



Center for
**LifeLong
Learning
& Design**

University of Colorado at Boulder

**Wisdom is not the product of schooling
but the lifelong attempt to acquire it.
- Albert Einstein**

Tools for Living and Tools for Learning

**Gerhard Fischer and Hal Eden
Spring Semester 2006, March 22, 2006**

Carmien, S., & Fischer, G. (2005) "**Tools for Living and Tools for Learning.**" In, Proceedings of the HCI International Conference (HCII), Las Vegas, July 2005, (published on CD).

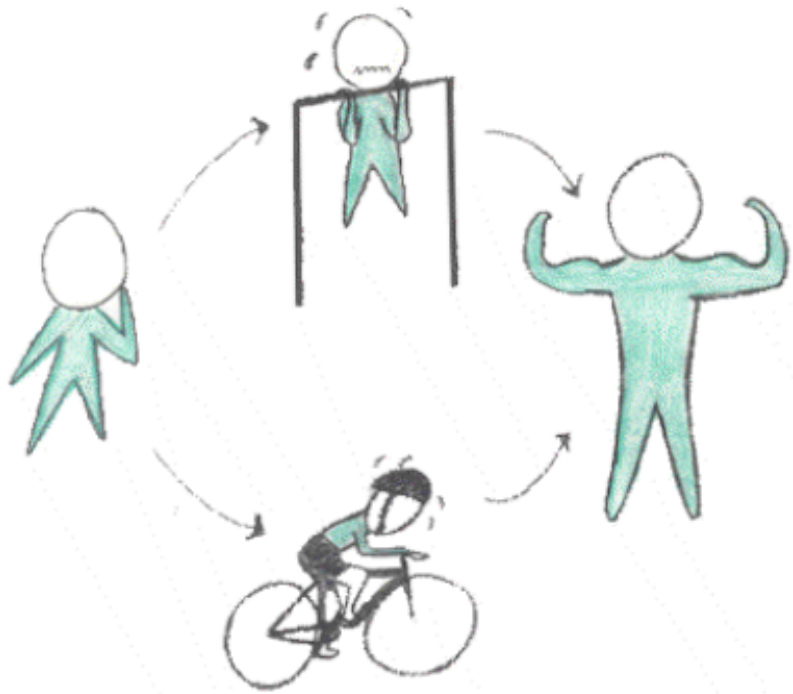
<http://l3d.cs.colorado.edu/~gerhard/papers/tools-hcii-2005.pdf>

Tools for Living and Tools for Learning

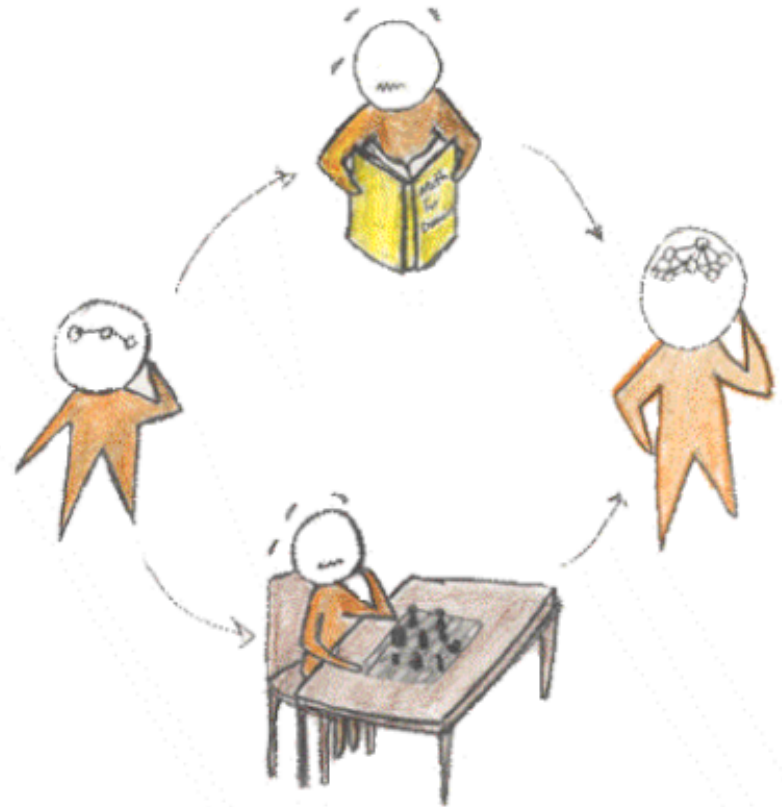
- tools for living → **distributed intelligence**
- tools for learning → **scaffolding with fading**
- **claim:** working with people with **cognitive disabilities**
 - creates new unique challenges for theories about distributed intelligence
 - provides a deeper understanding of distributed intelligence
- examples: hand-held calculators → spelling correctors → spelling correctors for people **with dyslexia?**

