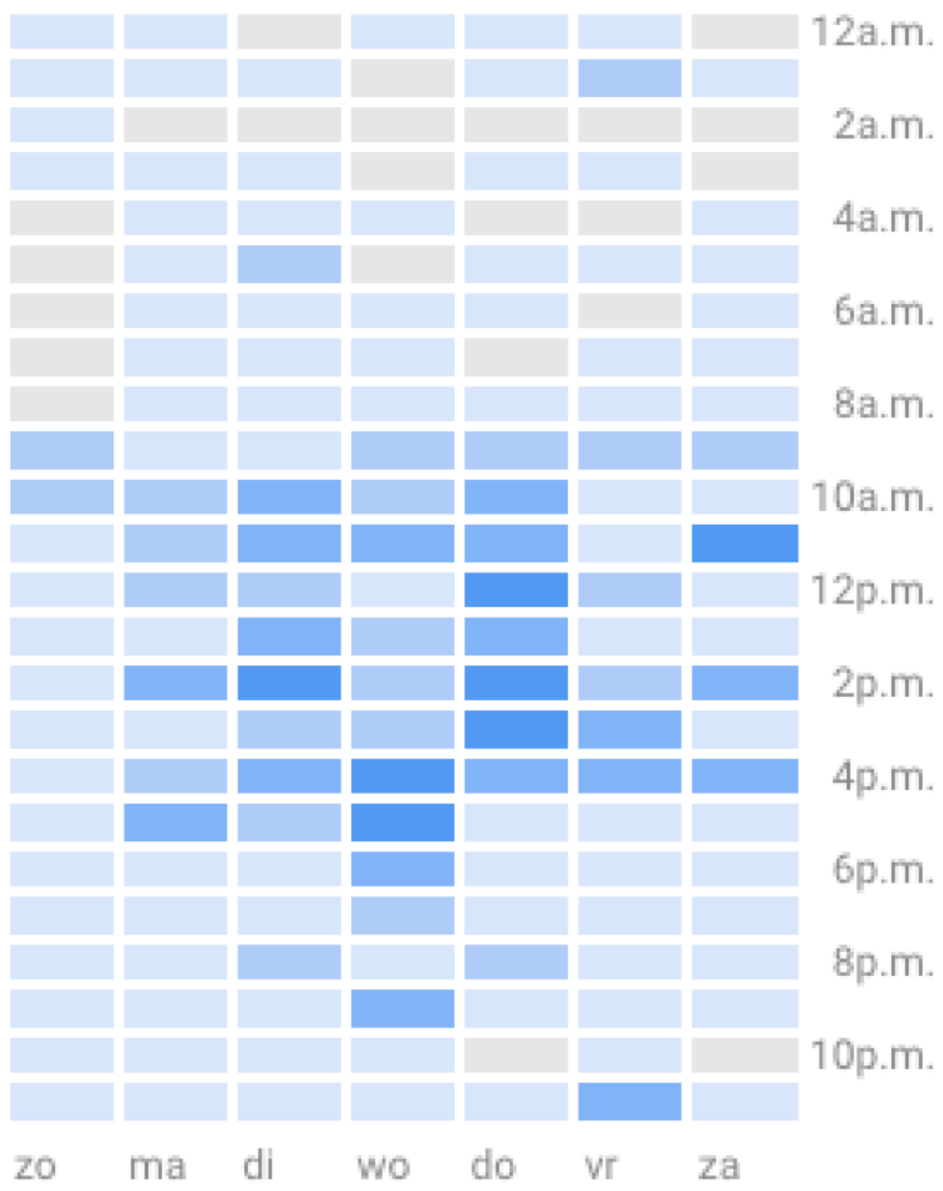
12a.m.
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1
1
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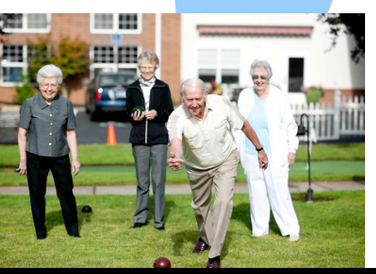
1


1
6
11
16
21



UNIVERSITY OF TWENTE.

