



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

Social Creativity and Meta-Design in Lifelong Learning Communities

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<http://www.cs.colorado.edu/~l3d/>

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Institute for Software Research (ISR), University of California, Irvine, October 2002

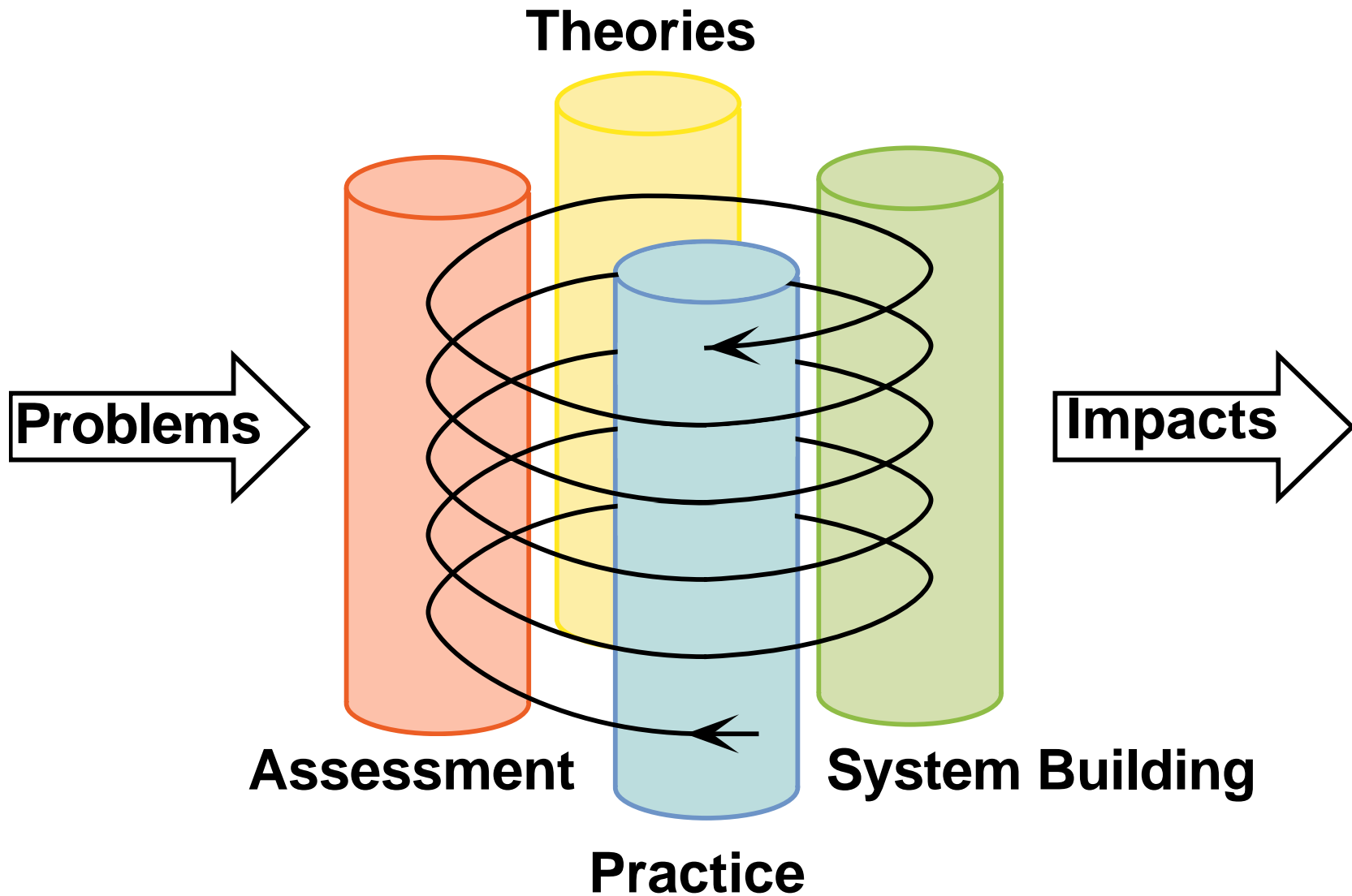
Overview

- **The Center for LifeLong Learning and Design (L³D)**
- **Conceptual Framework**
 - Communities of Practice (CoPs) and Communities of Interests (Cols)
 - symmetry of ignorance
 - social creativity and meta-design
- **Systems**
 - Envisionment and Discovery Collaboratory (EDC)
 - PitaBoard
 - CodeBroker
- **Practice**
- **Assessment**
- **Conclusions**

L³D's Research Focus and Intellectual Identity (“Branding”)

- **Artificial Intelligence (AI) → Intelligence Augmentation (IA)**
 - replacement → empowerment
 - emulate → complement (exploit unique properties of new media)
- **instructionist learning → constructionist learning**
 - learning about → learning to be
 - when the answer is known → when the answer is not known (collaborative knowledge construction)
- **individual → social (distributed cognition)**
 - knowledge in the head → knowledge in the world
 - access → informed participation
- **things that think → things that make us smart**
 - what computers can do → what people and computers can do together
 - computational → computational and physical
- **“gift-wrapping” with new media → co-evolution of media and new theories about thinking / working / learning / collaborating**
- **technical and formal aspect of SE → SE as a human activity**

L³D's Methodology: An Integrated Approach



The Basic Message

How can we exploit the **symmetry of ignorance**
in **communities of interest** as a source for **social creativity**?

