



# HUMAN-COMPUTER INTERACTION

ADVANCED LEVEL

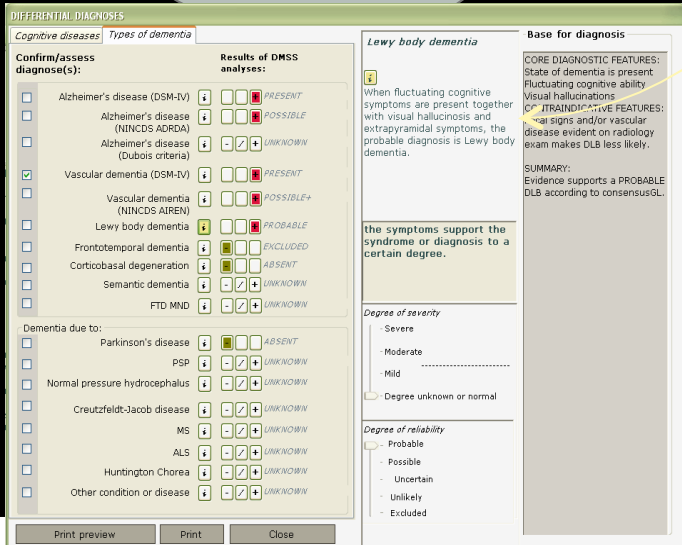
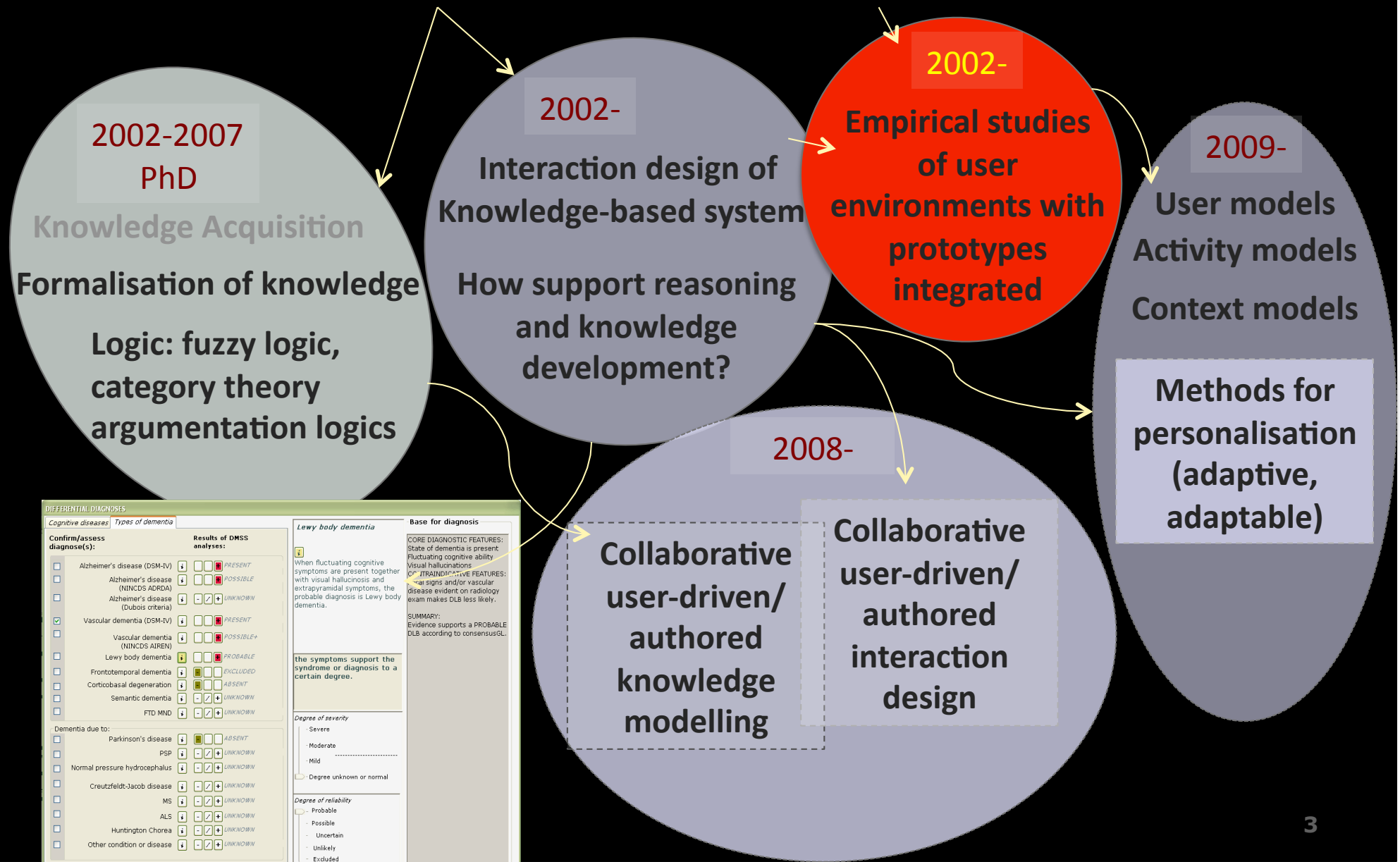
# ADMINISTRATION

- **Helena Lindgren**
  - coordinator, lecturer, project supervisor
  - Contact: [helena@cs.umu.se](mailto:helena@cs.umu.se)
  - Room: C435
  - Supervision/assistance: Tuesdays and Fridays
- **Dipak Surie**
  - coordinator, lecturer, project supervisor
  - Contact: [dipak@cs.umu.se](mailto:dipak@cs.umu.se)
  - Room: C420
  - Supervision/assistance:
- Register at the temporary student expedition (Anne-Lie, room C420)
- All information about the course can be found at:  
<http://www8.cs.umu.se/kurser/5DV048/VT12/>
- **AND: don't forget to sign up for examination in time!**



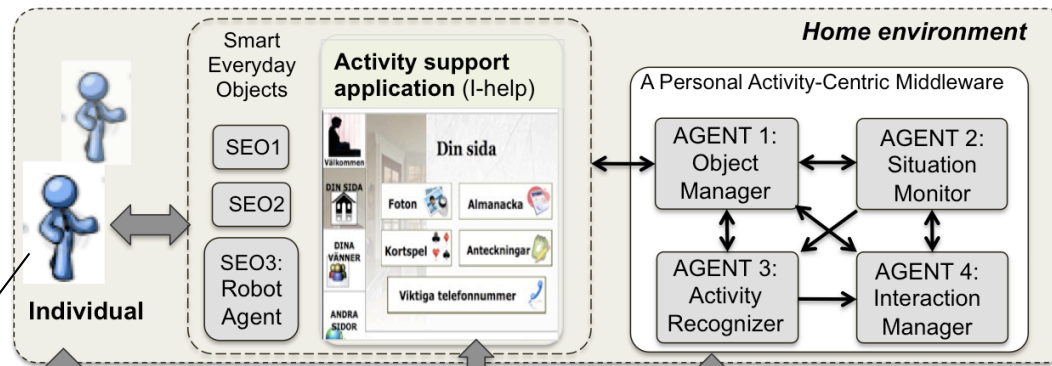
# WHAT ABOUT MY RESEARCH IN INTERACTION DESIGN?

## Knowledge-Based Systems for medical and health domains

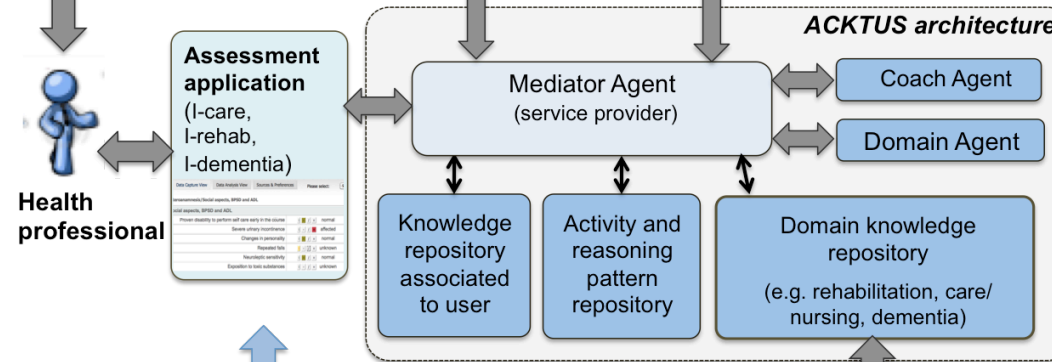


# A "SMART" HOME

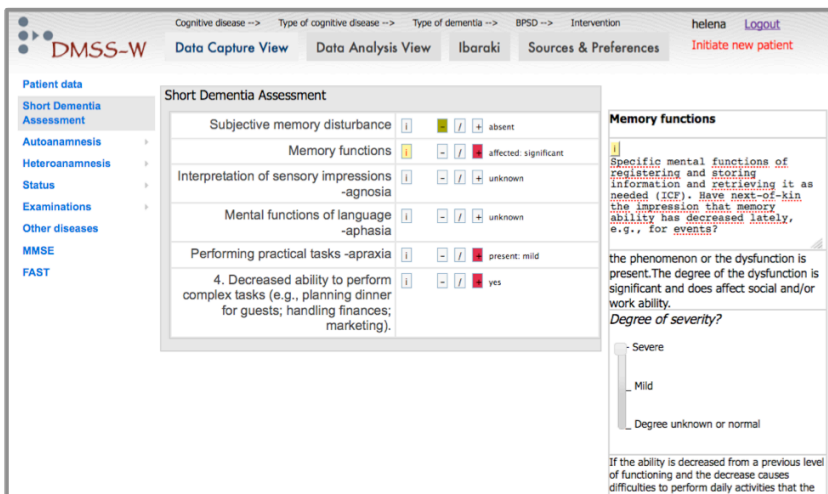
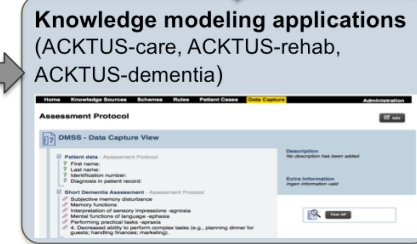
## HOSPITAL / CARE CENTRE



