



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

**Creating Learning Environments
for the Severely Mentally Handicapped**

and

L³D's and ICS's Work

**Center for LifeLong Learning & Design (L³D)
Department of Computer Science and Institute of Cognitive Science**

Meeting with Bill Coleman, Monday 9/20, 1999

Beyond Binary Choices

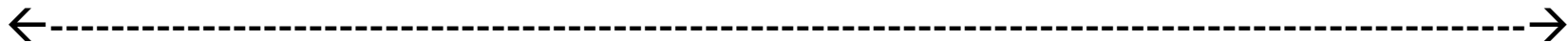
severely mentally
handicapped

mentally
handicapped

slow learner

normal

gifted



- **phobia (a mental handicap?)— examples:**

- math phobia
- new media phobia (Cole Neighborhood in Denver)

- **the haves and the have-nots of technology — examples:**

- Cole Neighborhood
- collaboration with children in Costa Rica

- **claims:**

- individuals can (and in some cases must) follow very different learning paths → challenge: to create environments that match individual needs and learning styles
- looking at the work and needs of humans with special educational needs can help to understand the thinking of humans in general

A Basic Metaphor: Technology as Prosthesis (Elimination of Prerequisites)

- **eye-glasses**

- an artifact that empowers many people to be “full members” of society (which they could *not* be without the artifact)
- an example of *visual prosthesis* (an artificial device to replace a missing part of the body)

- **computer**

- *information prosthesis* (an artificial device to replace a missing part of the mind)
- examples of information prosthesis: spelling (for dyslexia), grammar, hand-held calculators, Mathematica
- challenge: use “things that think” to create “things that make us smart”

Example₁: Cerebral Palsy and Autistic Children

source: Sylvia Weir, "Cultivating Minds", Harper and Row, New York, 1987

- **cerebral palsy — decoupling of physical and mental disabilities**
 - intelligence “trapped” in a body (great difficulty talking,)
 - humans who have never made something physical and who can not manipulate objects

- **autism — liberation of trapped intelligence**
 - disturbance in developing interpersonal relationships
 - computer as a therapeutic tool in autism
 - * a small effort can produce a large effect
 - * predictability
 - * with the “right” environment the child is in control

- **goal: to overcome learned helplessness** (a handicapped person often becomes adapted to total passivity)

Example₂: MindTouch — A Computer Assistant for a Person with Autism

<http://www.mindtouch.com>

*Senior Project (Bruce Sanders), CS Department
Steve Bjorg, Aaron Hart, Patrick Link, and Miranda Walton, 1998 - 1999*

TC's Community, a local non-profit organization provides care and management for an autistic woman named Teresa. The community is organized to assist Teresa with living in her own home.

Teresa does not communicate verbally. Interaction with Teresa is heavily oriented towards visual depiction, often using pictures and diagrams. In addition, Teresa is accustomed to making decisions based on a consistent set of options. Consequently, the Community believed a computer system would be ideal for establishing a consistent communication medium with Teresa, allowing her to perform many daily activities more independently. This project was centered around this idea and is intended to facilitate assistance for Teresa.

The principal feature of the system is a specialized user interface that includes touch-screens, picture prompting, and verbal audio messages. Teresa can guide herself through many daily routines with simple prompting through a sequence of pictures and verbal instructions from the computer system, making responses herself by pressing pictures on the touch-screen.

Example₃: Experience Journal — Sharing Stories and Narratives among Communities

source: MERL (Mitsubishi Electric Research Laboratory), Cambridge, MA and Children's Hospital, Harvard Medical School

- **community** (with shared life experiences): severely ill children with chronic illnesses and their families
- **objective**: to provide a way for a community to gather, organize, and share the community collective wisdom
- **experience journal**:
 - a psycho-educational intervention based upon a narrative model involving the sharing of personal stories about an illness (including personal narratives about experiences, helpful information, pictures, videos,)
 - these personal stories are quite unlike the logically structured scientific texts
 - important characteristics: an evolving information repository with distributed authorship (no webmaster) (compare: M1-M3 model of the WWW, Dynasites, Virtual Library at New Vista High School)