Humans and Tools – Individuals without Tools

Building Physical Strength



Building Cognitive Strength

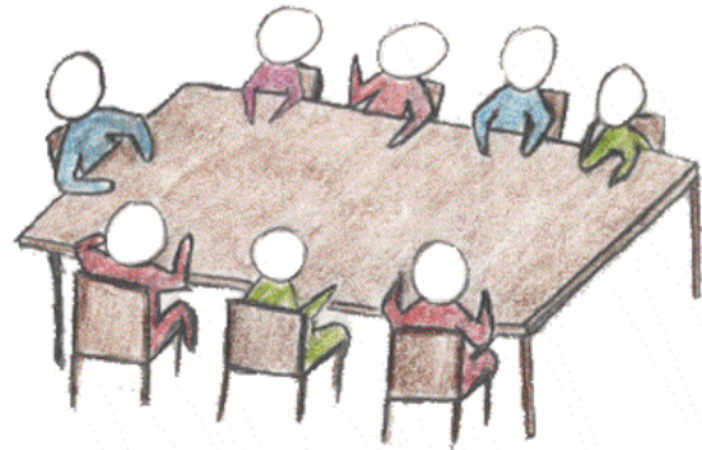


Collaboration Without Tools

Physical



Cognitive

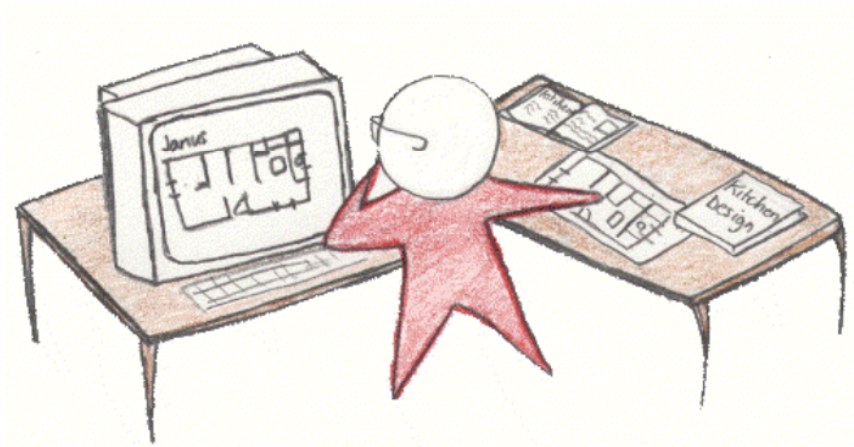


Empowering Individual with Tools

Physical



Cognitive

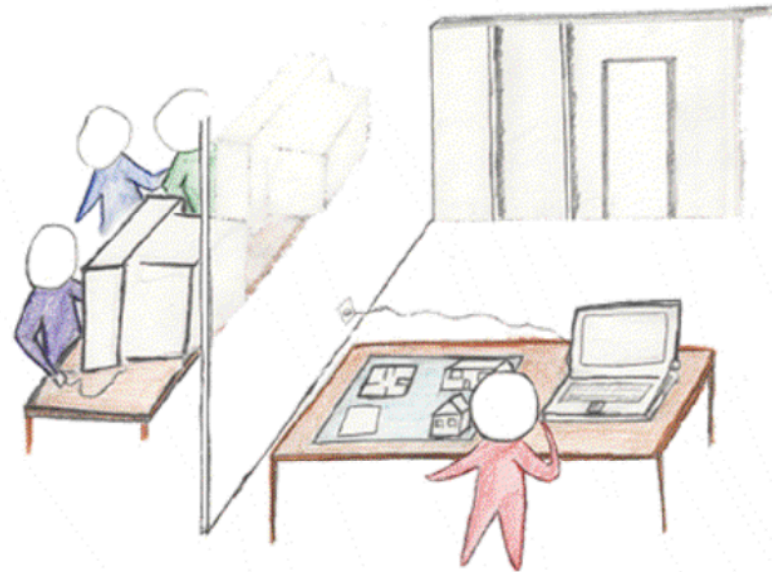