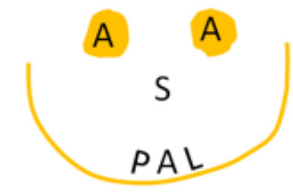
Activity recognition, data collected possibly through bio-sensors, cameras, text-based and / or voice-based input



The end user view allows assessing the patient, tailoring interventions, e.g. a personalised activity support application



Results can be tested in an end user view



Helena Lindgren

# EXAMINATION

- Written exam at the end of the course
  - theories and methods, concepts, and applying the theories to described cases
- Projects in cooperation with organisations
- 3 seminars that are mandatory, they are marked with \* in the schedule page
  
- This year: NO individual assignment



# WHAT YOU ARE EXPECTED TO KNOW FROM INTRODUCTORY HCI

- Quantitative and qualitative data gathering techniques
  - Interview techniques
  - Questionnaires
  - Observation techniques
- Heuristic evaluation
- Design process models



# EXPECTED STUDY RESULTS

After completed course the student should be able to:

- **Analyze a complex use situation** for the purpose to identify potentials and requirements for an existing or future user interface
    - Means among other things to apply knowledge about complex cognitive functions in humans and social aspects in a use situation
  - **Design** user interaction in complex use situations that meets the identified needs and requirements
  - **Plan, prepare and conduct evaluation** studies of complex use situations
- 
- **Select** appropriate theories, methods and tools for the abovementioned, and **motivate** the selections from applicability and utility
  - **Apply** and use theories, methods and tools for analysis, design and evaluation of use situations
  - **Critically analyze** applications of theories, methods and tools in evaluation studies and be able to identify results based on scientifically sound methods.



# REPRESENT A PROBLEM / USE SITUATION USING DIFFERENT METHODS

- A Running Example: By using the same task/problem (same scenario), but different analysis tools their advantages and drawbacks can be identified and illuminated
- Methods to apply:
  - Activity Theory
  - CWA
  - Distributed cognition
  - GOMS
  - Design rationale: claim specification and analysis
  - Formal method for representing dialogues



# SCENARIO OUTLINE: DELIVERING THIS COURSE

- We have a common experience of this particular course and therefore we will use it for this task.
- The course started with your registration to the course or the first lecture (the first event in time). Disregard any preparations done by e.g., lecturer before this date.
- The course ends with a written examination including its valuation (decision-making), which will be the focus to adjust and include in a future scenario
- Vision: computer-based and dialogue-based (formal argumentation) alternative method for examination.
- Be free to use any appropriate level or scope of this scenario to solve each tasks



## COURSE CONTAINS:

- Moment 1, theory part, 4.5 HP
  - The course contains among other things task analysis, GOMS, participatory design, activity theory, Distributed Cognition, Cognitive Work Analysis, evolutionary design, design rationale, ethnography and ethnomethodology.
- Moment 2, assignments, 3 HP
  - Project

**Emphasis is on the  
(collaborative)  
for a PURPOSE of THEORY  
APPLICATION**

# PURPOSES AND STRUCTURE FOR THE COURSE

- Week 4: Main focus: *Assessing the big picture*
  - *Activity analysis*
- Week 5: Main focus: *Assessing the details and involving users*
  - *Task analysis, roles*
- Week 6-7: Main focus: *Applying in real use/design scenarios*
  - *Objectives/outcome themes: Empowerment, autonomy, behavioral change, personalization, ...*
- Week 8: Main focus: *Understanding use situations and act upon this*
  - *Seminar I: discussing the results of the abovementioned*
- Week 9: Main focus: *Evaluation*
- Week 10-11: Main focus: *Digestion*
  - *Peer review, seminar II: discussing the results*
- Week 12: Main focus: *Contemplation*
  - *Lecture: repetition*
- Week 13: Main focus: *Completion*



# THEMES

**Beyond USER-CENTERED  
DESIGN**

**ACTIVITY-CENTERED  
DESIGN**

**Adaptation / Personalisation**

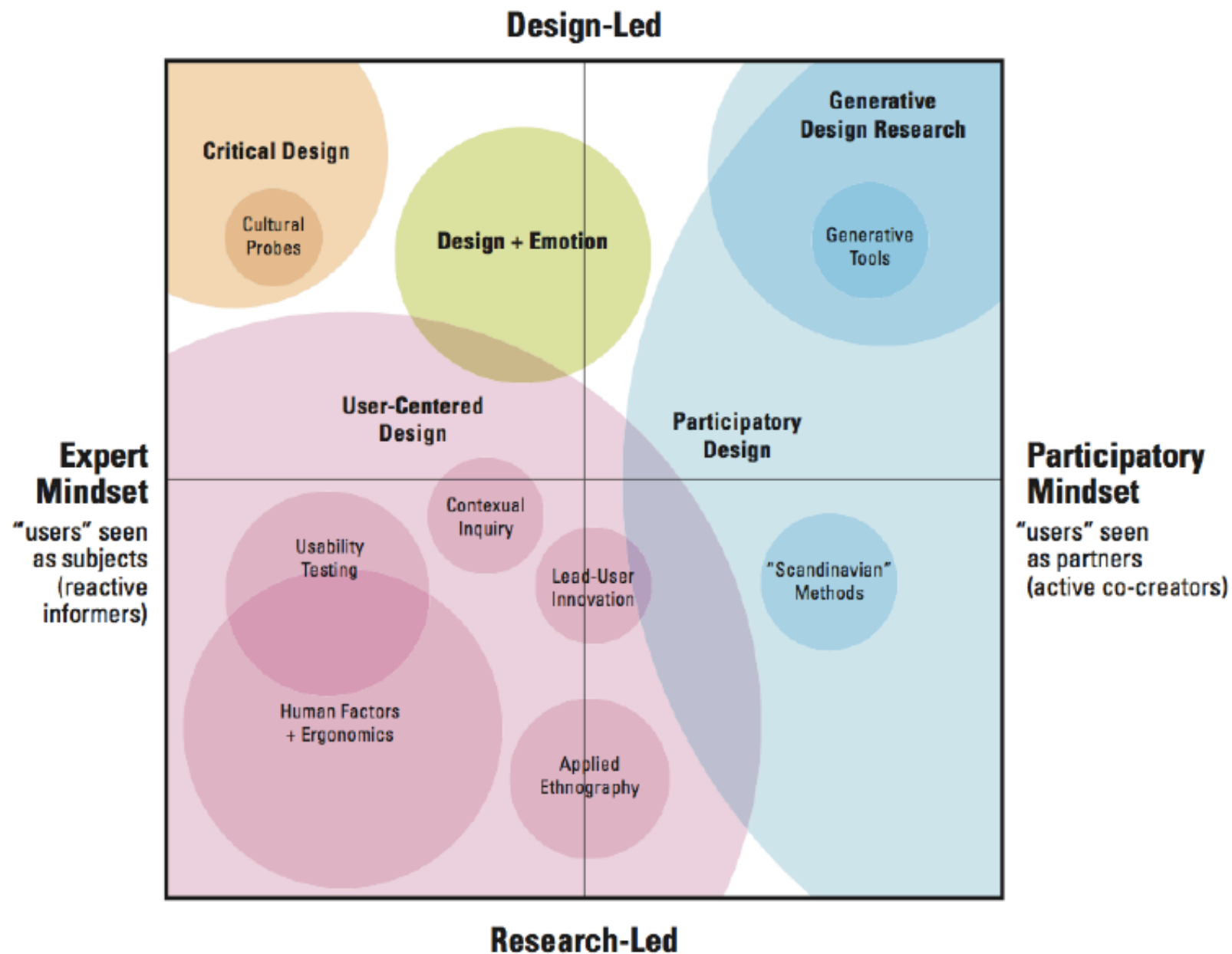
**Empowerment / Autonomy**

Donald Norman. **Human-Centered Design Considered Harmful.**

*Interactions*, 12. 4, (July + August, 2005). Pp. 14-19.