Two Current Major Research Projects



“**enTWine**: Social Creativity and Meta-Design in Lifelong Learning Communities”

- supported by the National Science Foundation, Directorate of Education and Human Resources, August, 2001 to July, 2004
- <http://www.cs.colorado.edu/~l3d/entwine/>



“**CLever**: Cognitive Levers — Helping People Help Themselves”

- supported by the Coleman Initiative, August 2000 – July 2003
- <http://www.cs.colorado.edu/~l3d/clever/index.html>

Collaboration—Among Whom: Communities of Practice and Communities of Interest

- *Communities of Practice (CoPs)*, defined as groups of people who share a professional practice and a professional interest (Lave, Wenger)
- *Communities of Interest (Cols)*, defined as groups of people (typically coming from different disciplines) who share a common interest, such as framing and solving problems and designs artifacts (Envisionment and Discovery Collaboratory)
- **for details see:**
Fischer, G. (2001) "Communities of Interest: Learning through the Interaction of Multiple Knowledge Systems," 24th Annual Information Systems Research Seminar In Scandinavia (IRIS'24), pp. 1-14.
[<http://www.cs.colorado.edu/~gerhard/papers/iris24.pdf>]

Communities of Practice (CoPs)

Homogenous Design Communities

- **CoPs:** practitioners who work as a community in a certain domain
- **examples:** architects, urban planners, research groups, software developers, software users,
- **learning:**
 - masters and apprentices
 - legitimate peripheral participation (LPP)
 - develop a notion of belonging
- **problems:** *“group-think”* → when people work together too closely in communities, they sometimes suffer illusions of righteousness and invincibility
- **systems:** domain-oriented design environments (e.g.: kitchen design, computer network design, voice dialogue design,

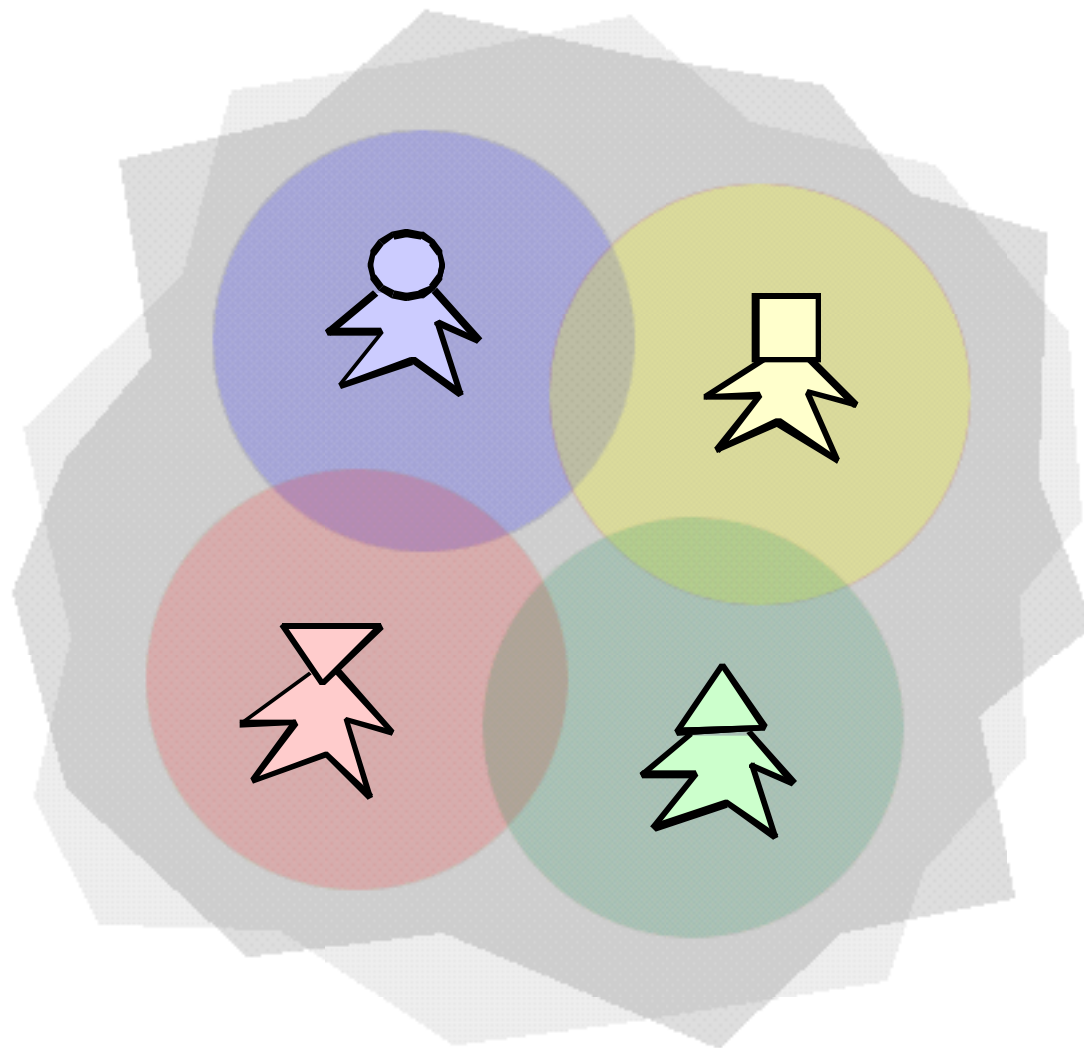
Communities of Interest (Cols)

Heterogeneous Design Communities

“Innovations come from outside the city wall.”