"How to design a feedback system providing feedback to frail older adults on their performance, regarding the squeeze exercise, using the Myo Armband?"

NOT INJURED,
BUT HIGH RISK

USER TEST

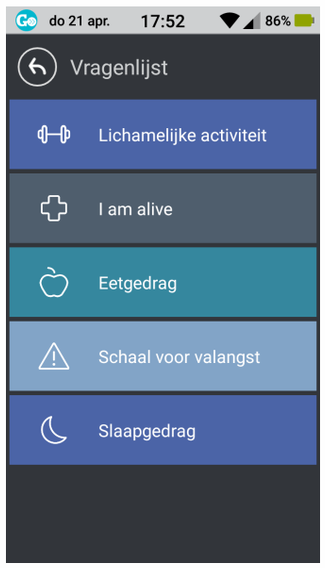
PERFORM SQUEEZE EXERCISE WITH BOTH SYSTEMS

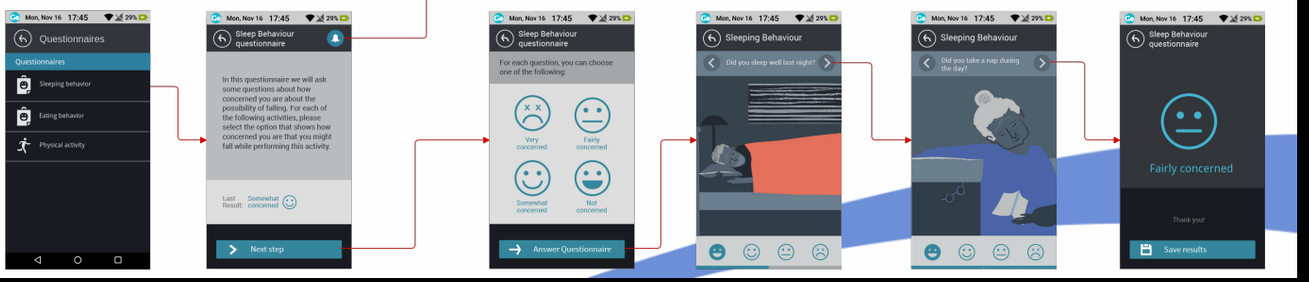
- Usability (SUS)
- Stimulation (1-5)
- Insecurity (1-5)
- Pleasure (1-5)

