Cognitive Levers (CLever): Helping People Help Themselves — Empowerment, Socialization, Inclusion Learning, and Independence”

A L3D Project funded by the Coleman Family Foundation / Institute

The CLever Project Team
Center for LifeLong Learning & Design (L³D)
Department of Computer Science and Institute of Cognitive Science

Presentation, April 12, 2001
CLever: The Vision and the Intellectual Coherence

Empowerment

Socialization

Independence

Inclusion

Learning
# The CLever Research Team

<table>
<thead>
<tr>
<th>Person</th>
<th>Research Domain</th>
<th>Specific Project</th>
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<tr>
<td>Leo Burd</td>
<td>universal design</td>
<td>I-Mail</td>
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<tr>
<td>Stefan Carmien</td>
<td>increase independence</td>
<td>MAPS (Memory Aiding Prompting System)</td>
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<tr>
<td>Mark Dubin</td>
<td>virtual reality in rehabilitation</td>
<td>Bp Visualization Center Support for “Mobility for All”</td>
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<tr>
<td>Gerhard Fischer</td>
<td>social creativity, personalization, user modeling,</td>
<td>Mobility for All</td>
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<td>collaborative human-computer systems</td>
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<tr>
<td>Rogerio de Paula</td>
<td>community building effort; make information relevant to</td>
<td>web2gether — collaboration with Eddie Caley (ETH/URA)</td>
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<td></td>
<td>the task at hand</td>
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<tr>
<td>Hal Eden</td>
<td>interfaces supporting direct collaborative interaction</td>
<td>“Chessboard”; Showcase Lab in DLC</td>
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# The CLever Research Team

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<tr>
<td>Ernie Arias</td>
<td>creating community and environments to support it</td>
<td>EDC; Showcase Lab in DLC</td>
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<tr>
<td>Andy Gorman</td>
<td>user modeling, personalization, adaptation</td>
<td>SPIDER</td>
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<tr>
<td>Shin’ichi Konomi</td>
<td>ubiquitous computing</td>
<td>QueryLens</td>
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<tr>
<td>Jim Rebman</td>
<td>living with a disability, advisor to the project</td>
<td>Input to the Portal</td>
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<tr>
<td>Jonathan Ostwald</td>
<td>dynamic, living, information repositories</td>
<td>DynaSites</td>
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<tr>
<td>Anja Kintsch</td>
<td>collaboration with teachers</td>
<td>Anja’s CD</td>
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<tr>
<td>Cathy Bodine</td>
<td>Colorado Assistive Technology Project</td>
<td>Showcase Lab in DLC</td>
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<tr>
<td>CLever-Team</td>
<td>empowerment, socialization, inclusion, learning, independence</td>
<td>Mobility for All</td>
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Problems and Objectives Addressed by the CLever Project

1. people with disabilities form “a universe of one”

2. individuals can (and in some cases must) follow very different learning paths

3. help understanding the thinking of humans in general

4. impairment of social interaction

5. comprehension difficulties

6. map problems (cognitive disabilities) $\leftrightarrow$ solutions (assistive technologies)

7. personalize and adapt technologies
CLever Research Objective: #1

- **problem:**
  people with disabilities form “a universe of one”

- **research challenge:**
  research in personalization, user modeling, and adaptation is of critical importance

- **specific CLever research activities:**
  research publications, recent PhD thesis, collaboration with BEA Boulder, SPIDER
**SPIDER**

**Sharing Pertinent Information in Dynamically Evolving Repositories**

<table>
<thead>
<tr>
<th><strong>Problem</strong>: rapidly develop and deploy information systems that can personalize the presentation of information to a particular user in a particular context</th>
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<tbody>
<tr>
<td><strong>Research Challenge</strong>: User Modeling, Personalization, Adaptation, Machine Learning, and Information Retrieval, Component-based Software Engineering</td>
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<tr>
<td><strong>Current Work</strong>: SPIDER = a component-based framework for developing web applications that require personalized information delivery</td>
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**Diagram**