Example₄: Sensitive Periods of Development: Evidence from Deaf and Hard-of-Hearing Children

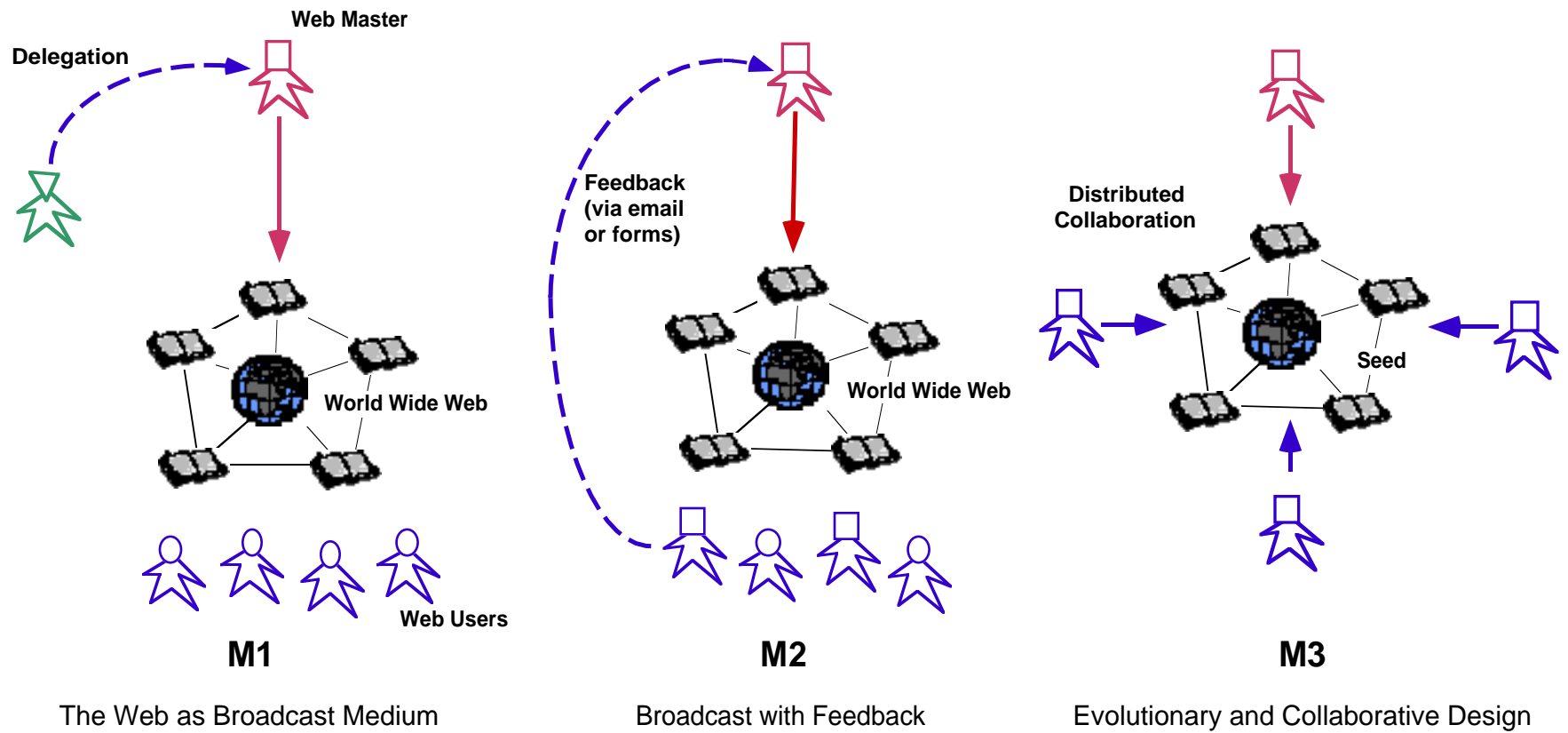
Christine Yoshinaga-Itano

The speech and language development of deaf and hard-of-hearing children is characterized by plateaus in the development of vocabulary, reading and speech. Despite technological advances, early identification of hearing loss (prior to 2.5 years of age), development of intervention techniques, the language, speech and academic achievement levels of the average child with a hearing loss has remained at a middle third to fourth grade level for children with severe to profound hearing loss, and at a sixth grade level for children with mild to moderate hearing loss.