- N = 8
- Above 65

Collaboration Gociety Solutions & RRD

enabling screening and video-based physical activity exercise





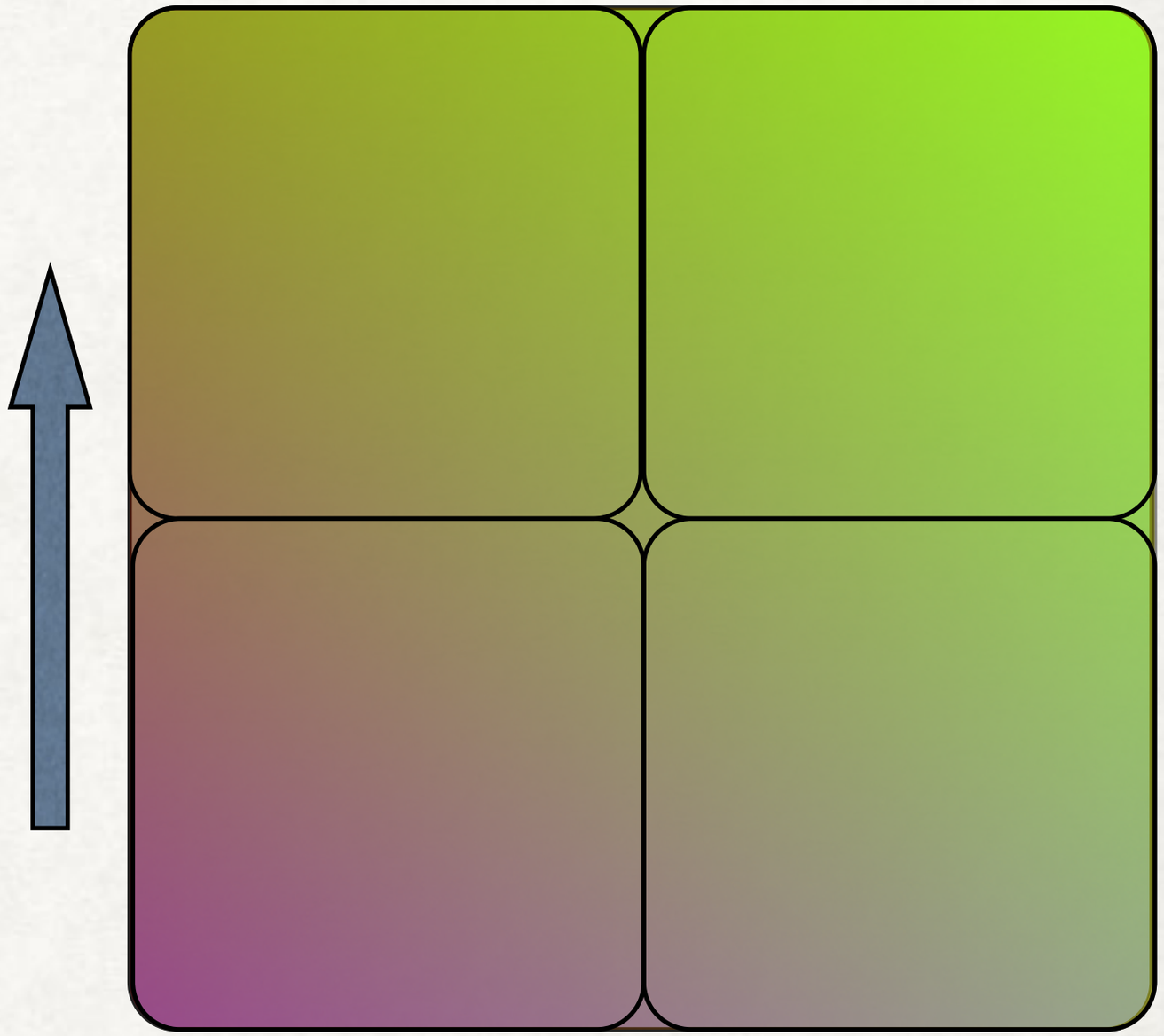
Tracking activity to confront users and provide
means to cope

WHICH BUILDING BLOCKS?