- BEA's WebLogic Application Server
- SPIDER Framework
- Application Layer
- Coleman Institute Portal
  - Mobility for All
  - Web2Gather
  - MAPS
- Advanced Information Retrieval
- Enhanced User Modeling
- Persona Management
- Discussion Forum
- File Repository
- Social Filtering
- Personalization Server
- User Management
- EJB Container
- J2EE
CLever Research Objective: #2

- **problem:**
  
  individuals can (and in some cases must) follow very different learning paths

- **research challenge:**
  
  to create environments that match individual needs and learning styles

- **specific CLever research activities:**
  
  MAPS (Memory Aiding Prompting System), I-Mail
CLever Research Objective: #3

- **problem:**
  looking at the work and needs of humans with special educational needs and with very different cognitive abilities can help to understand the thinking of humans in general

- **research challenge:**
  *new architectures for collaborative human-computer systems providing new user experiences*

- **specific CLever research activities:**
  dual use technologies, space program effect, Mobility for All
CLever Research Objective: #4

- **problem:**
  many cognitively disabled people suffer from an impairment of social interaction with others, lack communication possibilities, and have no true concept of other minds or even of their own

- **research challenge:**
  such problems can be successfully addressed by computational environments supporting multi-model interactions, visualization, and very concrete (rather than abstract) representations

- **specific CLever research activities:**
  Interfaces Supporting Direct, Collaborative Interaction ("Chessboard"), QueryLens
Interfaces Supporting Direct Collaborative Interaction

• support more direct interaction — current generic interaction techniques in EDC require more attention to the interface than to the problem and force turn taking regardless of appropriateness

• new other sensor technologies that allow extended interaction capabilities with the following goals for the CLever project:
  - supporting face-to-face group interaction
  - providing a lower threshold for use (more direct and concrete, less abstract), allowing a broader range of individuals to join into the collaborative activities.
  - **Bus-Trip-Planner**, as part of “Mobility for All” showcase—users could concretely interact with a map to plan their bus trip
  - **I-Mail-Direct**—augmenting the I-Mail project by allowing the creation of messages using concrete physical objects
The Prototype
CLever Research Objective: #5

• **problem:**
  many cognitively disabled people suffer from comprehension difficulties

• **research challenge:**
  using basic comprehension research and computational techniques (e.g.: Latent Semantic Analysis (LSA)) to create representation which will be easier to use by people with comprehension problems

• **specific CLever research activities:**
  I-Mail
CLever Research Objective: #6

• **problem:**
  existing technologies for disabled people are too much in the abstract, and not geared towards specific situations

• **research challenge:**
  to make information relevant to the task at hand and to match the specific needs of people to specific devices

• **specific CLever research activities:**
  web2gether
CLever Research Objective: #7

• **problem:**
  teachers and parents do not have the time and the knowledge to identify the most important devices and explore their adequacies for their specific needs

• **research challenge:**
  provide support for lifelong learning, and develop an infrastructure in which task-relevant knowledge can be shared

• **specific CLever research activities:**
  - web2gether, I-Mail & MAPS in collaboration with Boulder Valley and Adams County School District,
  - portal for the CLever project
web2gether project

• **social and technical challenges:**
  - Finding information and tools to the task at hand that matches with the specific needs of students with disabilities
  - Creating social-technical artifacts that help teachers, parents and caretakers find, share and learn new ways of using assistive technology

• **Existing Work:**
  - Assistive Technology Team (CD-ROM = Anja’s CD)
  - Commercial Catalogues (online and otherwise)
  - Specific Community Support Web-sites
web2gether project — continued

• **Addressing the Challenges – web2gether project:**
  - Designing and Developing a collaborative and evolvable repository of software applications
  - Designing and Developing new ways of allowing this community to share stories and experiences
  - Creating a Culture of collaboration and support among teachers, parents and caretakers so that they could help each other