Empowering Collaborators with Tools


Physical

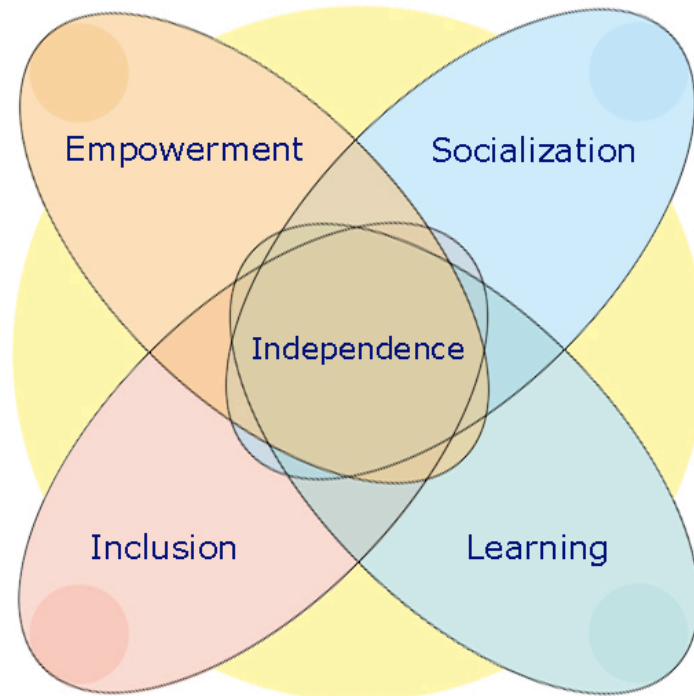


Cognitive



CLever: Cognitive Levers – Helping People Help Themselves

	<h2>CLever: The Vision and the Intellectual Coherence</h2>
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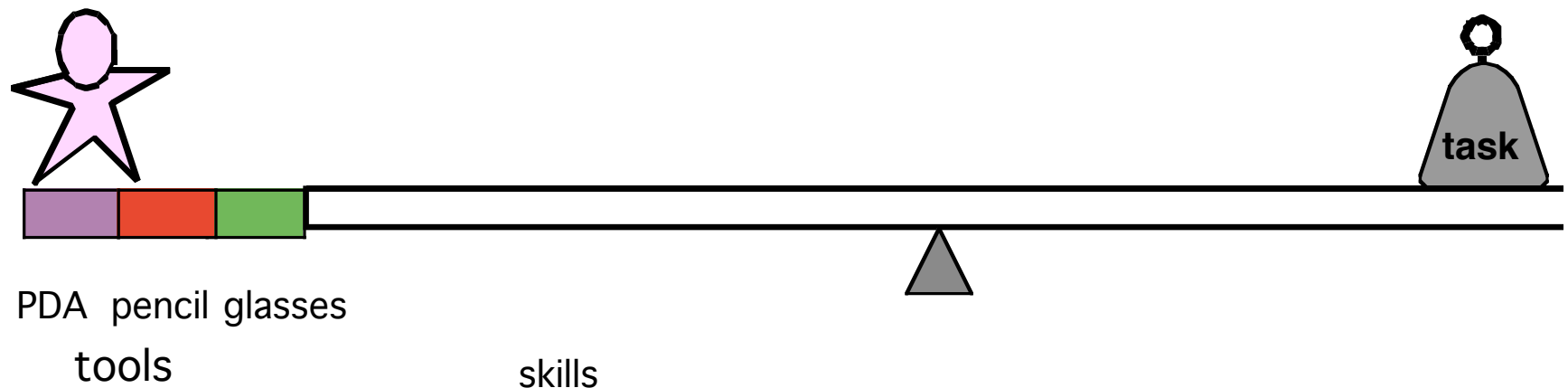