- **Cols** = bring different CoPs together to solve a problem
- **membership** in Cols is defined by a shared interest in the framing and resolution of a design problem
- **diverse cultures**
 - people from academia and from industry
 - software designers and software users
 - students and researchers from around the world
- **fundamental challenges:**
 - establish a common ground
 - building a shared understanding of the task at hand (which often does not exist up-front, but is evolved incrementally and collaboratively and emerges in people’s mind and in external artifacts)
 - learning to communicate with others who have a different perspective → learning: not **“moving toward a center” (CoP)** but **“integrating diversity”**

CoPs and ColS



Symmetry of Ignorance

- **the Renaissance scholar does not exist anymore** — the individual human mind is limited (“the great individual” → “the great group”)
- **distinct domain of human knowledge exist** → of critical importance: mutual appreciation, efforts to understand each other, increase in socially shared cognition and practice (source: Snow, C. P. (1993) “The Two Cultures”, Cambridge University Press, Cambridge, UK)
- **create “boundary objects” / “bridge objects”** → shared objects
 - to “talk about” and to “think with”
 - to coordinate the perspectives of various constituencies (Cols) for some purpose
- **example: symmetry of ignorance in software design**

“System development is difficult not because of the complexity of technical problems, but because of the social interaction when users and system developers learn to create, develop and express their ideas and visions” (Greenbaum, J. & Kyng, M. (Eds.) (1991) “Design at Work: Cooperative Design of Computer Systems”, Lawrence Erlbaum Associates, Inc., Hillsdale, NJ)

Social Creativity

*“The strength of the wolf is in the pack,
and the strength of the pack is in the wolf.”*
Rudyard Kipling

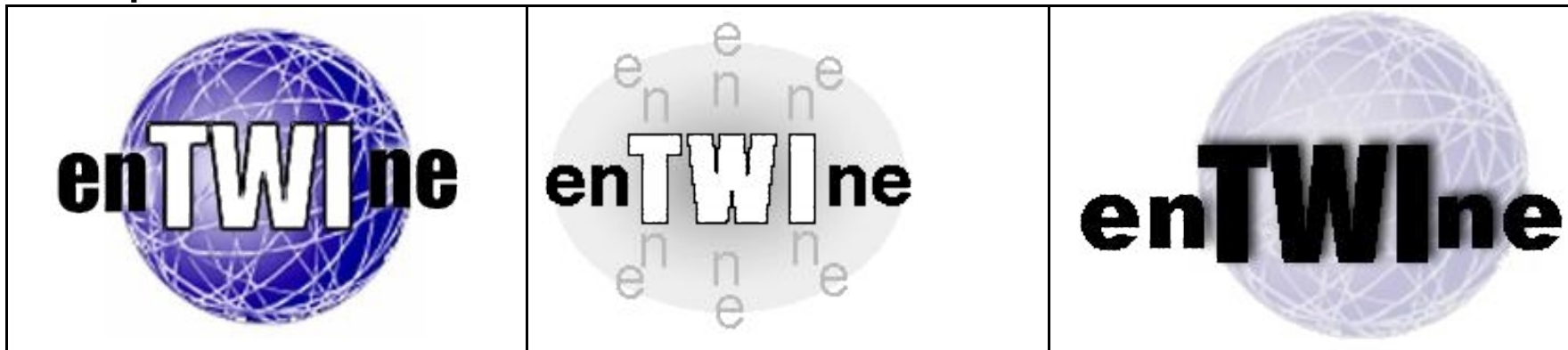
- **social creativity: requires designers not consumers** — domain professionals, discretionary users, and competent practitioners worry about tasks and are motivated to contribute and to create good products
(see: Fischer, G. (1998) "Beyond 'Couch Potatoes': From Consumers to Designers," Asian Pacific Computer Human Interaction Conference (APCHI'98), pp. 2-9
<http://www.cs.colorado.edu/~gerhard/papers/apchi-98.pdf>)
- **requires externalizations/oeuvres to serve as boundary objects**
(see Bruner, J. (1996) "The Culture of Education", Harvard University Press, Cambridge, MA)
- individual **versus** social creativity → individual **and** social creativity
 - not a binary choice
 - explore the relationship between the individual and the social
(e.g., autonomy ↔ collective goals)

Social Creativity in Action: Name and Logo for enTWIne

- Names:

- Jazz
- TWINE (Together **W**e **I**nvent) → ENTWINE → enTWIne

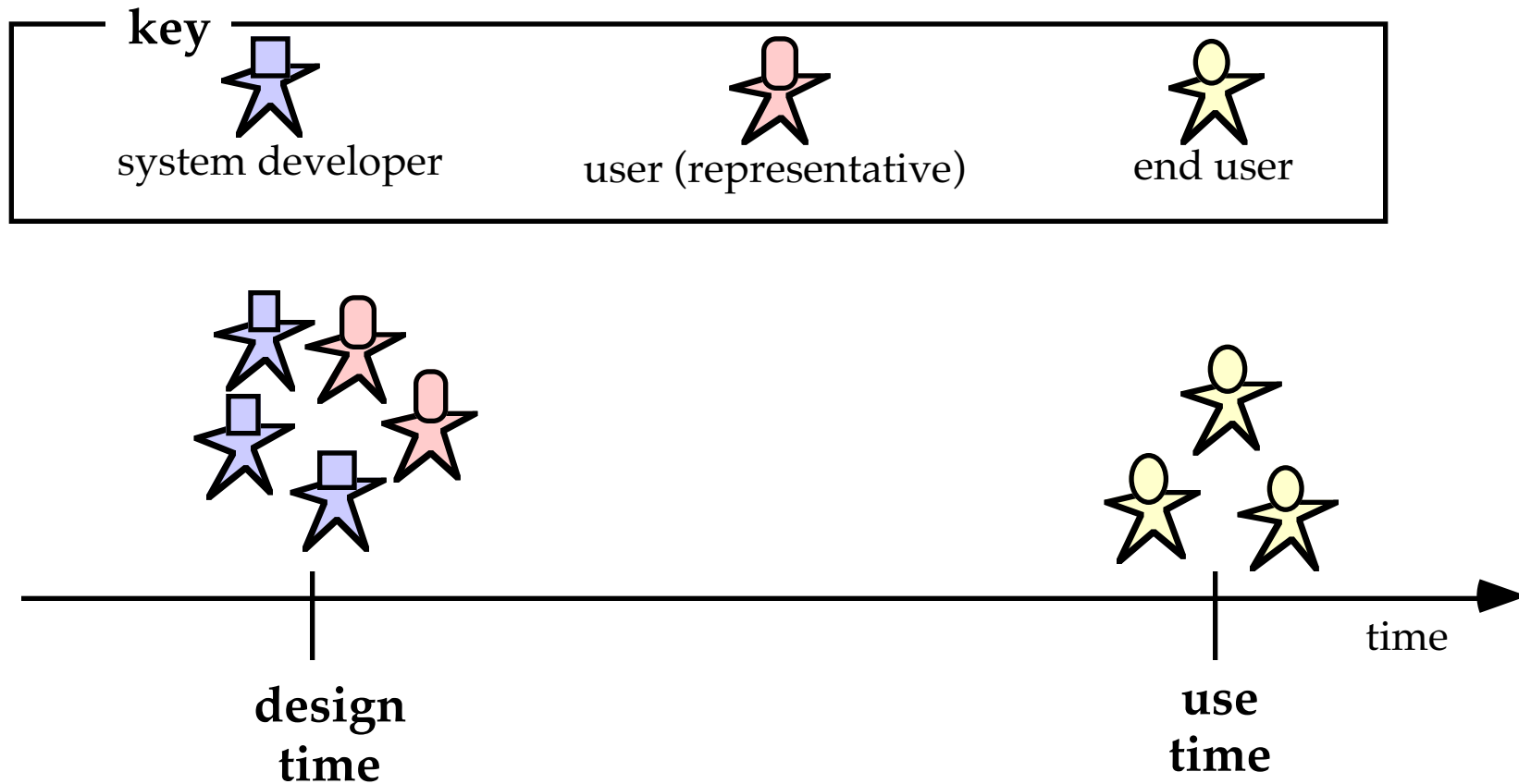
- Graphical Illustrations:



Meta-Design

- **meta-design** = how to create new media that allow users to act as designers and be creative
- **why meta-design?**
 - design as a process is tightly coupled to use and continues during the use of the system
 - address and overcome problems of closed systems
 - transcend a “consumer mindset”
- **impact of meta-design**
 - *“if you give a fish to a human, you will feed him for a day — if you give someone a fishing rod, you will feed him for life” (Chinese Proverb)*
 - can be extended to: “if we can provide someone with the knowledge, the know-how, and the tools for making a fishing rod, we can feed the whole community”

Design Time and Use Time



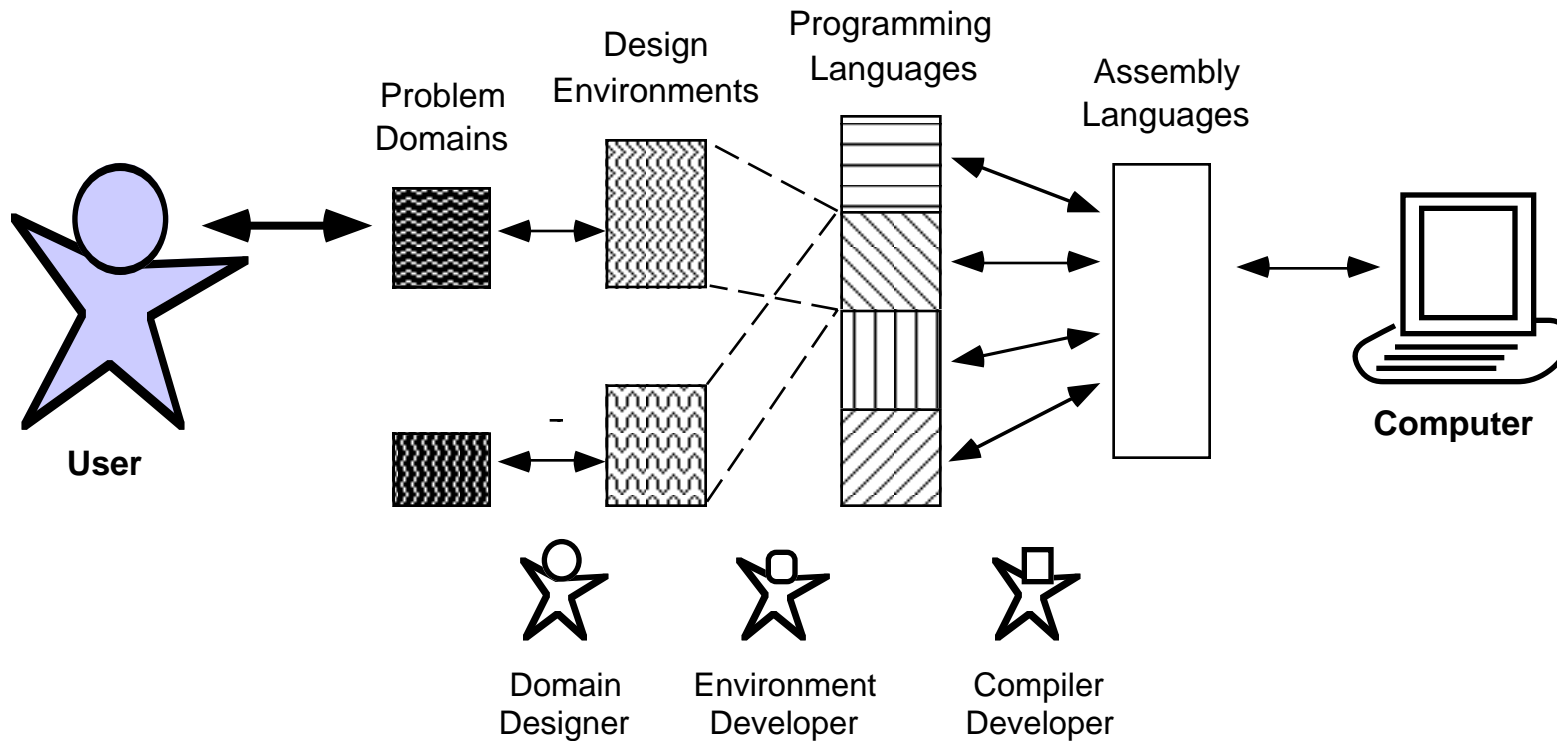
the fundamental challenge: how do you write software for millions of users (at design time), while making it work as if it was designed for each individual user (only known at use time)?