What to put in your service: development strategy

1/2

importance



Realization time

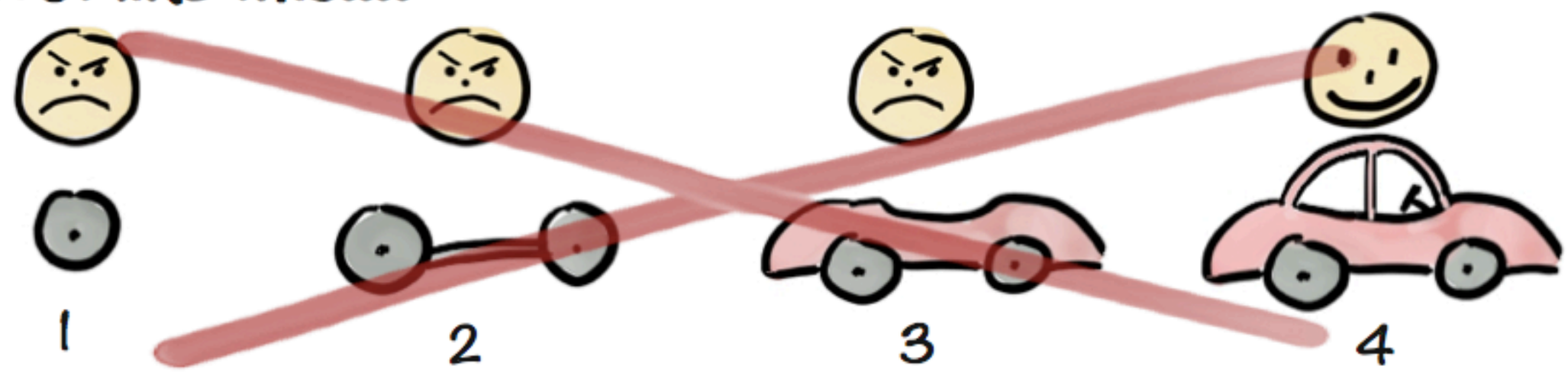
telemedicine

What to put in your service? 2/2

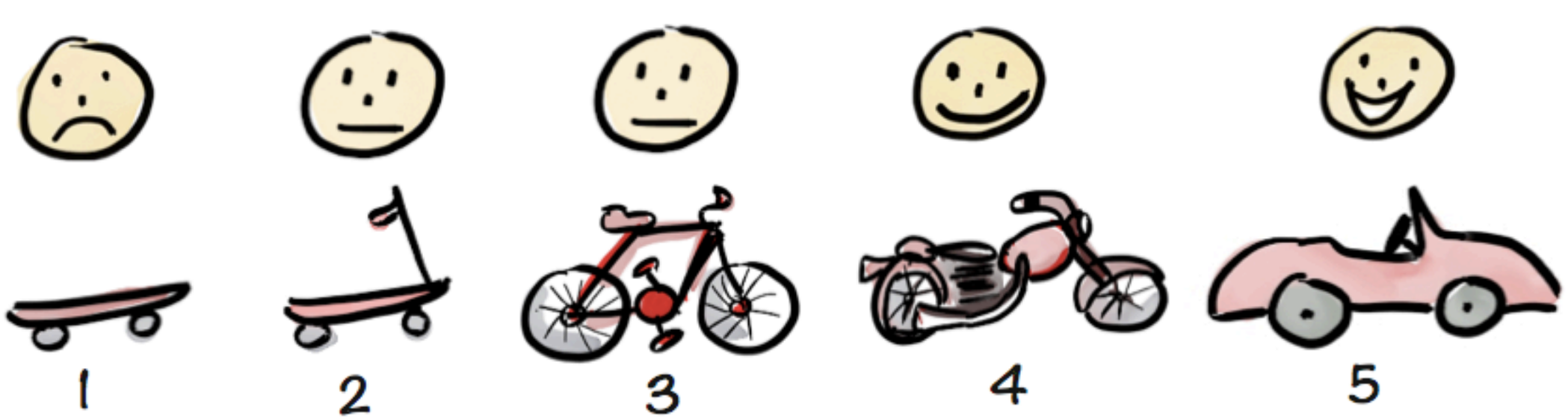
(Impact/Value framework, Hammer & Manguarian 1987)

Impact	Value			
		Efficiency (Things right)	Effectiveness (Right thing)	Innovation
	Time	Accelerate Business processes	Reduce information load	Create service excellence
	Distance	Increase reach	Ensure control	Cover new areas
	Relation	Bypass brokers	Open up knowhow	Build networks/chains

Not like this....