[http://www.jnd.org/dn.mss/human-centered\\_design\\_considered\\_harmful.html](http://www.jnd.org/dn.mss/human-centered_design_considered_harmful.html)





**Figur 2.1** Olika designtyper presenteras i en övergripande karta över designforskning. Sanders (2008:14) © Association of Computer Machinery,

# LITERATURE

- John M. Carroll, ed.: HCI Models, Theories and Frameworks and articles
- Textbook out of print, articles from the university library and the Internet
  
- University library:  
[www.ub.umu.se](http://www.ub.umu.se)
- choose Journals (Tidskrifter)
- insert journal name to search
  
- Detailed information can be found on the course website, literature link
- Use CAS login when outside the university





# WHAT IS A “COMPLEX USE SITUATION”?

HISTORICAL AND FUTURE PERSPECTIVE

# WHAT HCI WAS, IS AND WILL BE ABOUT IN THE FUTURE

- Desired outcome:
  - Usable, useful, efficient, satisfactory systems
- Process:
  - Procedural view, typically included in late stage of e.g. a waterfall development model
- Roles:
  - Clear roles between designers, ethnographers, end users, stakeholders, developers, etc. Future users had typically minimal influence over the results.
- Tools:
  - Guidelines and methods based on studies in cognitive science and human factors: e.g., task analysis, GOMS





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**SHIFT FROM HUMAN FACTORS TO HUMAN ACTORS**



**SHIFT FROM REDUCTIONISTIC VIEW TO SYSTEMIC VIEW**







- Desired outcome:
    - Empowerment
  - Process:
    - Experience
    - Procedural view vs. emerging interaction
    - Creativity vs. production
  - Tools:
    - Theories about human in activity
    - AI methods and technology
- Personalisation  
– Social development  
– Knowledge  
– Computer-supported collaborative environments  
– Who is in charge?  
– Designer's role  
– Users' role  
– Who

# EVOLVEMENT OF HCI DISCIPLINE

- Multidisciplinary development, internationalisation, development of technology
- Differences in the view on
  - Human
  - User
  - Task
  - Artefact
  - Environment
  - Evaluator/ designer / system developer



# DIFFERENCES IN THE VIEW ON...

<ul style="list-style-type: none"> <li>Capacity, intellektual ability, production, autonomous, independent, affects</li> </ul>	<b>Human/user</b> 	Developable, part of a system, affects, is affected
<ul style="list-style-type: none"> <li>Rationality, intentionalism</li> </ul>	<b>Drives</b> 	Needs, motives
<ul style="list-style-type: none"> <li>Sekvential, optimizable</li> </ul>	<b>The task</b> 	Dynamisc, changeable/ changing
<ul style="list-style-type: none"> <li>Object, change the task</li> </ul>	<b>The artefact</b> 	Mediating tool, change human's capacity
<ul style="list-style-type: none"> <li>Static, relatively uninteresting</li> </ul>	<b>User environment</b> 	Dynamic, changeable/ changing, strong influence, condition for activity
<ul style="list-style-type: none"> <li>Expert, objective</li> </ul>	<b>Designer/sys.dev/evaluator</b> 	Affects, not objective, limited knowledge



# MULTIDISCIPLINARY DEVELOPMENT

- Sciences
  - ↑ Sociology, antropology, psycology, philosophy, phenomenology, computer science, cognitive science, ...
- Theories / models
  - ↑ - Activity theory, Situated Action, Action Science, information processing, Distributed Cognition, ...
- Methods
  - ↑ - Ethnography, etnometodology, applied experimental psychology (TEP), cognitive modelling, participatory design (PD), conversation analysis, contextual design, formal methods, ...
- Tools
  - Activity checklist, scenarios, models of work, task analysis (TA), design rationales, cognitive walkthrough, GOMS, ...



# WORK

Development of software that aims to support work...

- ...demands understanding of the tasks to be done including its environment/context
  - Task analysis, activity analysis, organisationsanalys, Activity theory
- ...understanding of how (s)he/they who are executing the tasks function
  - Cognitive modeling – Cognitive Science, Activity theory
- ...and also of *how* and *by what* work tasks change over time..?!
  - Evolutionary design – "Action science", Activity theory



# CONFLICT #1: *SCOPE AND TOOLS*

## SYSTEMIC VS. REDUCTIONISTIC PERSPECTIVE

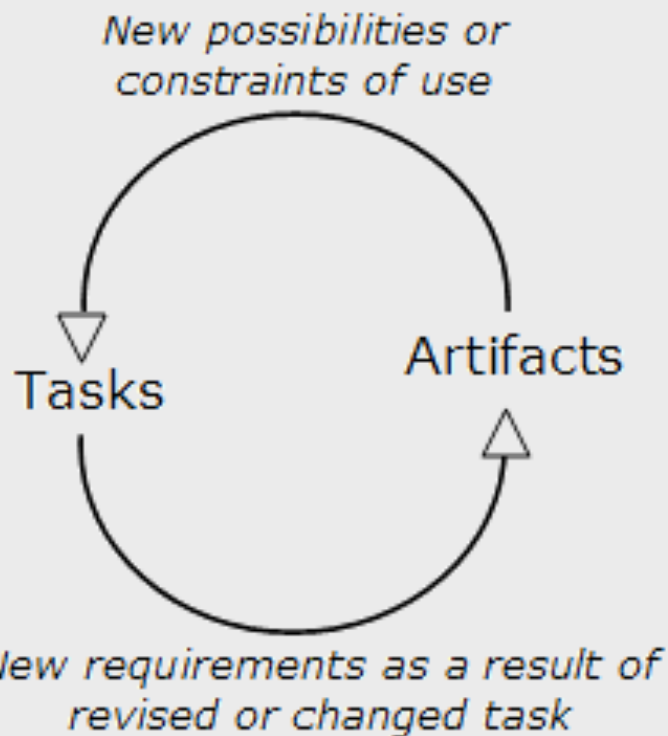


Figure 1: The task-artifact cycle.

Carroll et al. 1991. **The Task-Artifact Cycle.** In: Carroll, John M. (ed.). "Designing Interaction: Psychology at the Human-Computer Interface". Cambridge University Press

# DEFINITION OF HUMAN FACTORS / ERGONOMICS

- “THE SCIENTIFIC DISCIPLINE CONCERNED WITH
  - THE UNDERSTANDING OF **INTERACTIONS** AMONG HUMANS AND OTHER ELEMENTS OF A **SYSTEM** AND
- THE PROFESSION THAT **APPLIES THEORY, PRINCIPLES, DATA AND METHODS TO DESIGN IN ORDER TO OPTIMIZE HUMAN WELLBEING AND OVERALL SYSTEM PERFORMANCE**”

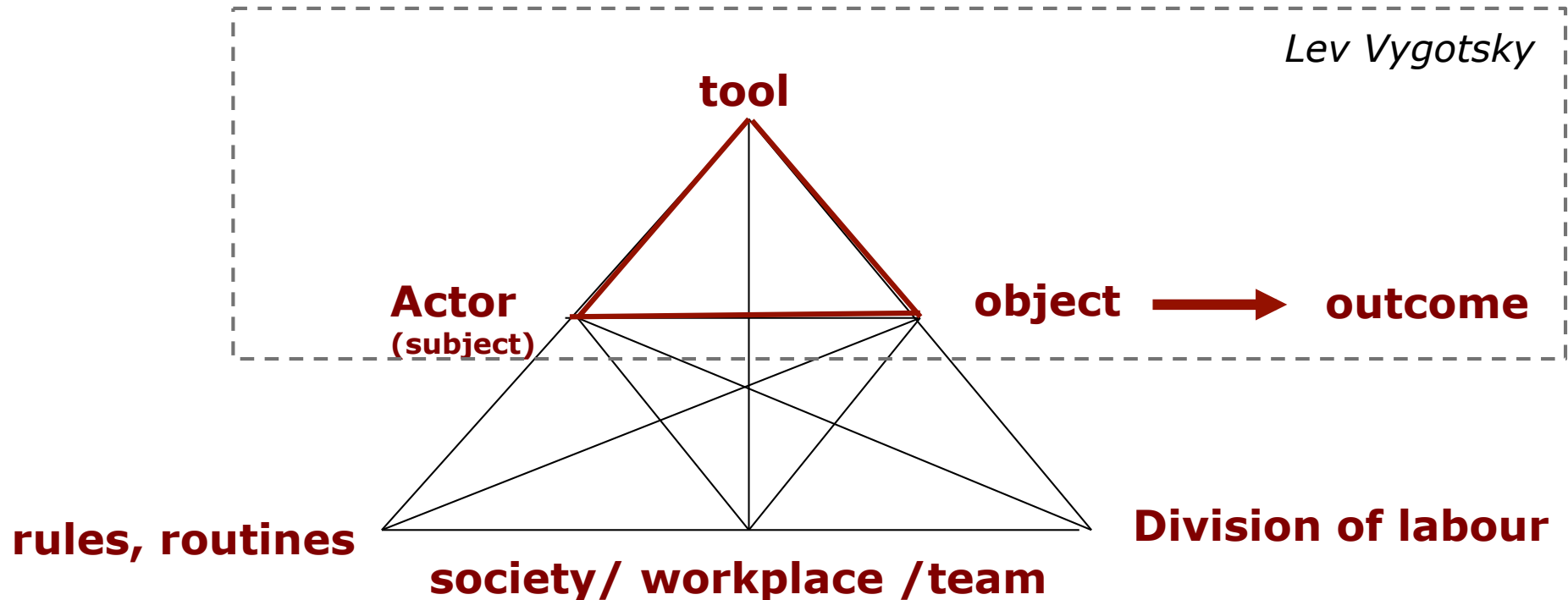
**SOCIO-TECHNICAL SYSTEM**

International Ergonomics Association. **What is Ergonomics?**  
[http://iea.cc/01\\_what/What%20is%20Ergonomics.html](http://iea.cc/01_what/What%20is%20Ergonomics.html), accessed 2011-12-12