Bridge Objects / Boundary Objects

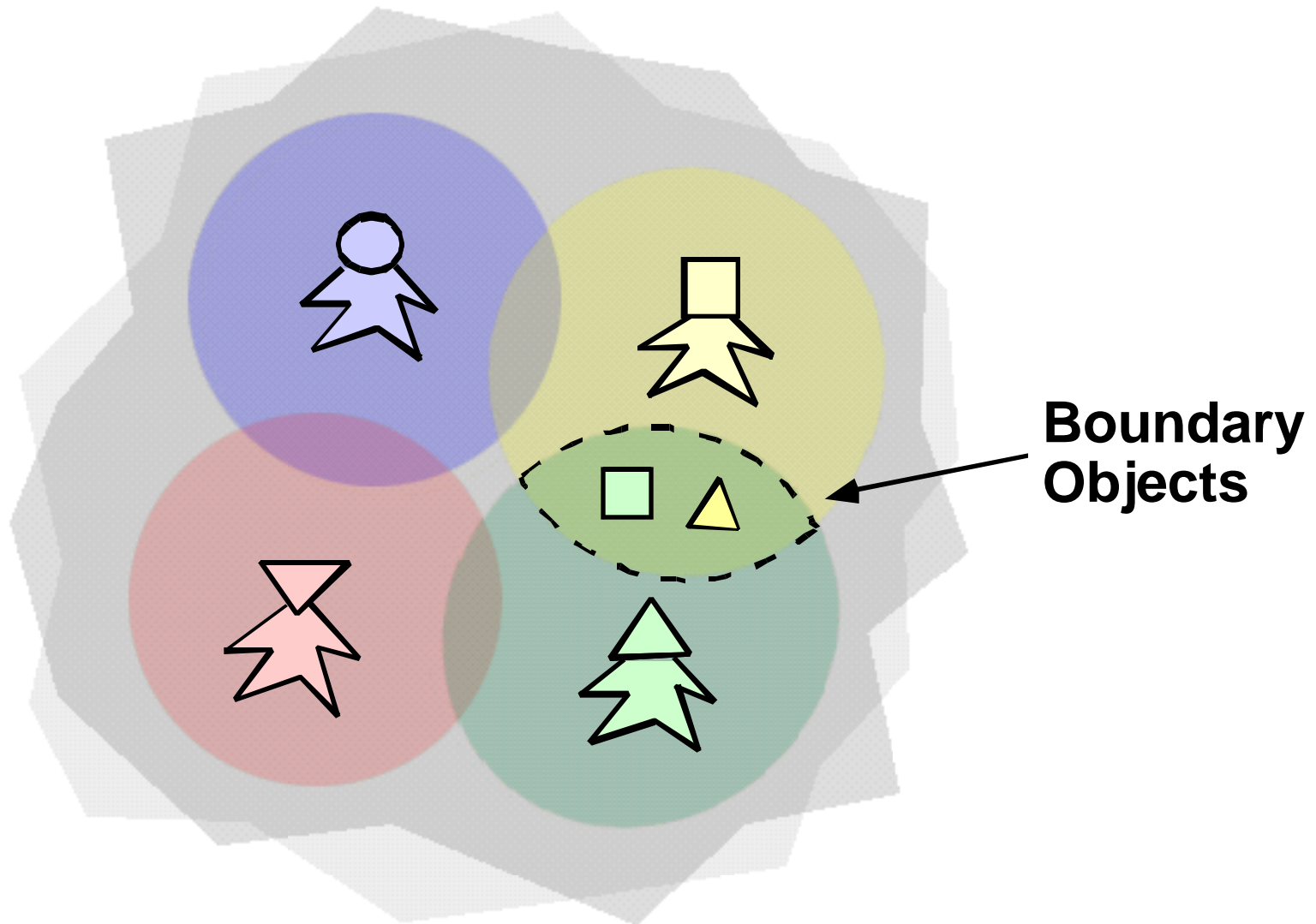
“If a lion could speak would we understand him?” — Wittgenstein

- **boundary objects serve**
 - to communicate and coordinate the perspectives of CoPs brought together for some purpose leading to the formation of a Col
 - the interaction between users and (computational) environments
- perform a **brokering role** involving translation, coordination and alignment between the perspectives of different CoPs
- **examples:**
 - boundary objects can bridge the gap between situation models and system models
 - prototypes serve as boundary objects between developers and users in participatory system design
 - examples: vocabulary problems, help system, software reuse, McGuckin hardware store, ...