Distributed Intelligence— Empowering Humans with Media and Technology

- **“anatomy is not destiny”**

“The invention of eyeglasses in the twelfth century not only made it possible to improve defective vision but suggested the idea that human beings need not accept as final either the endowments of nature nor the ravages of time. Eyeglasses refuted the belief that anatomy is destiny by putting forward the idea that our minds as well as our bodies are improvable!” — Neil Postman

- **"Give me a lever long enough and I can move the world."**



Tools for Living (“Distributed Intelligence”)

- **definition:** do task **with** tools

- **examples:**
 - **eye-glasses:** to compensate for poor eyesight (⇒ question: is the correction of eyesight with “lasik surgery” conceptually different?)

 - **pencil and paper** (literacy): to overcome the limitations of short-term memory

- **opportunity:** while some people might have no problems to learn to perform the tasks without the tools (e.g., spelling, critiquing systems), they use tools for doing these “low level” tasks and can therefore focus on the more interesting tasks

- **independence:**
 - people will be **dependent** on the tool
 - but: the availability of the tool may give people the **independence** to engage in personally relevant activities (e.g., mobility)
 - analyze how **dependence** in one dimension can increase **independence** in another dimension?

Tools for Learning (“Scaffolding with Fading”)

- **definitions:**

- **scaffolding:** situations in which learners get assistance or support to perform a task beyond their reach if pursued independently when “unassisted”
- **fading:** people learn to perform the tasks over time without tools (an objective of many things students learn in school)

- **examples:** training wheels, wizards, external scripts, templates, prompting systems,

- **independence:** people will become independent of these tools

- **external resources**

- profoundly affect our conception of what, how, and why one needs to know and learn
- put greater emphasis on access to tools to-think-with than a solo understanding without tools

A Tool for Learning – Training Wheels



A Tool for Living — Adult Tricycle



Memory Aiding Prompting System (MAPS)

- socio-technical environments supporting people with cognitive disabilities
- creating new “knowledge” (scripts) by end-users who have no interest or technical knowledge