Previously, very little of the variance in language skills has been accounted for by tests of intelligence or degree of hearing loss and until the 1998 study by our research group at the University of Colorado, Boulder in Pediatrics, the age of identification of hearing loss was inconsistently found to be a significant variable in later outcome. The emergence and development of symbolic representation in the infant and toddler period was found to account for a substantial amount of variance in the language development of these children. This cognitive/language relationship, however, was found predominantly for those children who had hearing loss identified prior to six months of age. All of these children also received immediate intervention services, within two months of identification of the hearing loss. The findings from this study lead to the hypothesis that the first six months of life, are a very sensitive period for later normal language development, and that the characteristics of development found in the infant through toddler period remain until entrance into kindergarten. The children we are following longitudinally are not old enough yet to determine long term impact.

More recent findings from our research group have investigated the development of speech in young children with hearing loss. There is evidence that the sensitive period for the normal development of oral speech has a longer timeline than for the normal development of language. Children with minimal or absent speech development even up to five years of age were able to develop the skills necessary for normal intelligible speech, leading to the hypothesis that auditory neural pathways can be developed throughout the first five years of life and perhaps even longer. The interrelationships between speech production, degree of hearing loss, age of identification of the hearing loss, cognitive development and language production were surprising.

WWW: From Broadcast to Collaboration Medium

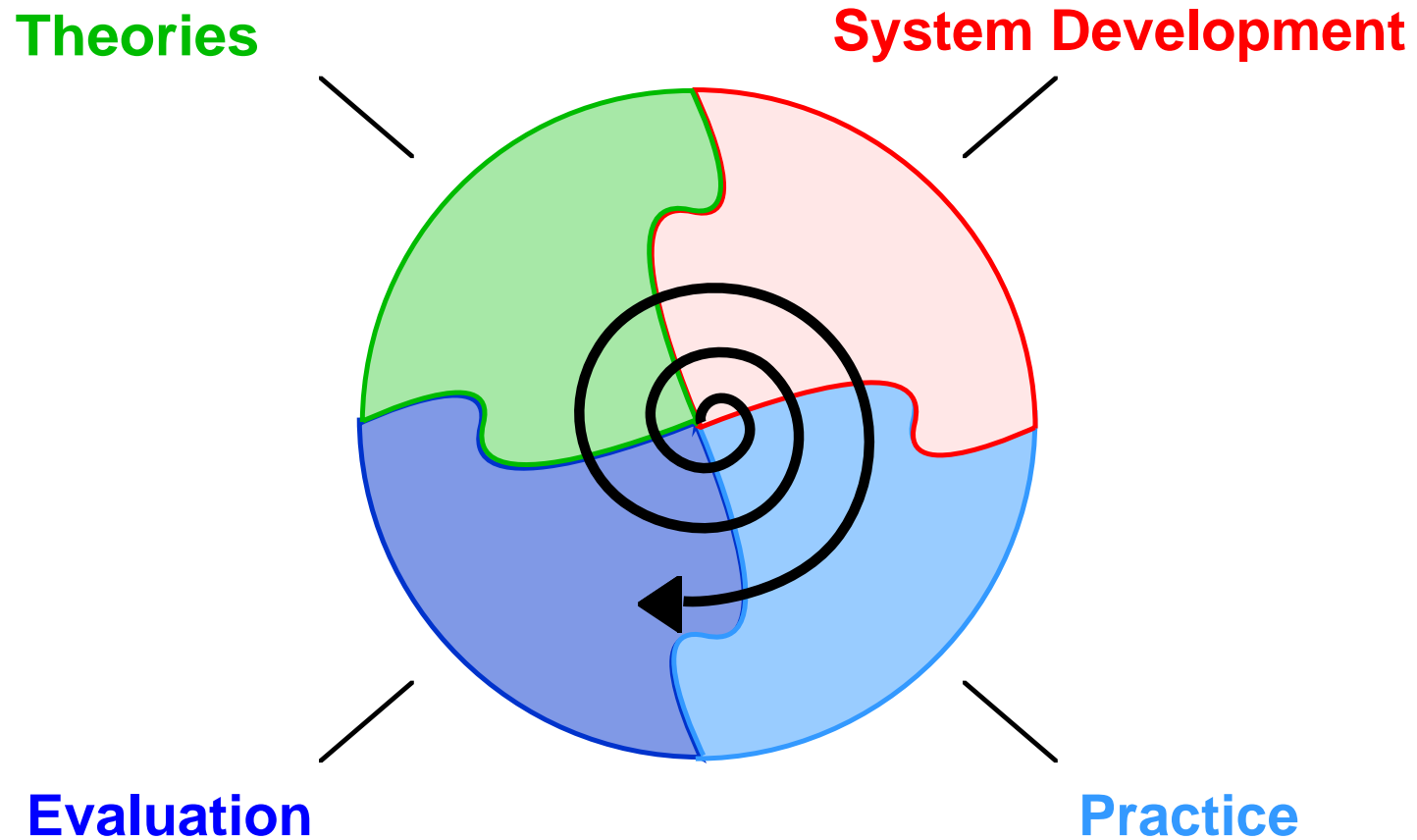


A Few Examples of L³D's Work

Beyond “Gift-Wrapping”

- **“gift-wrapping”**
 - *Jerome Bruner: “Old wine does not improve for being poured into different shaped bottles.”*
 - *Peter Drucker: “There is nothing so useless as doing efficiently that which should not be done at all.”*
- **examples of “gift-wrapping”**
 - the “e-memo” fallacy
 - “webify your courses”
- **examples of beyond “gift-wrapping”**
 - transformative visions (illustrated by Envisionment and Discovery Collaboratory)
 - * from access to informed participation and ownership
 - * learning as collaborative knowledge construction
 - rethinking and reinventing working, learning and collaborating