A Layered Architecture Supporting Human Problem Domain Interaction

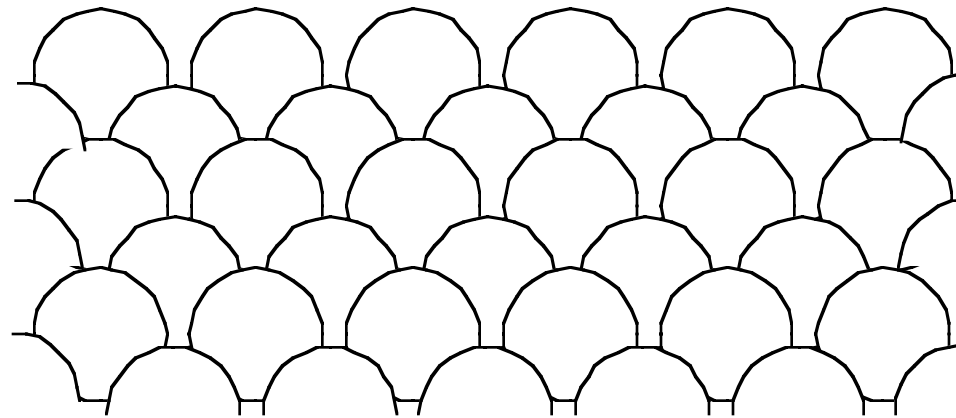


Cols: Social Creativity and Boundary Objects



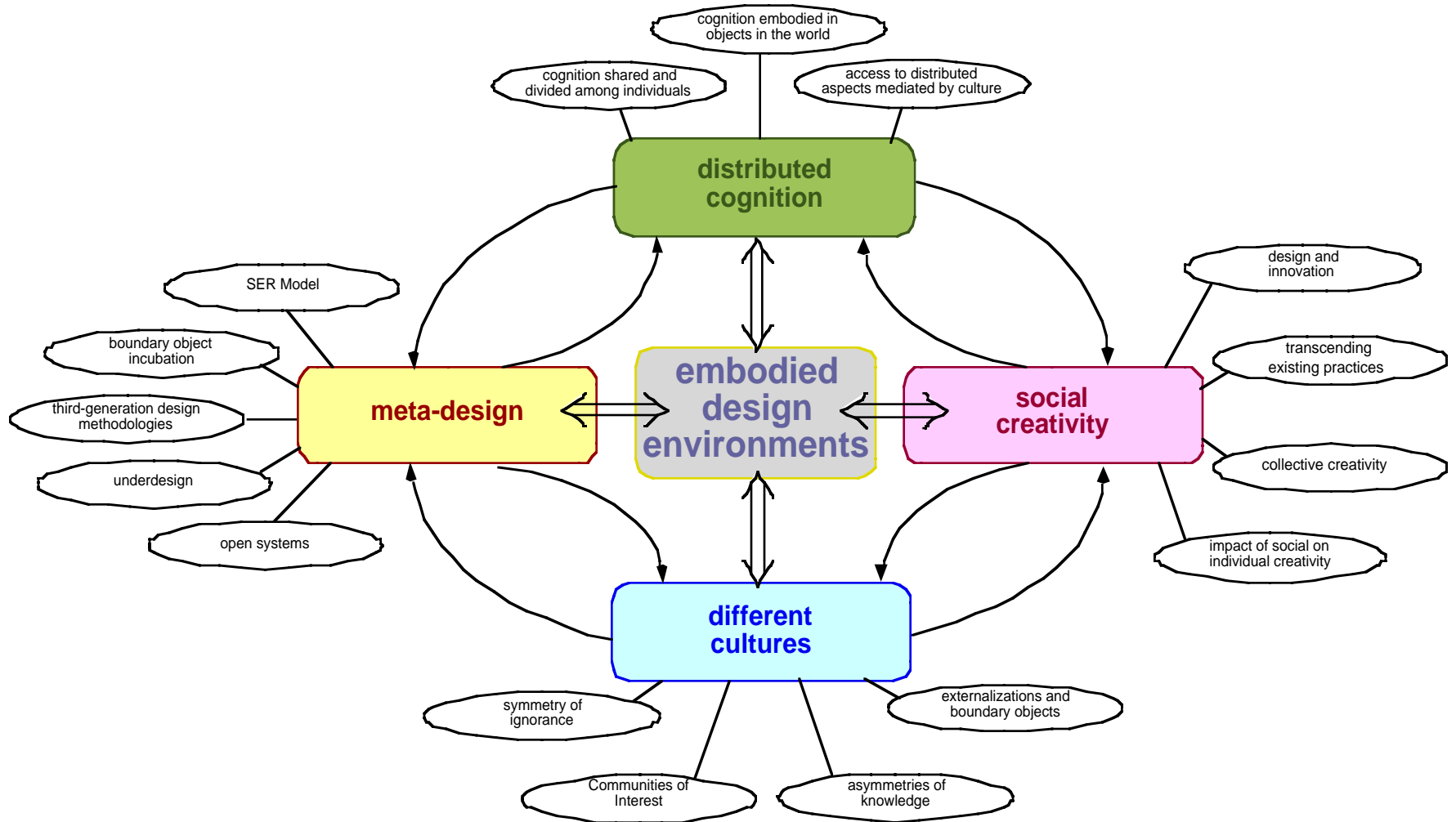
Social Creativity

- “collective comprehensiveness through overlapping patterns of unique narrowness” → Campbell, D. T. (1969) "Ethnocentrism of Disciplines and the Fish-Scale Model of Omniscience." In M. Sherif & C. W. Sherif (Eds.), *Interdisciplinary Relationships in the Social Sciences*, Aldine Publishing Company, Chicago, pp. 328-348.



- “none of us is as smart as all of us” → Bennis, W. & Biederman, P. W. (1997) *Organizing Genius: The Secrets of Creative Collaboration*, Perseus Books, Cambridge, MA.
- “Linux was the first project to make a conscious and successful effort to use the entire world as a talent pool” → Raymond, E. S. & Young, B. (2001) *The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*, O'Reilly & Associates, Sebastopol, CA.