The Maps Script Editor



Script Design Time

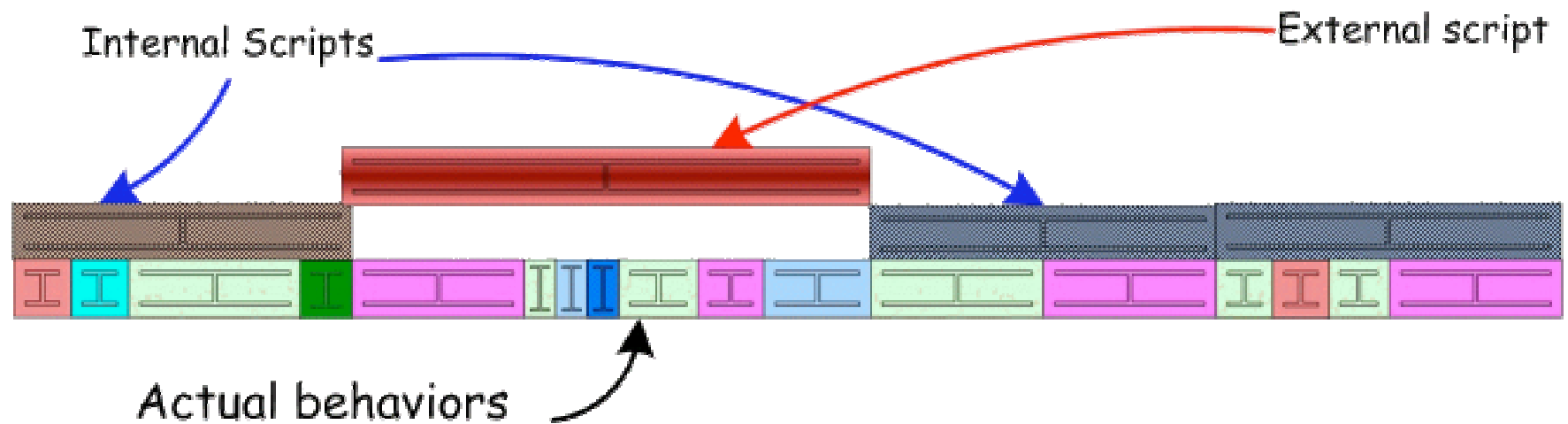
MAPS Handheld Prompter and Caregivers Monitor in Use



Script Use Time

MAPS as a Tool for Living

- script on the MAPS prompter provide missing executive and mnemonic content



Overview of Tools for Living and Tools for Learning

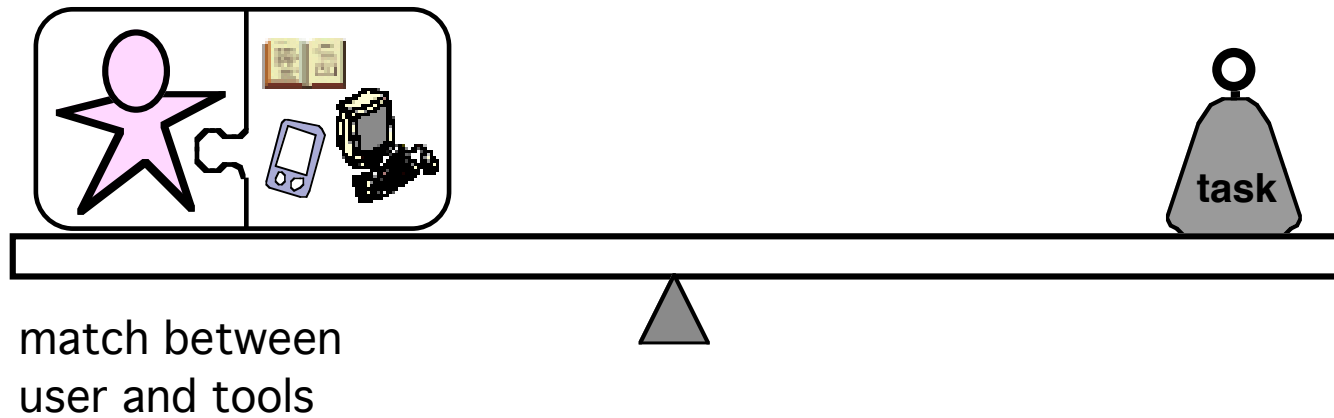
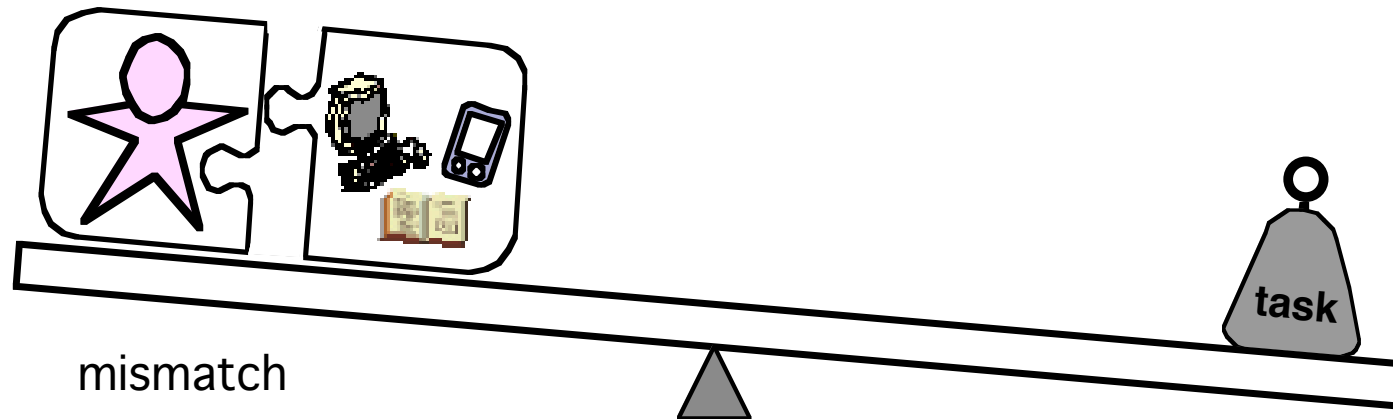
	Tools for Living	Tools for Learning
Definition	do task with tools	do tasks without tools
Examples	eye glasses, phone, radar, cockpits, scuba diving gear	spelling correctors, hand-held calculators, tricycles, wizards,
people with disabilities	spelling correctors, hand-held calculators, tricycles, wizards	learning Braille, learning how to use prompts, learning a bus route
prompting systems (MAPS)	for people with memory problems (disabilities, elderly)	for people without memory problems (but: people use calendars on paper, reminding systems)
distributed intelligence perspective	resource rich (professional life)	become independent of external resources (school)