• **Current Developments and Next…**
  - The web2gether web-site
  - A novel way of information retrieval based on social-navigation, social filtering and retrieval by reformulation
  - Workshops for teachers and parents – support for lifelong learning and community building
Shared Understanding → the Need for Personalization, Adaptation and User Modeling
Distributed Cognition, Informational Prosthesis, Media as Extensions of Humans

examples: eye glasses, reading and writing, spelling correctors, ....
CLever as Seed for New Additional Research Activities
—
Research Grants

- NSF Education and Human Resource Directorate: "Social Creativity and Meta-Design in Lifelong Learning Communities" (G. Fischer, E. Arias, H. Eden, and M. Eisenberg)

- Contribution to and Collaboration with ITR Proposal: “Wearable Computers for the Cognitively Impaired” (PI: Stephen Fickas, University of Oregon)
## Research Collaborations

<table>
<thead>
<tr>
<th>Person / Research Group / Company</th>
<th>Topic</th>
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<tr>
<td>Cathy Bodine</td>
<td>Coleman Showcase Lab</td>
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<tr>
<td>AbleLink Technologies</td>
<td>Pocket Coach and MAPS system</td>
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<tr>
<td>Communications Art</td>
<td>Mobility for All (“Intelligent Bus Stop”)</td>
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<tr>
<td>BVSD Assistive Technology Program — e.g., Eisenhower School, Adams Twelve School (Special Education Transition Services)</td>
<td>Participatory Design Approaches</td>
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<tr>
<td>University of Colorado</td>
<td>cognitive foundations urban environments and communities Virtual Reality Environments</td>
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<td>- Institute of Cognitive Science</td>
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<td>- Architecture and Planning</td>
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<td>- Bp Visualization Center</td>
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Computer Supported Collaborative Learning (CSCL’2002) Conference, January 7-11, CU-Boulder

- support from the Coleman Institute

- at the conference: special events at the conference related to the Coleman Institute
Research Results


Mobility for All ("Intelligent Bus Stop")

collaboration with Communications Art, RTD, City of Boulder, disabled communities, elderly

Technologies

Access and feedback

Assessment

Communities
Design Approach for “Intelligent Bus Stop”

• socio-technical environment: how things are → how things could/should be
  - how things are: understanding the current situation (collaboration with Faye Byrd, Adams Twelve School)
  - how things could/should be → technology-enriched environments including: personal digital assistants, GPS, wireless communication, smart bus stops, smart buses, computational support for bus drivers

• design approach (“staged innovation” — close collaboration with Communications Art):
  - building on our experience with the Envisionment and Discovery Collaboratory (EDC) (plus “ChessBoard”, 3D environments)
  - Virtual Reality → collaboration with Bp Visualization Center and their Virtual Reality Environments (“Caves”)
  - kiosk in Coleman Showcase Lab in the Discovery Learning Center (DLC)
  - “real” world → intelligent transit infrastructure

• how to avoid: “build it and nobody will come” → building an outstanding public transportation system and no one will come and use it
Computation: Making Information Relevant to the Task at Hand
Space Program Effect — Dual Use Technologies

research challenges:

• work and needs of humans with special needs and with different cognitive abilities → can help to understand the thinking of humans in general
• new architectures for collaborative human-computer systems providing new user experiences
Next Steps — Collaboration CLever + Coleman Institute

• in-house expert(s) in disabilities and augmenting technology (→ Anja Kintsch)

• official partnership with the Boulder Valley School District
  - reimburse the teachers??
  - I-Mail tasks as an official part of their duties

• usage of commercially available software (e.g., by schools)
  - standard picture libraries: Mayer-Johnson (http://www.mayer-johnson.com/)
  - I-Mail should be compatible with them → official agreement with these companies

• Software distribution
  - teachers asks how much the software would cost and how it is going to be advertised and distributed
  - develop distribution policies

• more involvement by undergraduate students
  - ETH ↔ URAP collaboration
  - more publicity on campus