Summary of Conceptual Framework



Examples of Systems Supporting Social Creativity

The Envisionment and Discovery Collaboratory (EDC)

<http://www.cs.colorado.edu/~l3d/systems/EDC>

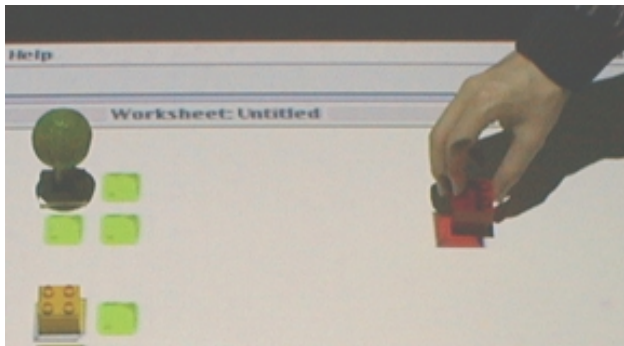
demo on the web: <http://www.cs.colorado.edu/~l3d/systems/EDC/demo/demo01.html>

- **creating shared understanding through collaborative design**
 - symmetry of ignorance, mutual competence, and breakdowns as sources of opportunity
- **integration of physical and computational environments**
 - hardware: electronic whiteboards, crickets
 - software: AgentSheets, Dynasites
 - beyond the screen: immersive environments
- **support for:**
 - social creativity in Cols
 - meta-design and informed participation
 - collaborative design
 - reflection-in-action
 - boundary objects

The Envisionment and Discovery Collaboratory

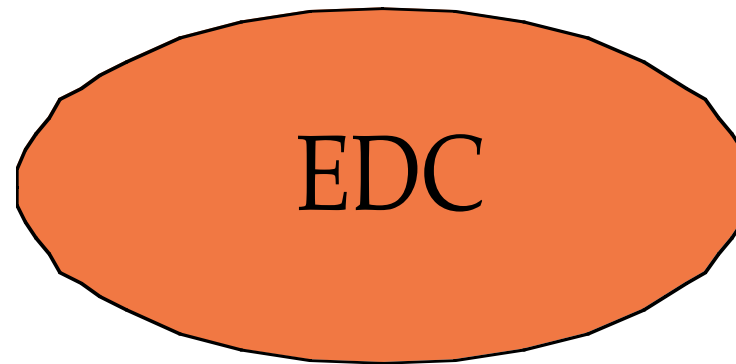


The Envisionment and Discovery Collaboratory



The Envisionment and Discovery Collaboratory

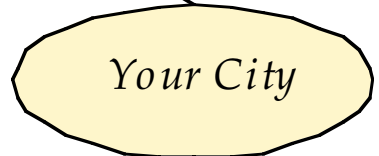
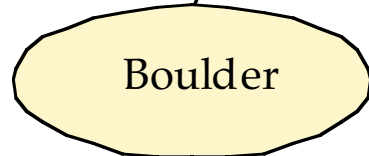
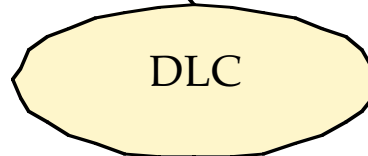
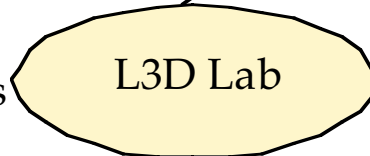
Domain-Independent Architecture



Application Domains



Specific Applications



Meta-Design Aspects in the EDC: Closed versus Open Systems

- **user control:**
 - end-user modifiability
 - conviviality (independence of high-tech scribes)
 - ownership (putting owners of problems in charge)

- **example for a closed system: SimCity** — too much crime
 - solution supported: build more police stations (fight crime)
 - solution not supported: increase social services, improve education (prevent crime)

- **important goal of EDC:** create end-user modifiable versions of SimCity
 - background knowledge can never be completely articulated
 - the world changes

Assessment of EDC_{smartboard}

- **interaction problems:**

- touch-screen designed for single-user-at-a-time (single cursor) interaction, requiring turn taking to avoid errors
- frequent mode errors resulting from “select-object/select-action/perform-action” interaction
- needed to press the object onto the touch screen to make the physical-virtual connection rather than just placing it on top

- **tactile interface provides:**

- Lower threshold for interaction
- Concrete interaction with abstract objects
- Interpersonal engagement (e.g., collaborative script planning)

- **more information** — Hal Eden: “Conceptual and Technological Support for Social Creativity in Face-to-Face Collaboration”, Ph.D. thesis, forthcoming

<<< show movie clip??? >>>

EDC_{pitaboard}: The Participate-In-The-Action (PITA) Board

based on: DGT electronic chessboard, NL; <http://www.dgtprojects.com/>



New Support for Interaction

- **multiple** “points of control” rather than a single interaction cursor
- **parallel** interactions supported
- pieces **sensed automatically** when placed on board