## EXAMPLE: ACTIVITY THEORY

Engeström's "Activity system"



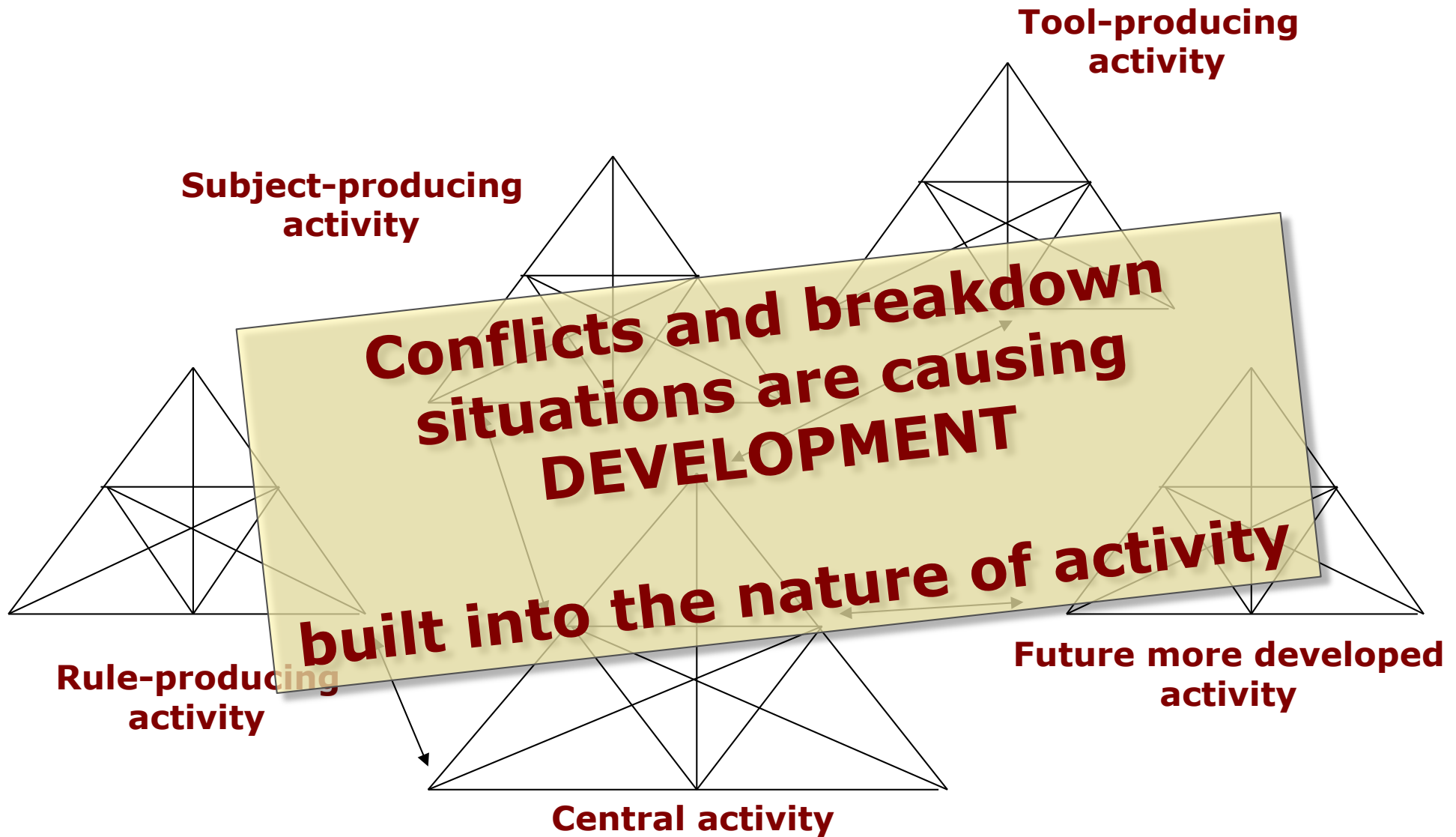
Vygotsky, L. 1978. **Mind in Society.**  
Harvard University Press, London.

Engeström, Y. 1999. **Expansive visibilization of work: An activity-theoretical perspective.**  
*Computer Supported Cooperative Work* 8, 63-93.

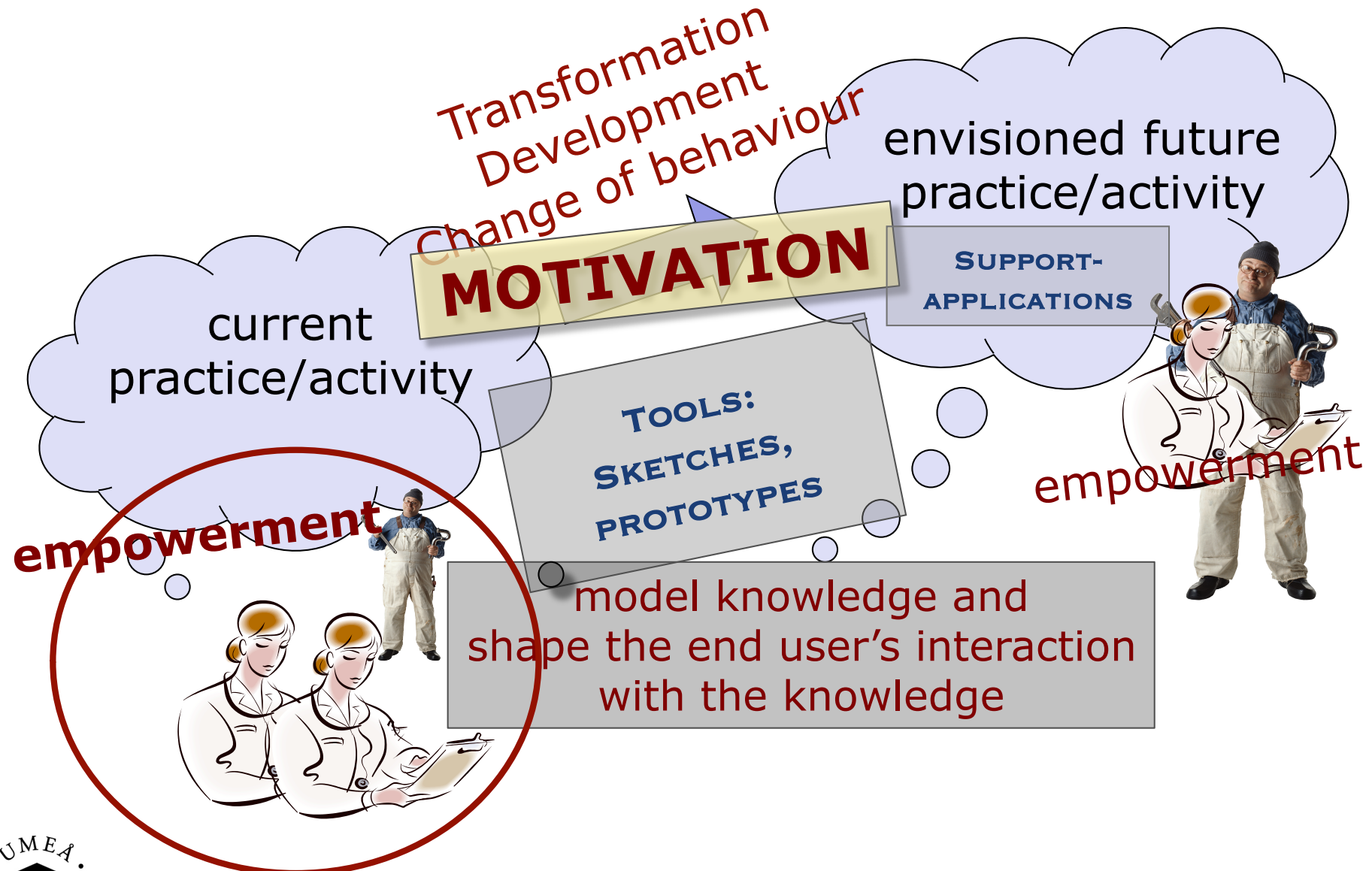




# ”WEB OF ACTIVITIES”



# PURPOSE OF KNOWLEDGE-BASED SYSTEMS



## **CONFLICT #2: *PROCESS***

**CREATIVITY VS. PRODUCTION,**

**EMERGENT INTERACTION VS. STRUCTURED PROCEDURES**

Beuscart-Zéphir, Elkin et al. **The Human Factors Engineering Approach to Biomedical Informatics Projects: State of the Art, Results, Benefits and Challenges.**

Geissbuhler A, Haux R, Kulikowski C, editors. IMIA Yearbook of Medical Informatics 2007. Methods Inf Med 2007; 46 Suppl 1: 109-27