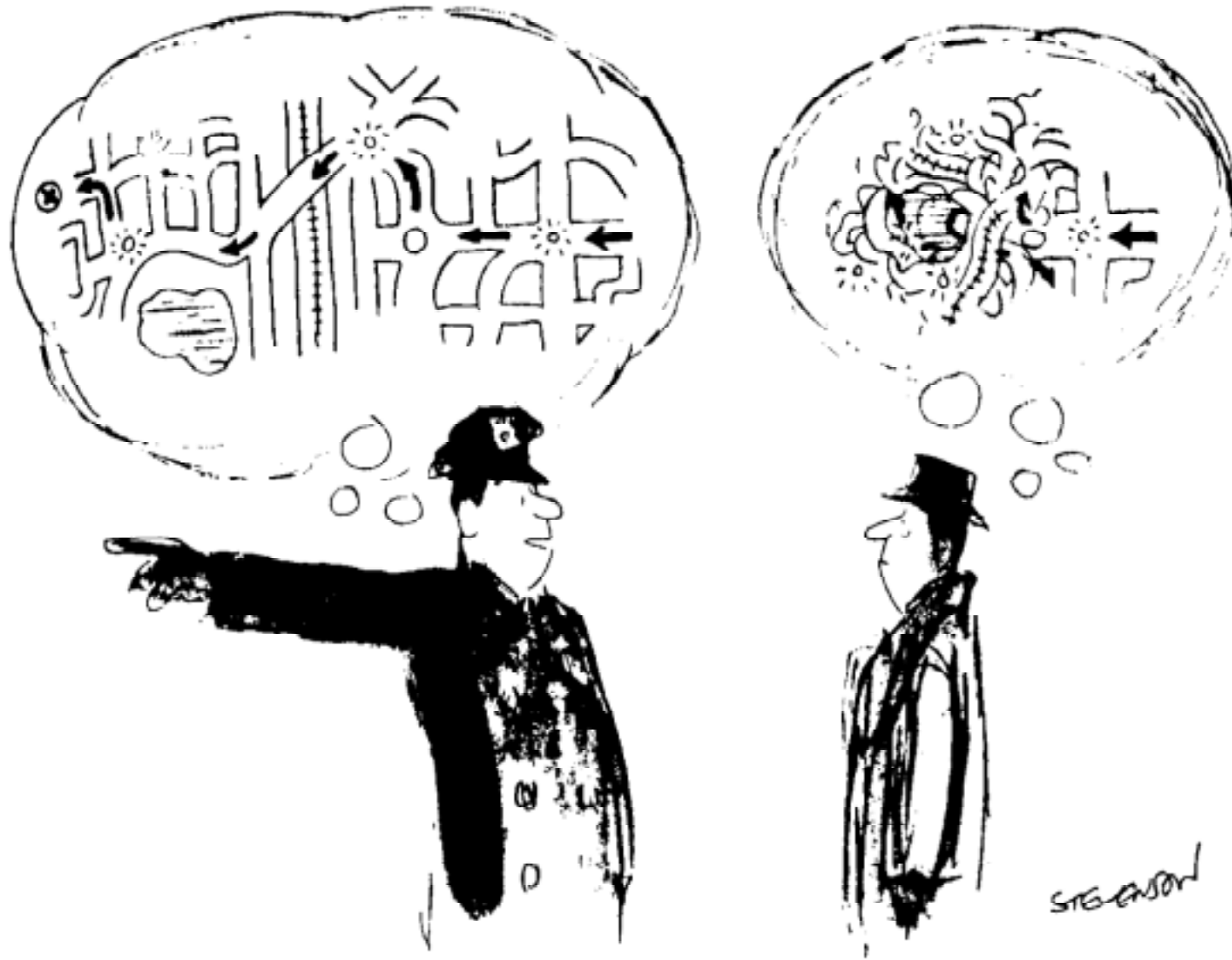
L³D's + CS + ICS Research Methodology



Challenges

- **identify, address and overcome myths and misconceptions**
 - computers by themselves will change education
 - information is a scarce resource
 - content / value / quality of information and knowledge is improved just because it is offered in multi-media or over the WWW
- **overcoming the two (or many) cultures** (C.P. Snow)
 - exploit “symmetry of ignorance” as an opportunity
 - design for mutual understanding and change — *“If a lion could talk, we could not understand him.”* (L. Wittgenstein)

Shared Understanding and Background Knowledge



The Envisionment and Discovery Collaboratory (EDC)