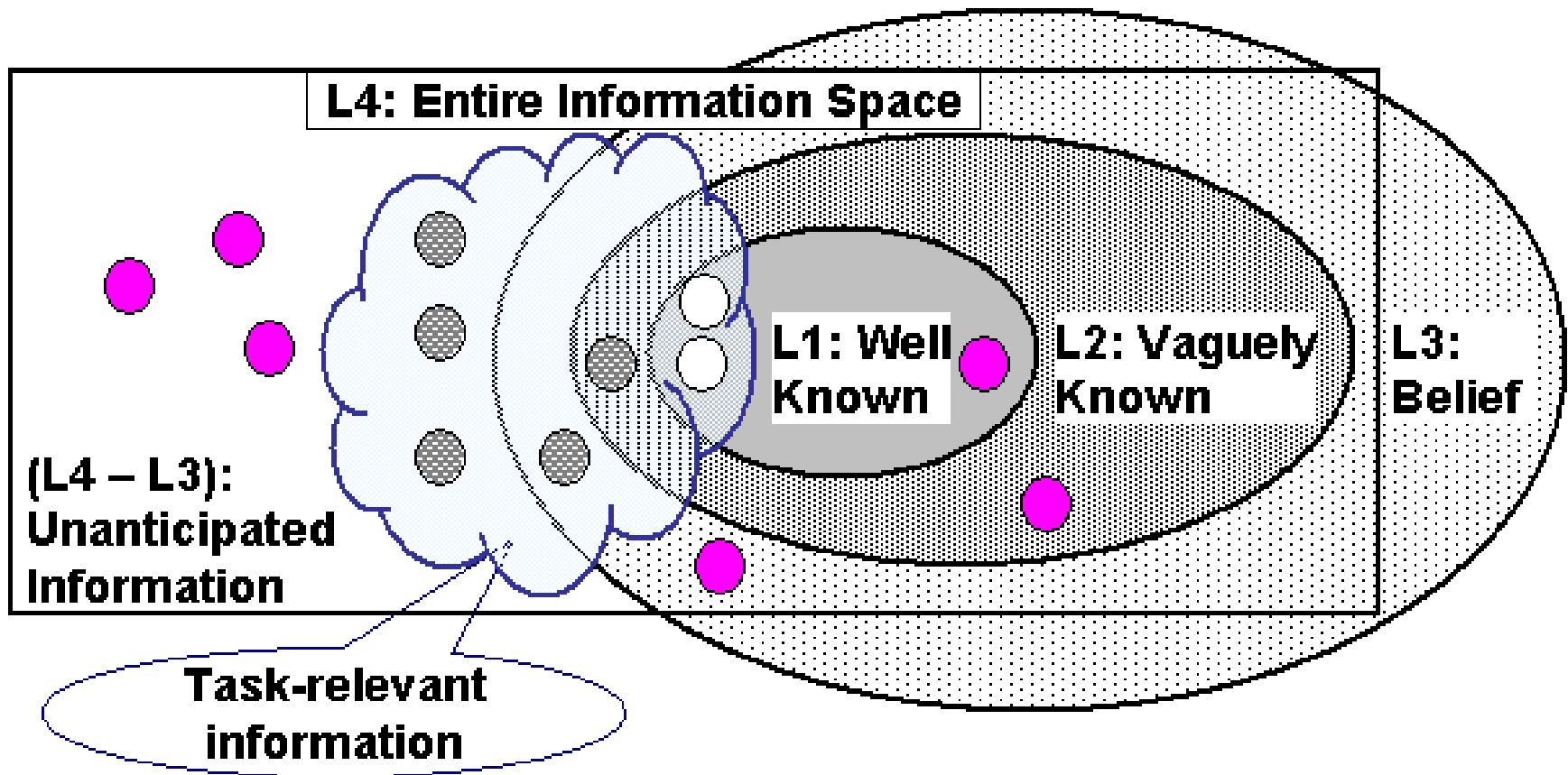
CodeBroker — Personalizing Delivered Information in a Software Reuse Environment

Yunwen Ye — more info at: <http://www.cs.colorado.edu/~yunwen>)

- **thousands of components, constantly evolving**
 - standard Java repository: has grown from 211 classes to more than 2100 classes in 4 years
 - no programmer knows all of them
- **information access does not support programmers who do not actively search for reusable components**
 - unaware of the existence of relevant components
 - unable to locate components
- **delivering personalized components based on task and user modeling techniques**
 - immediate task → task model
 - current development session → discourse model
 - user's knowledge of components → user model

The Fundamental Challenge for Information Delivery

Making Information Relevant to the Task at Hand



Practice and Self-Application

“A major illusion on which the school system rests is that most learning is the result of teaching” — Ivan Illich

- **L3D’s “Undergraduate Research Apprenticeship Program (URAP)”**
 - <http://www.cs.colorado.edu/~l3d/urap/>
 - models: Ph.D. students, community feeling in sports
 - challenges: scalability, cost-effectiveness
- **courses of the future: *supporting evolving learning communities***
 - courses-as-seeds (lessons from social creativity and meta-design to transform our classrooms)
 - <http://www.cs.colorado.edu/~l3d/courses/atlas-2000/>
 - <http://webguide.cs.colorado.edu:3232/atlas>
- **lessons learned**
 - to create a community requires **more than using collaborative technologies**
 - it requires a change of **mindsets**

Assessment

“Who is the beneficiary and who has to do the work?”
Jonathan Grudin

- **what will make people want to engage in social creativity?**
 - requires: culture change, new mindsets, new reward systems
 - organizational rewards
 - social capital
- **self-application of this idea to L3D:**
 - value gained by the individual to contribute to the social is greater than the effort expended
 - barriers with creating and evolving organizational memories:
 - individuals must perceive a direct benefit
 - the effort required to contribute must be minimal so it will not interfere with getting the real work done
- **“collaborative systems will not work in a non-collaborative society”**
 - a student’s observation in one of our classes using technologies to enhance peer-to-peer learning, sharing of information, self-evaluation, etc.
 - collaboration should not be considered as cheating

CoPs and CoIs Models → Shaping our Organizations

- the *Alliance for Technology, Learning, and Society*
 - <http://www.colorado.edu/ATLAS/>
 - new innovative collaborations and learning opportunities between the arts, humanities, science, and engineering
 - new media to support these collaborative efforts and express new ideas

- the **Institute of Cognitive Science**
 - <http://psych-www.colorado.edu/ics/>
 - a **department** (the **CoP** dimension; example: UC San Diego)
 - remaining an **institute** bringing representatives of different departments together (the **CoI** dimension; example: CU-Boulder)

- **School of Design at UC Irvine????**

Industry / University Relationships

Past and Future

- **objective:** create a “win-win” future for all partners
- **old: technology transfer**
 - contracts with detailed specifications
 - exchange of products and financial resources
 - projects of fixed duration with fixed goals provided by industry to universities
- **new: knowledge transfer through symbiotic relationships**
 - human relationships: trust, mutual respect and understanding
 - exploiting the “symmetry of ignorance” as an opportunity for social creativity
 - building long-term relationships

The Basic Message

- some initial frameworks, systems, and reflections on

How can we exploit the **symmetry of ignorance**
in **communities of interest** as a source for **social creativity**?
and
the potential relevance to ISR?