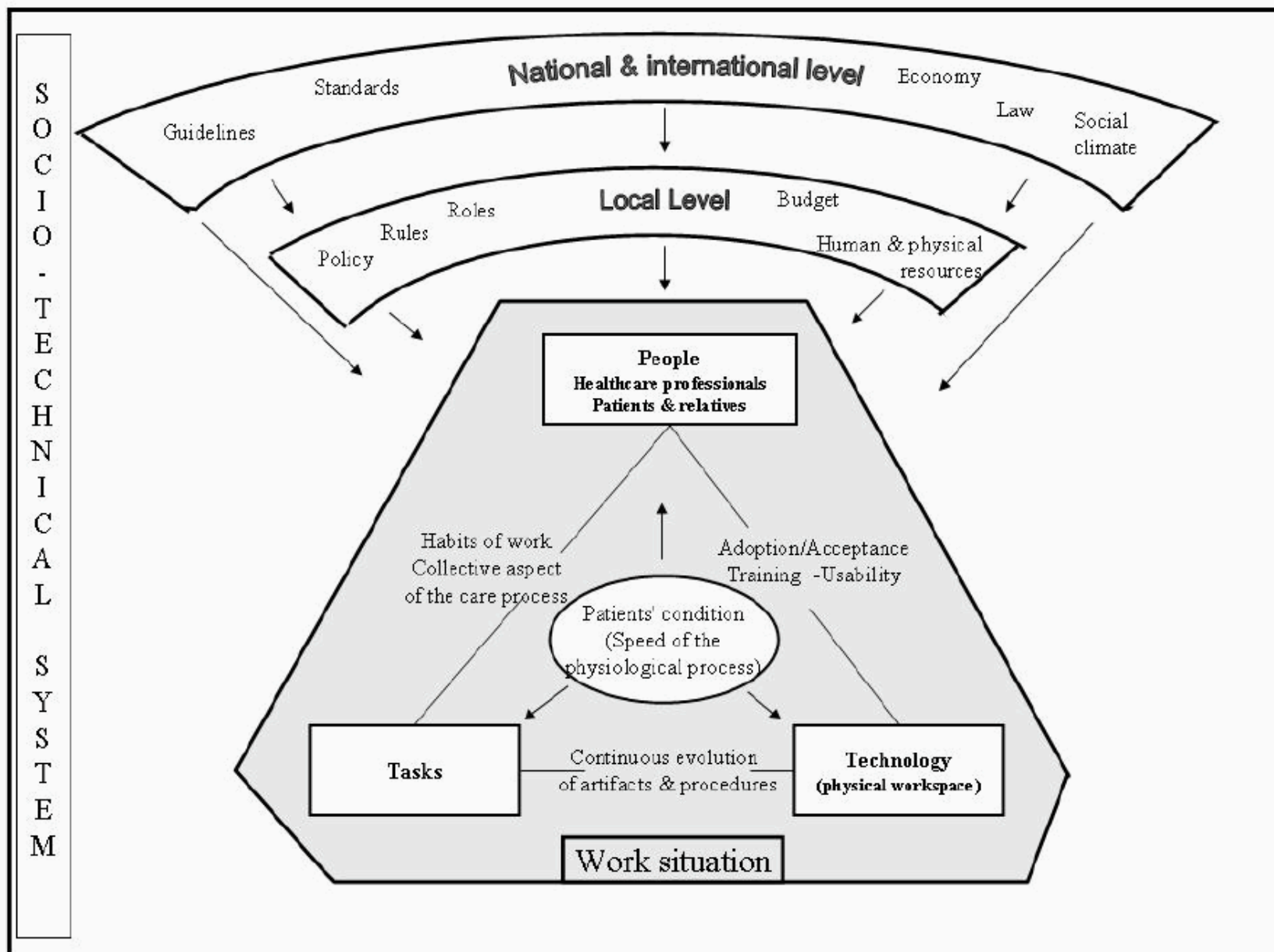


Fig. 1 The work situation and the socio-technical system

## HUMAN FACTORS ENGINEERING FRAMEWORK

## (RE)-DESIGN OF A PRODUCT

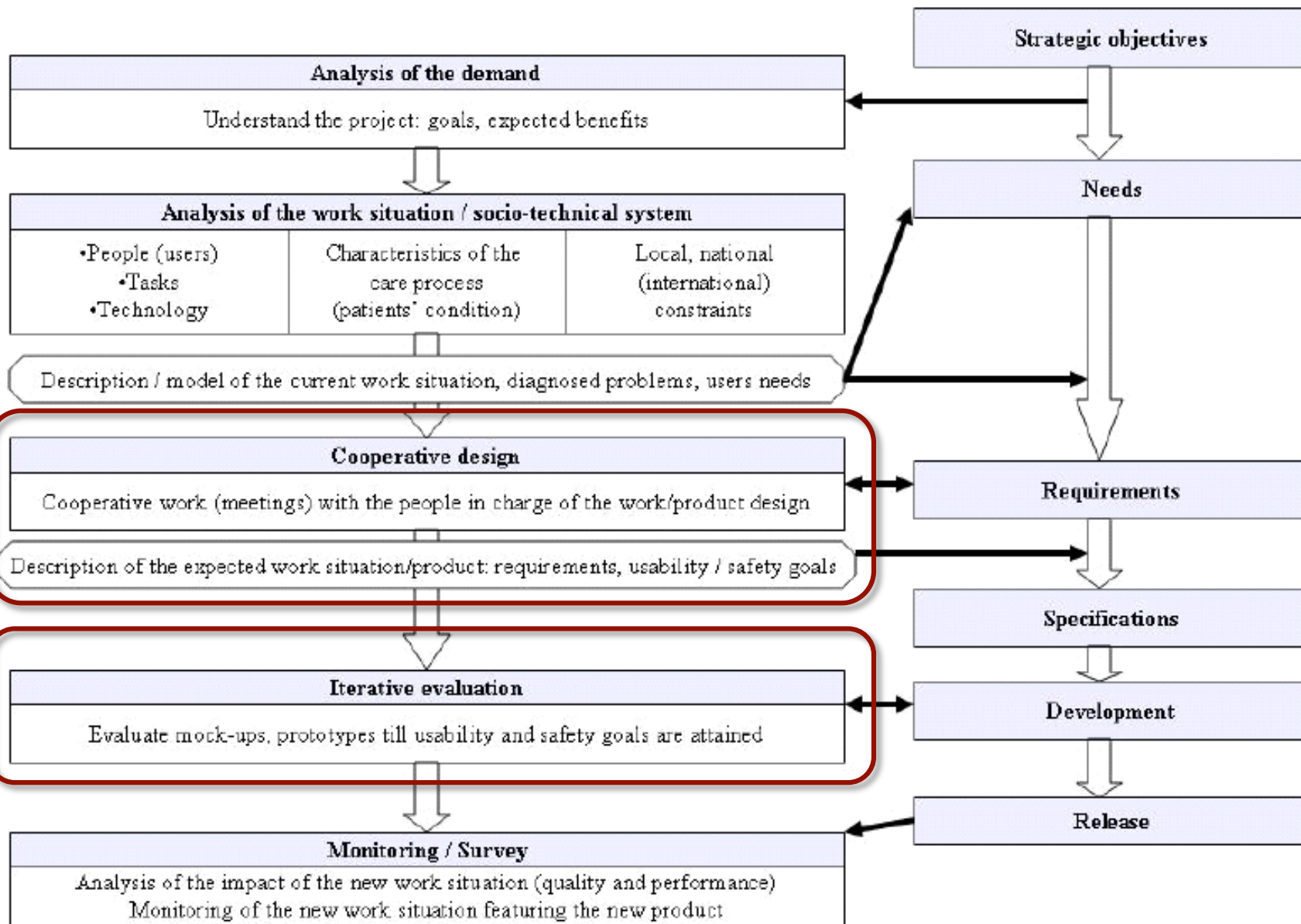


Fig. 4 Integration of the HFE framework in a project of (re)-designing a product

