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

Communities of Interest (CoIs):
Learning through the Interaction of Multiple Knowledge Systems

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Overview

- Basic Message / Question
- Center for LifeLong Learning and Design (L^3D)
- Communities of Practice (CoPs)
- Communities of Interest (CoIs)
- Examples from our Work:
  - domain-oriented design environments (DODEs)
  - Envisionment and Discovery Collaboratory (EDC)
  - Participate-In-The-Action (PITA) Board
  - DynaSites
- Conclusions

The Basic Message / Question

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

Brief Introduction of the Major Concepts

- **knowledge systems** — relations and interfaces between the different actors and aspects of knowledge

- **CoPs** — practitioners who work as a community in a certain domain

- **CoIs** — bring different CoPs together to solve a problem
  Remark: CoP ←→ CoI: these are not either/or choices, but points on a continuum (relative to our definitions of "domains and practices")

- **symmetry of ignorance** — in CoIs there is nobody among all the carriers of knowledge (individual person or group) who has a guarantee that her/his knowledge is superior

- **social creativity** —new insights, new ideas, and new artifacts by bringing different points of view together and creating a shared understanding among all stakeholders

- **boundary objects** — perform a brokering role involving translation, coordination, and alignment between the perspectives of *different* CoPs

Knowledge Systems

- **knowledge systems include:**
  - computational systems
  - individual minds
  - knowledge building communities
  - knowledge management repositories
  - relations and interfaces between the above aspects of knowledge

- **human knowledge systems: internal, tacit, conceptual**
  - uniform, homogenous → **CoPs**
  - multiple, heterogenous → **CoIs**

- **computational knowledge systems: externalizations**
  - uniform, homogenous → DODEs
  - multiple, heterogenous → EDC, Participate-In-The-Action (PITA) Board, DynaSites

- Neil Postman: **"One cannot do philosophy with smoke signals"** (in "Amusing Ourselves to Death") → knowledge systems can both enable and constrain our thinking and our ability to express ourselves, and knowledge systems for specific activities and objectives must provide appropriate support

L³D's Research Focus

- **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**
  - knowledge in the head → creating shared understanding, distributed cognition
    - among humans: CoIs, CoPs, boundary objects
    - among humans and tools/media ("virtual stakeholders")
  - 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 → tradition and transcendence**
  - technology → co-evolution of media and new theories about thinking / working / learning / collaborating

Thinking, Learning and Working —The "Wrong" Image?

"The Thinker" by Auguste Rodin (1840-1917)

Individual and / versus Social

"The strength of the wolf is in the pack,
and the strength of the pack is in the wolf."
Rudyard Kipling

- **John-Steiner, V. (2000) "Creative Collaboration**" (Oxford University Press)

  "Rodin's sculpture "The Thinker" dominates our collective imagination as the purest form of human inquiry — the lone, stoic thinker.

  But while the Western belief in individualism romanticizes this perception of the solitary process, the reality is that scientific and artistic forms emerge from the joint thinking, passionate conversations, and shared struggles common in meaningful relationships!

  Many of the collaborators complemented each other, meshing different backgrounds and forms into fresh styles, while others completely transformed their fields.

  The mind — rather than driving on solitude — is clearly dependent upon the reflection, renewal, and trust inherent in sustained human relationships."

- **response from Ernesto Arias (a colleague of mine):**

  "Human interaction is not only needed but central to social creativity, but I do believe that we as individuals, to participate in such collaborative inquiry and creation, need the individual reflective time depicted by Rodin's sculpture. Without such reflection it is difficult to think about contributions to social creativity."