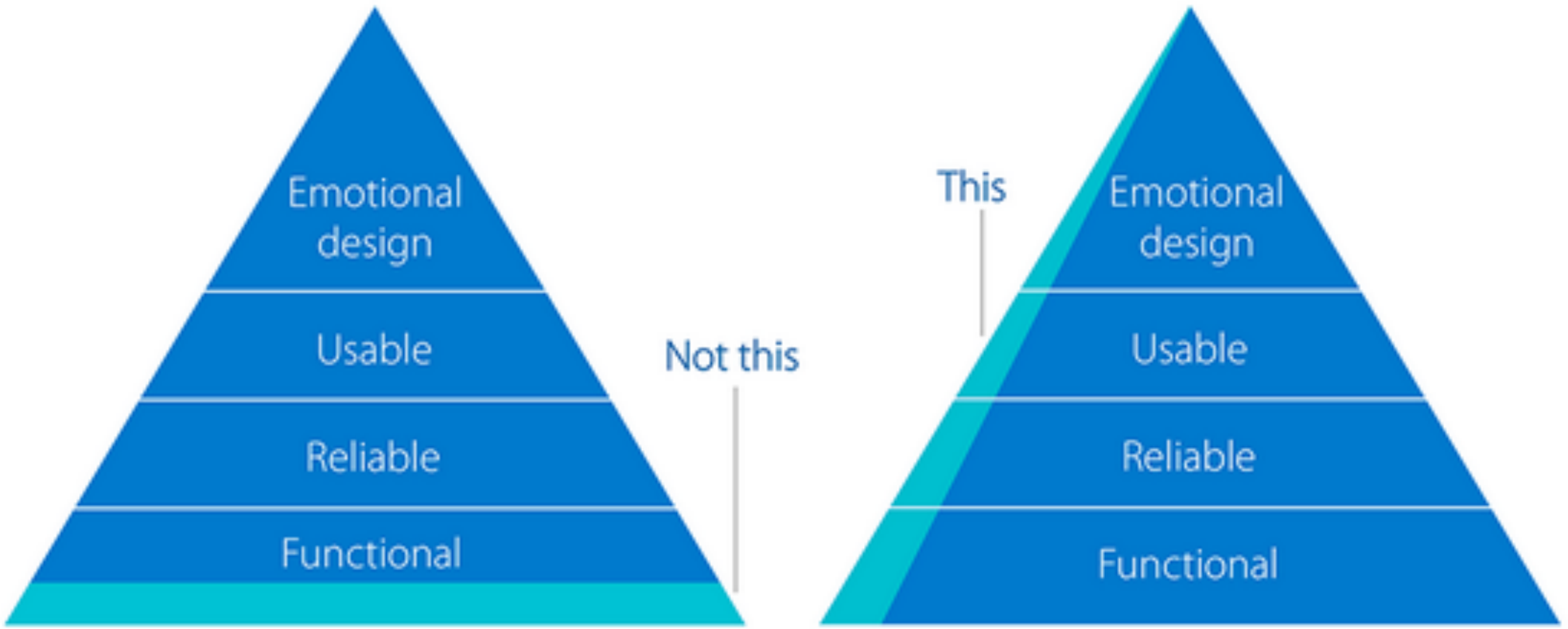


Like this!