## Participatory design as separated phases

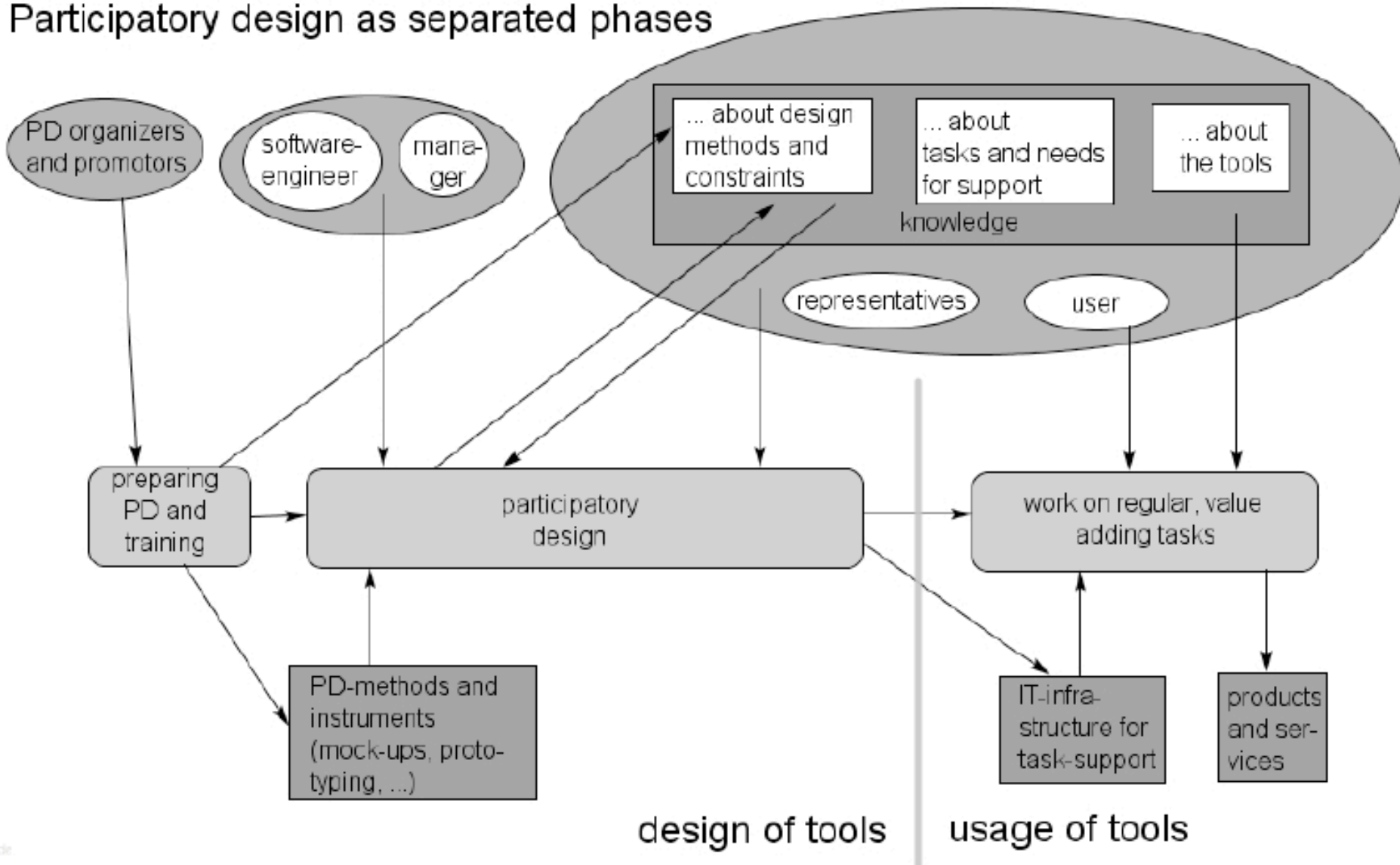


Figure 1. *Traditional participatory design.*

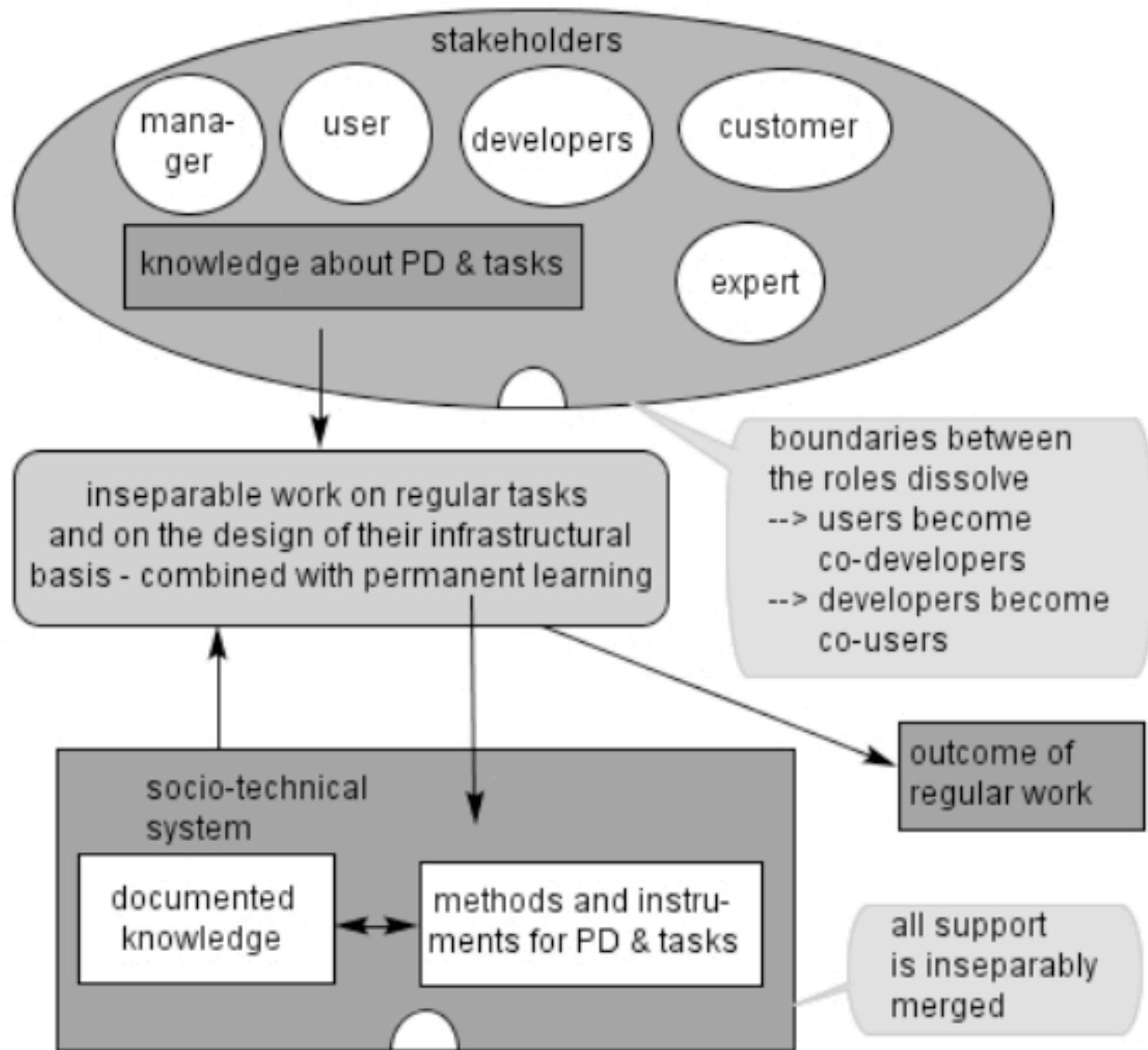
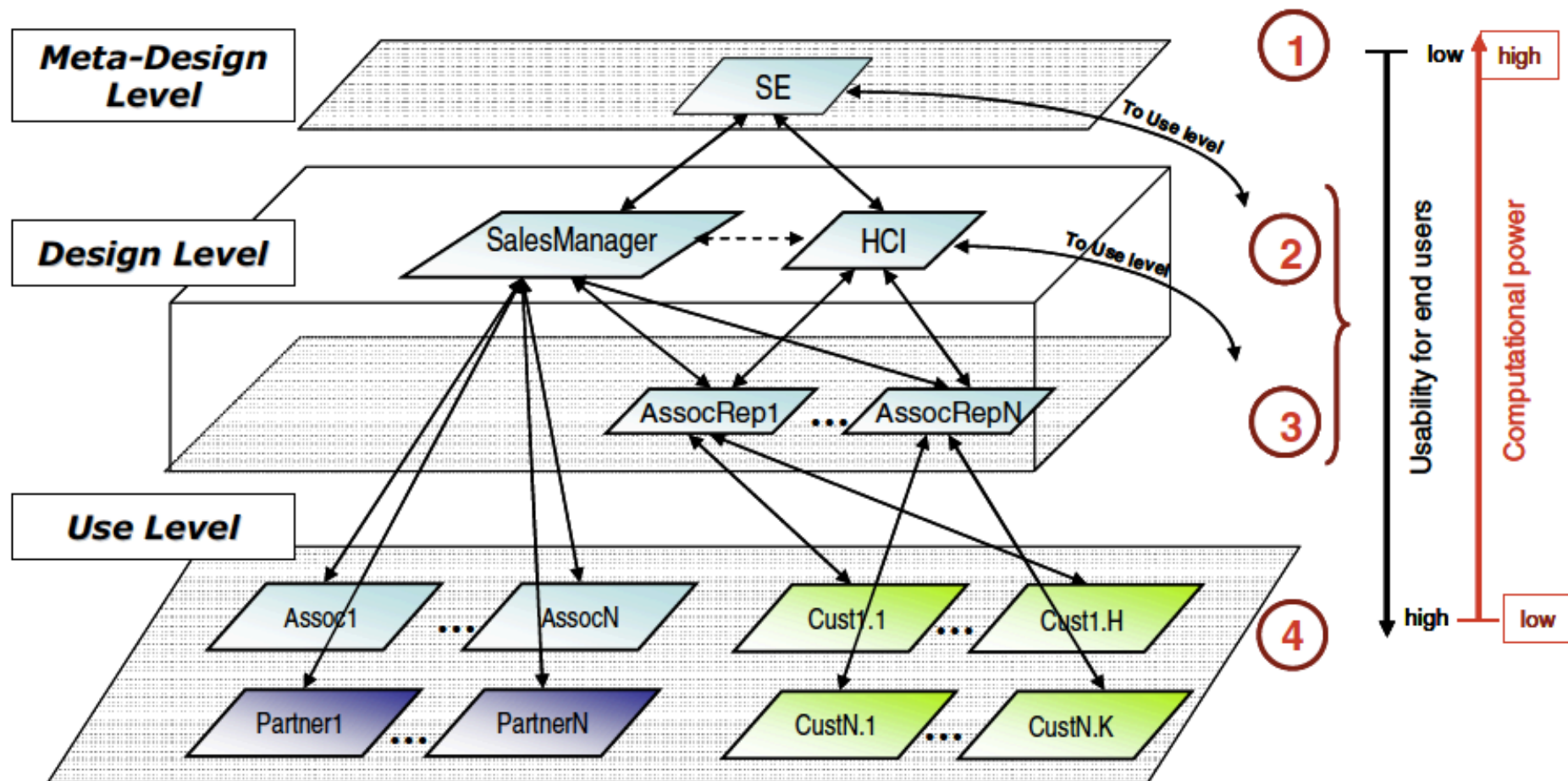