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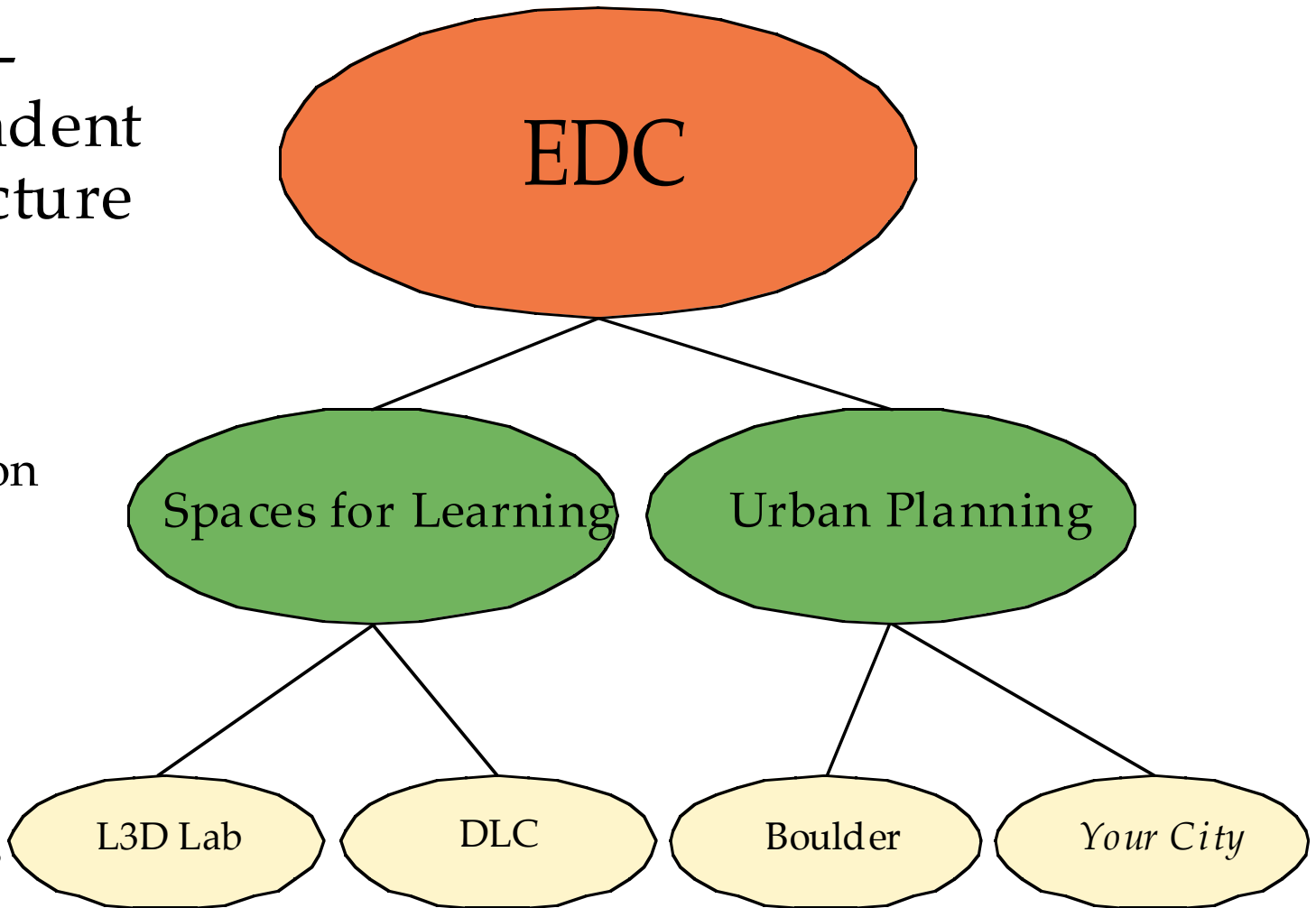
- **creating shared understanding through collaborative design**
 - illustrates that “learning is more than being taught”
 - transcends the greatly impoverished conception of education as a view of learning “where omniscient teachers tell or show unknowing learners something”
 - exploits the “symmetry of ignorance” as a source of power
- **integration of physical and computational environments**
 - hardware: electronic whiteboards
 - software: AgentSheets, Dynasites
 - beyond the screen: immersive environments
- **support for reflection-in-action**
 - action space
 - reflection space
- **open system:** creates an emerging environment evolved by its users acting as active contributors
- **beyond “gift-wrapping”:** explores innovative uses of new media and technologies

Overview of the EDC Environment

Domain-Independent Architecture

Application Domains

Specific Applications



BEA and L3D — A LifeLong Learning Perspective

- **BEA:**

- leading provider of middleware for enterprise applications
- future of global e-commerce
- mission-critical Web applications
- enterprise application integration
- component-based development

- **lifelong learning:**

“A decade of interdisciplinary research on everyday cognition demonstrates that school-based learning, and learning in practical settings, have significant discontinuities. We can no longer assume that what we discover about learning in schools is sufficient for a theory of human learning.” (Scribner and Sachs, 1990)

- **success of training:**

“American businesses have a major stake in fostering transfer of training, since they spend up to \$100 billion each year to train workers. Yet the estimate is that no more than 10% of training transfers to the job. So, businesses waste \$90 billion each year because of lack of transfer.” (Detterman and Sternberg, 1993)