Tools for Living change Tasks

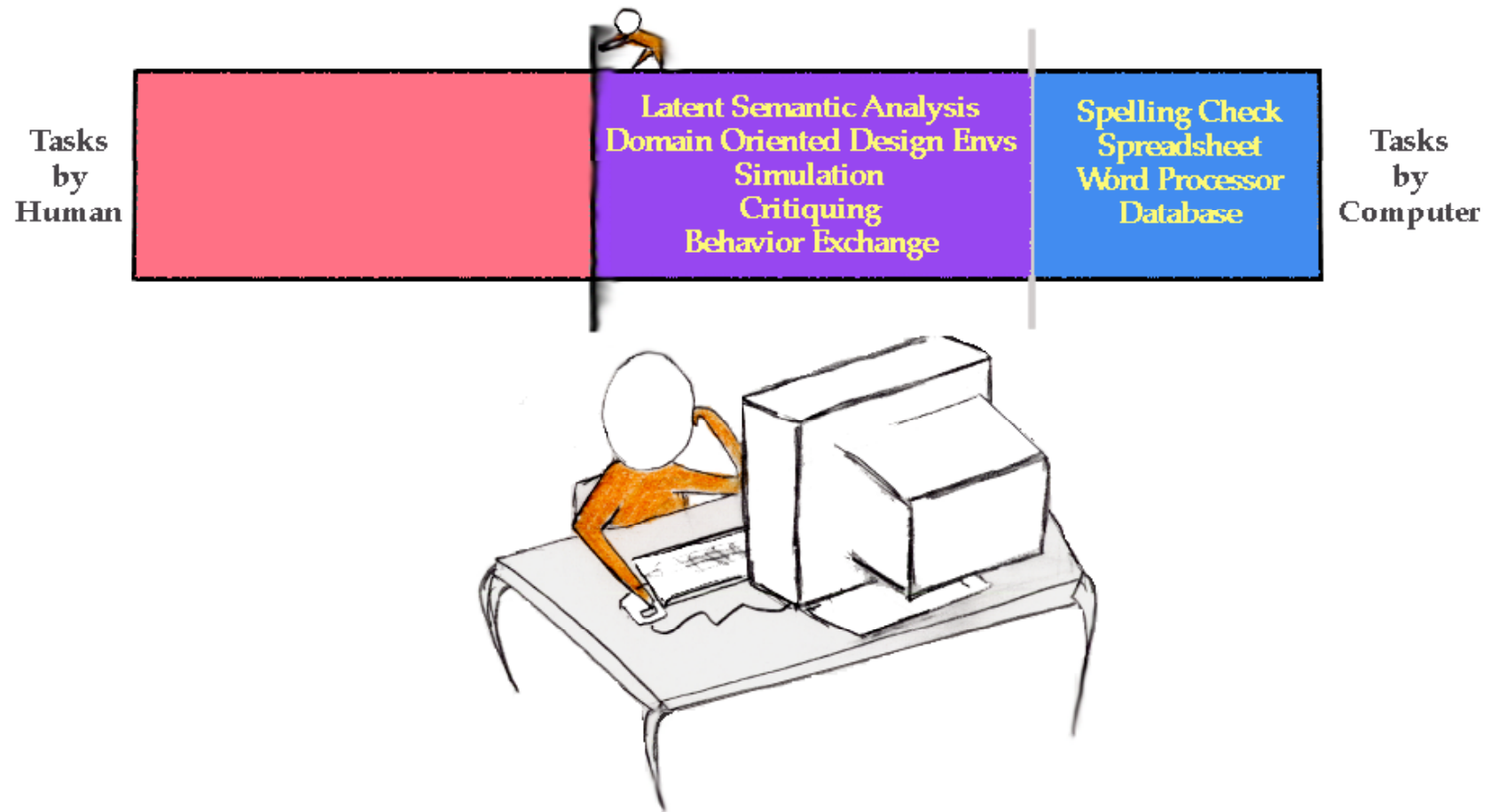
From the Neighborhood Store to the Smart Store of the Future