Figure 2. *Cultures of participation—design in use.*



**Fig. 2.** The SSW network for the case study

*SSW: Software Shaping Design Methodology*



## **CONFLICT #3: *ROLES***

**DESIGNER VS. STAKEHOLDER VS. USER VS.**

**DEVELOPER:**

**- WHO KNOWS WHAT AND WHO KNOWS BEST ?**

**CONFLICTS #4, #5: *OUTCOME***

**BEHAVIOUR CHANGE VS. HABITUAL SYSTEMS**

**AND**

**EMPOWERMENT VS. ADAPTIVITY**

Honka et al. **Rethinking health: ICT-enabled services to empower people to manage their health.**

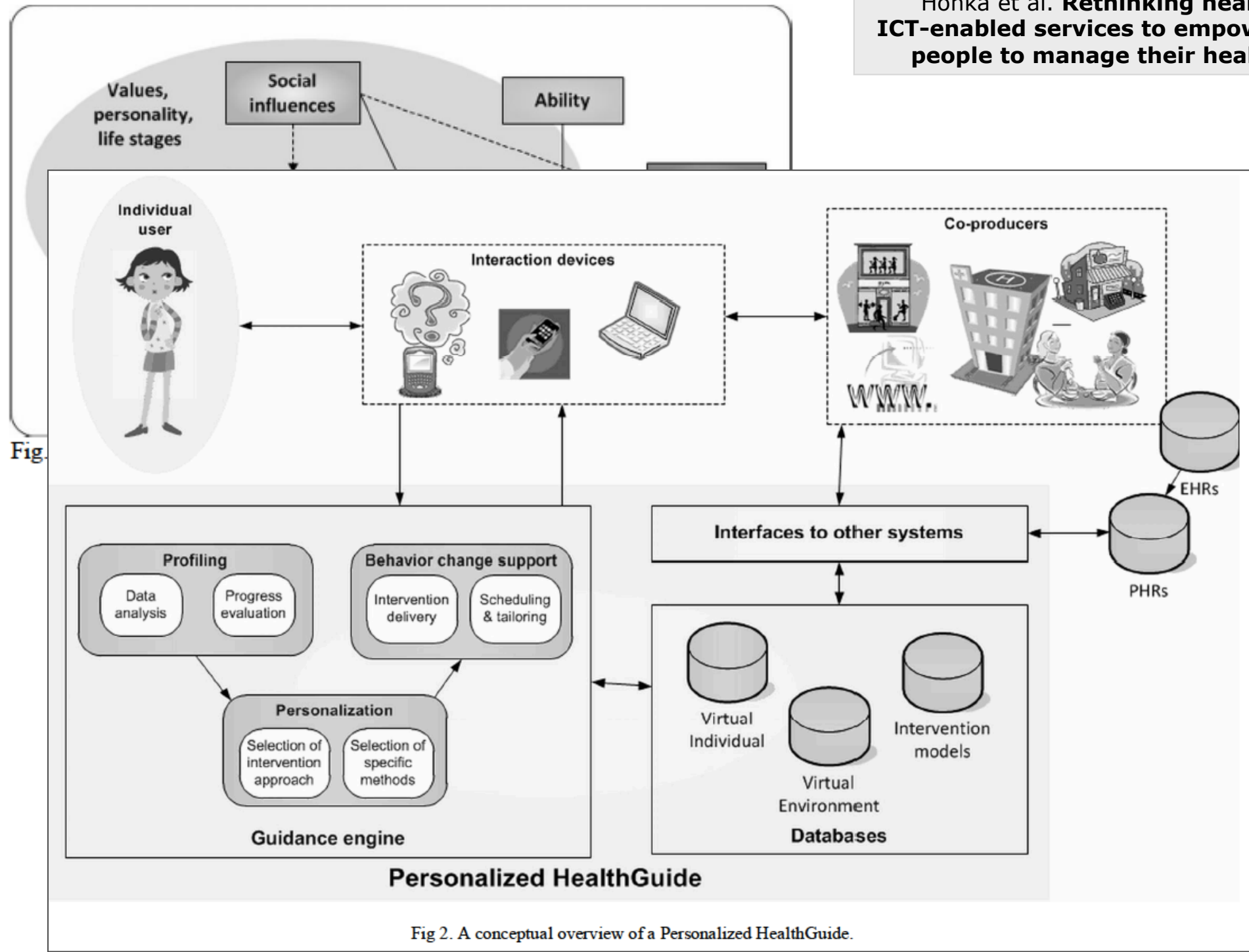


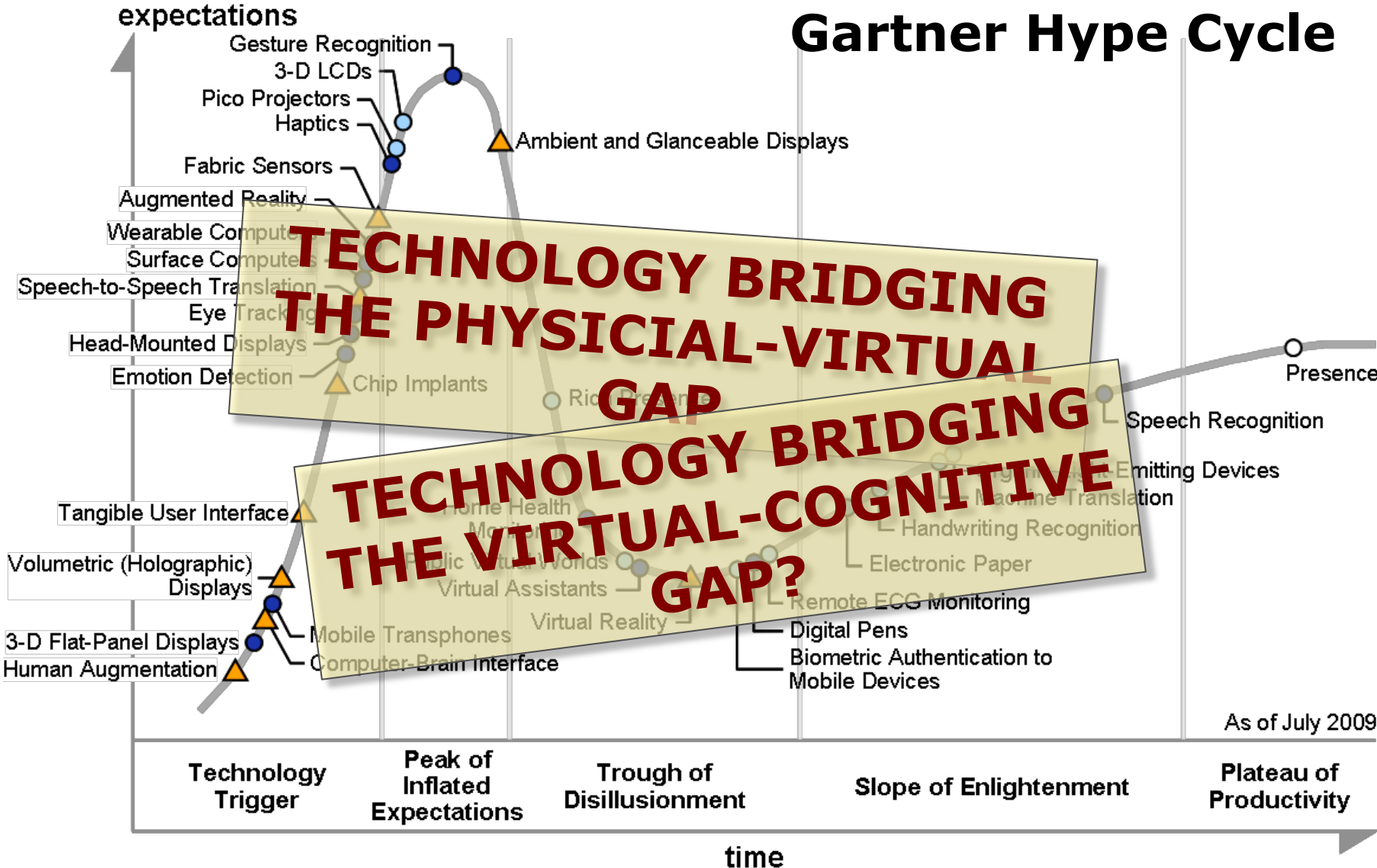
Fig 2. A conceptual overview of a Personalized HealthGuide.