by Henrik Kniberg

Minimum Viable Product

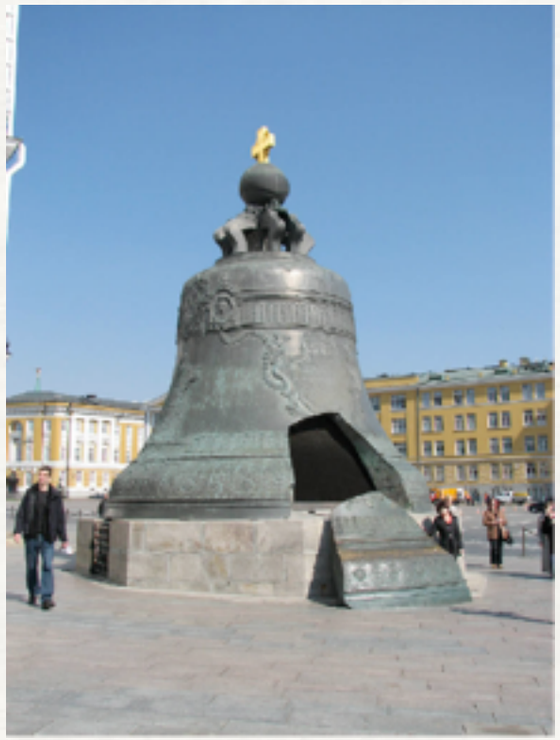


@jopas

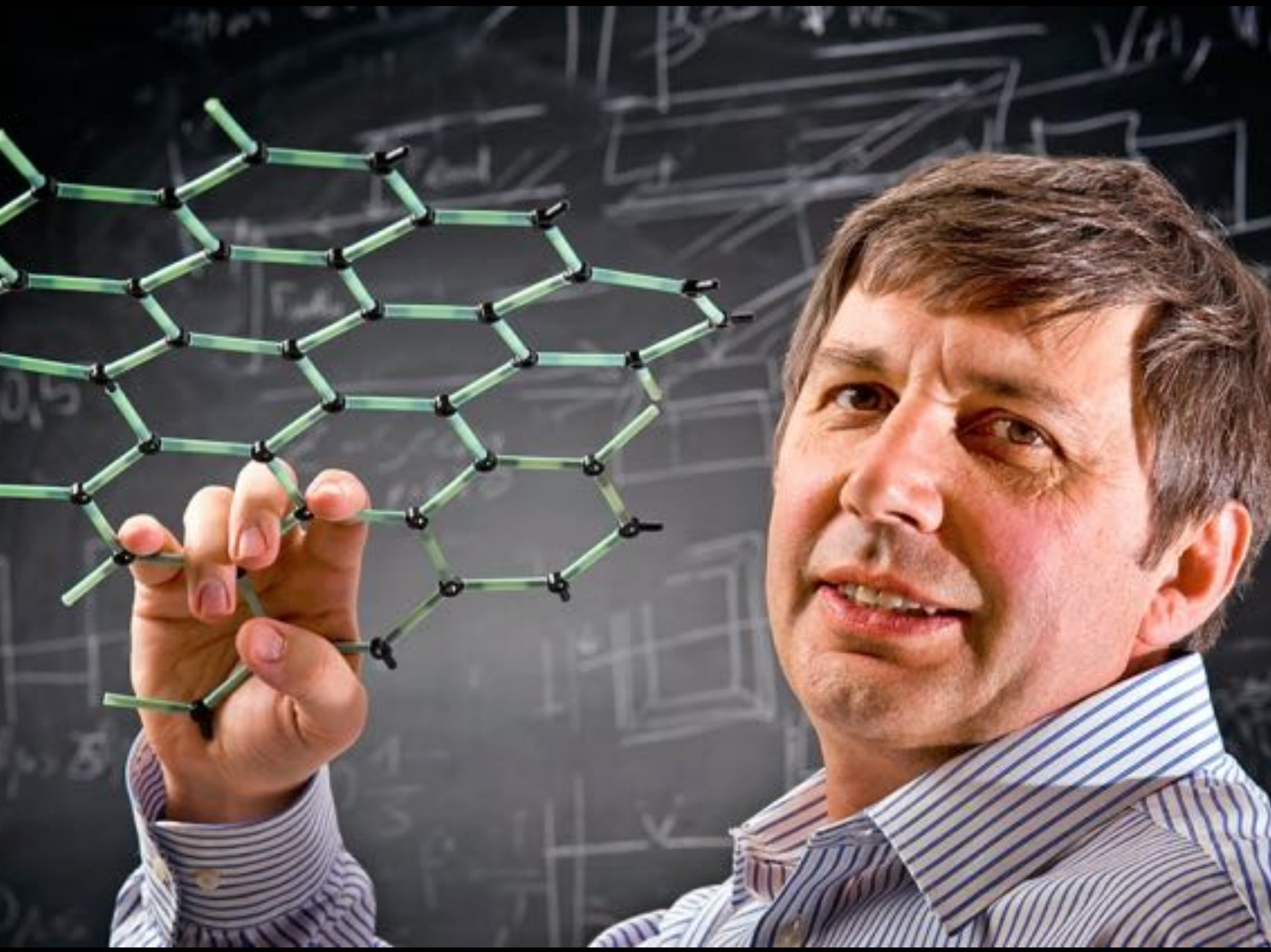
September 2014 | With compliments to Aarron Walter

RECOMMENDATIONS

- *Keep the user in mind*
- *Gather the right people*
- *PDCA*
- *Think big, Start small*



80/20



IREHI 2017 LOME - TOGO
15 DECEMBER 2017

DESIGN OF TELEMEDICINE SERVICES: METHODS, BUILDING BLOCKS AND EXAMPLES.

JAN-WILLEM VAN 'T KLOOSTER, PHD
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Roessingh
Research and Development

University of Twente
Enschede - The Netherlands

http://www.ted.com/talks/eric_topol_the_wireless_future_of_medicine.html