- **media:** head → pencil and paper → adding machines → UPC, scanners and databases, RFID tags
- **sales clerks:** adding prices
 - *in their heads*
 - *using pencil and paper*
 - *using adding machines*
 - *using scanners*
 - *no need for their services anymore*
- **money:** computing the change in the head → by the machine → processing credit cards
- **customer:**
 - *checking out their own groceries (“do I want to do this?”)*
 - *walking by a RFID reader*
- **overall performance of the system:** speed, reliability, visibility (total cost, partial costs)

Tools for Living Must Fit the Task



Tools for Living: Using Technology to Free Humans to Focus on Important Tasks



Over-Reliance on Tools for Living



Over-Reliance on Tools for Living



"Nurse, get on the internet, go to SURGERY.COM, scroll down and click on the 'Are you totally lost?' icon."

Challenges associated with Cognitive Tools

- cognitive tools require some “understanding and learning” on the side of the person who use them → these people must have or acquire these cognitive skills to take advantage of these tools

- research methodology of the CLever project — to make progress, our research is grounded in three major developments: theory, empirical studies, and engineering construction
 - theory: to understand how human cognition results from an interplay between mental processes (“internal scripts) and external computational and memory aids (“external scripts”)
 - empirical research: examines how people perform tasks and the roles of artifacts
 - engineering design and construction: create new classes of artifacts and test them in natural settings → dimensions to be investigated:
 - the complementarity between human and artificial capabilities,
 - the role of availability and portability,
 - interface principles (the nature of the interaction between the person and the artifact
 - personalization and adaptation

Assessment Dimensions

- **over-reliance on tools for living** → does it lead to *learned helplessness* and *deskilling*, ruining the users native abilities by making them dependent on the tool?
- **beyond human capabilities** → under which conditions are tools for learning (and the associated “scaffolding with fading”) simply out of the question (e.g. advanced visualization tools, simulation tools, critiquing tools, that *complement* human cognitive abilities and thereby preclude internalization of the functions they provide)?
- **values in our culture** → how do new cultural values change our thinking about tools for living versus tools for learning in a world that is characterized by pervasive computing, always-on Internet access, reliable service networks, and sufficient level of technological fluency?