# HOW TO CREATE A SMART HOME ENVIRONMENT?



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# Gartner Hype Cycle



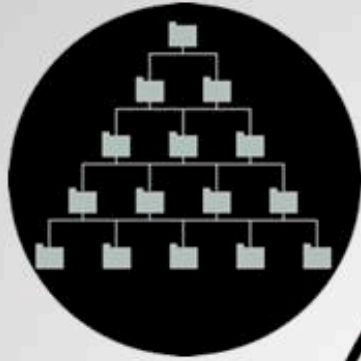
As of July 2009

Years to mainstream adoption:

- less than 2 years
- 2 to 5 years
- 5 to 10 years
- ▲ more than 10 years
- ⊗ obsolete before plateau



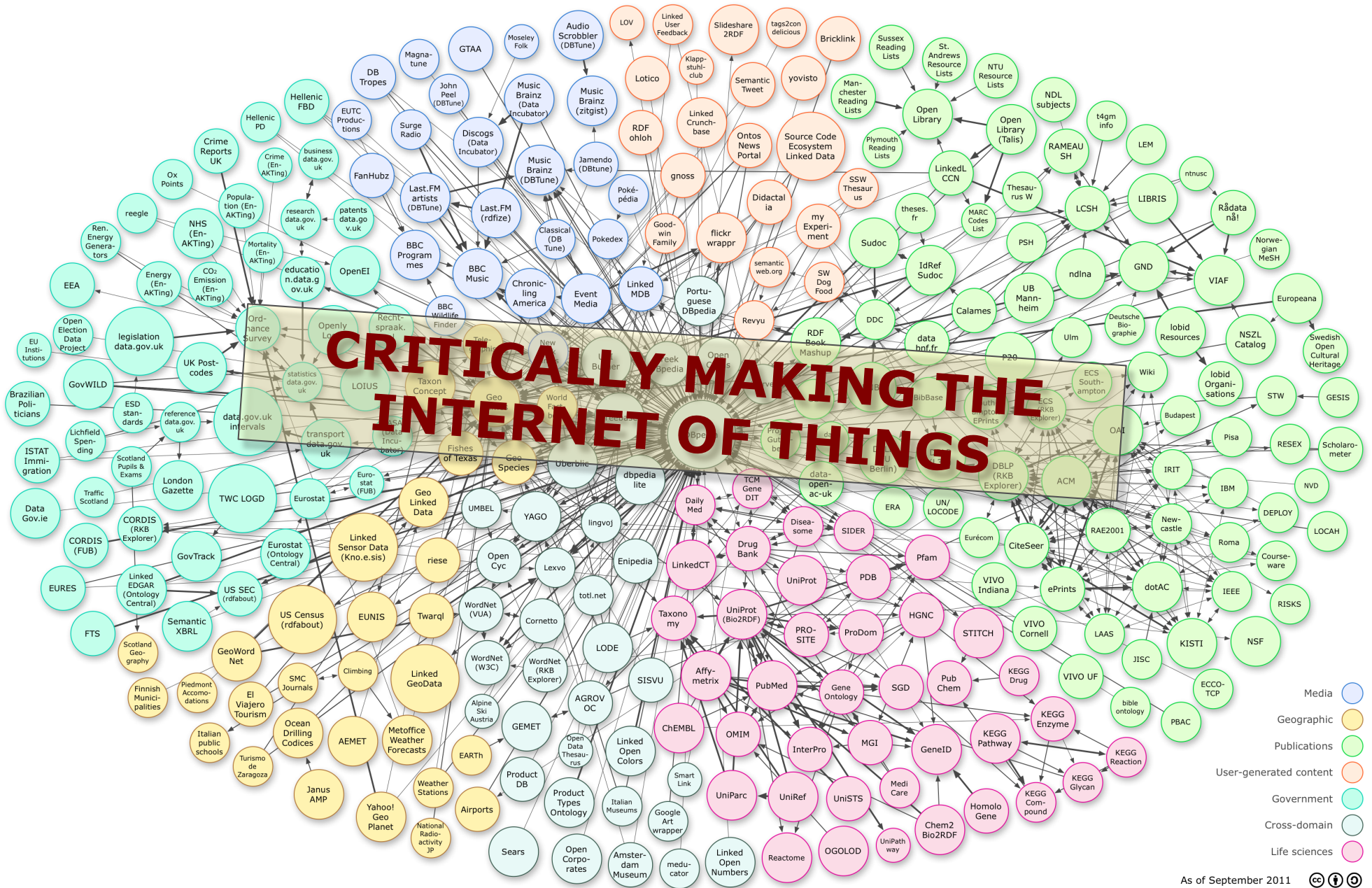
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**Terminological  
knowledge**



**Factual  
knowledge**

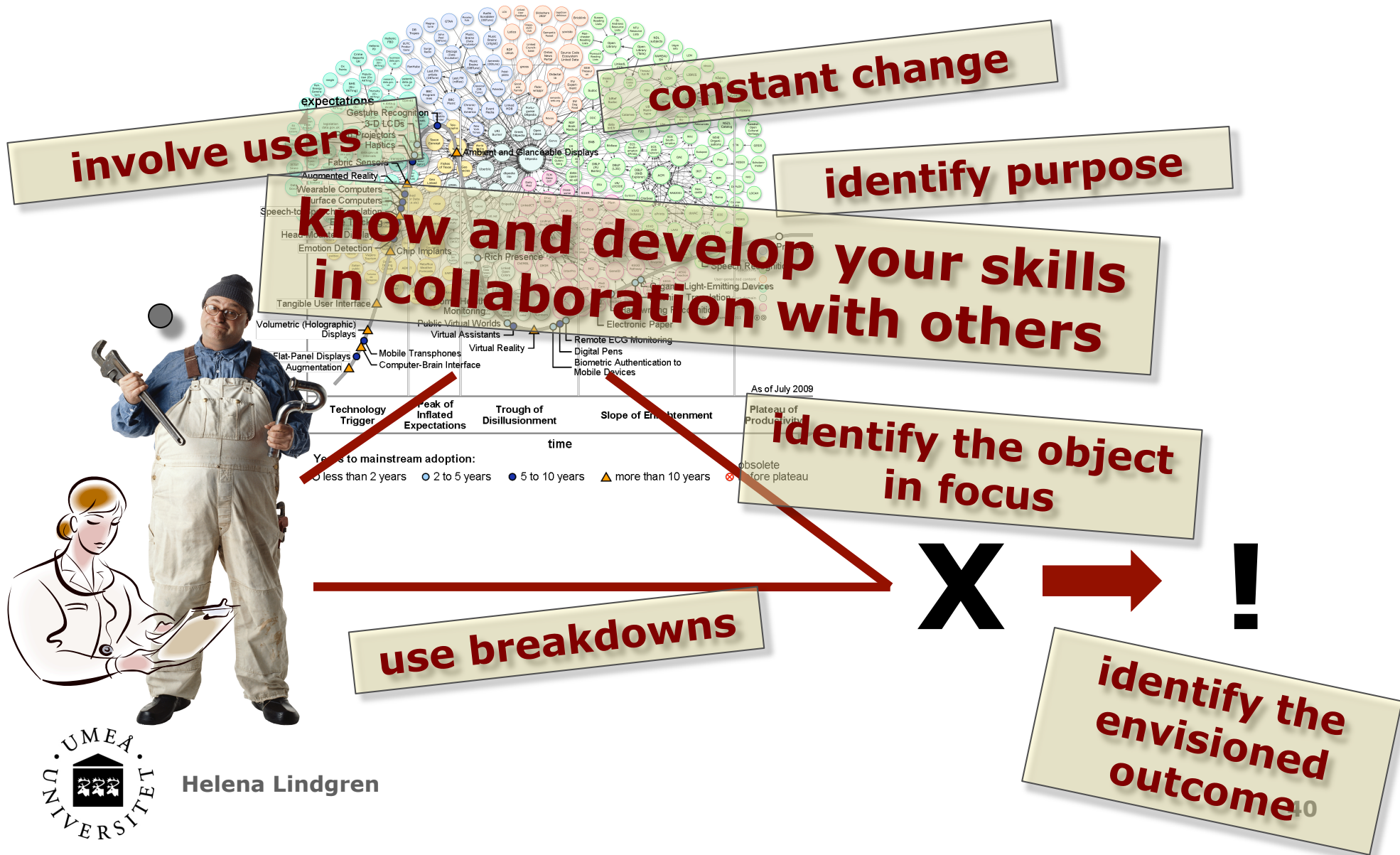


"Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch. <http://lod-cloud.net/>"



Helena Lindgren

# THE THINGS THAT MAKE DESIGNING INTERACTION WITH COMPUTERS DIFFICULT ... AND INTERESTING!



Helena Lindgren