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, and software users
  - Worm Community System (1,400 scientists, 120 labs); to allow distributed scientists to work together on data

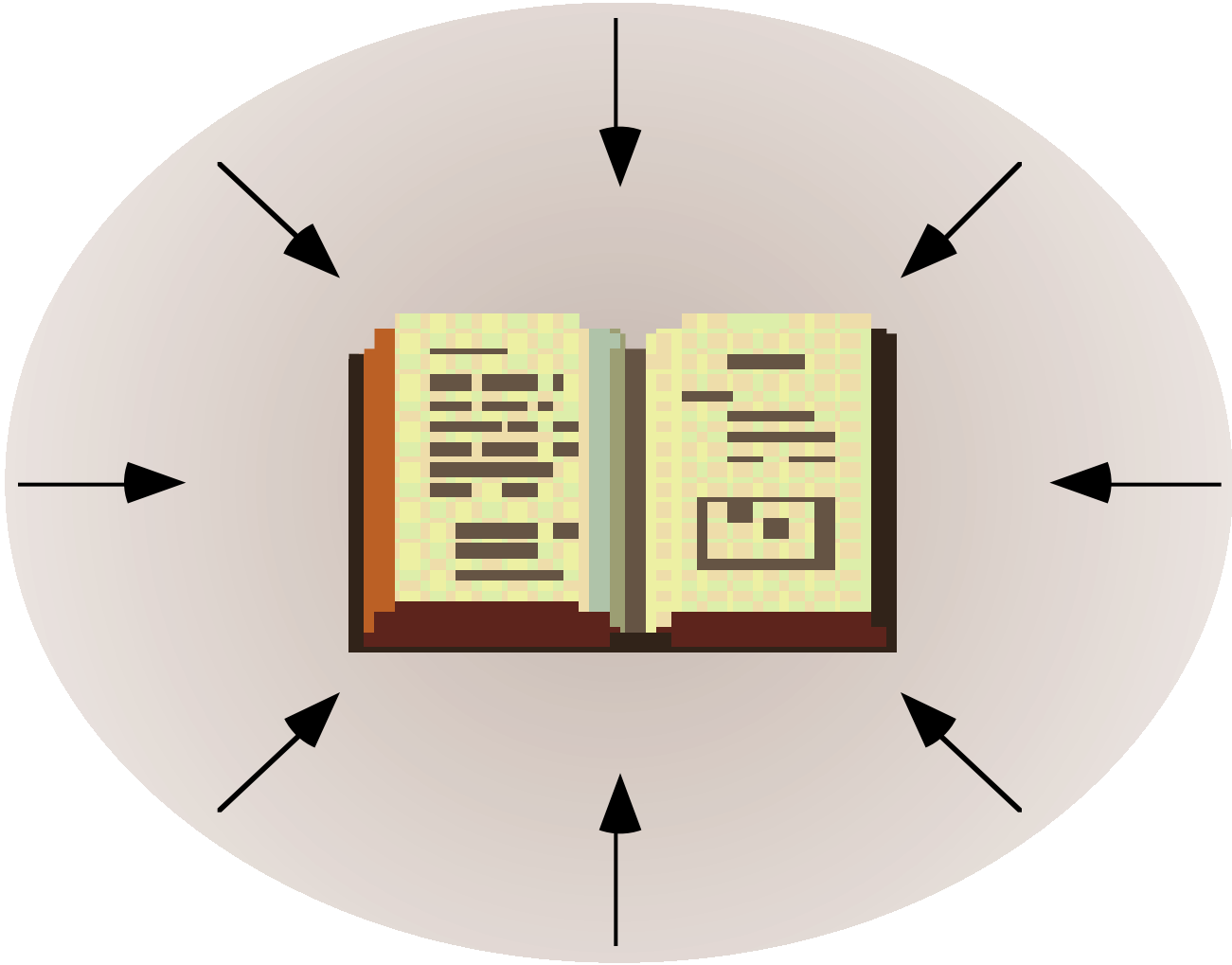
- **learning:**
  - masters and apprentices
  - legitimate peripheral participation (LPP)
  - develop a notion of belonging

- **problems:**
  - *"Group-Think"* → when people work together too closely in communities, they sometimes suffer illusions of righteousness and invincibility
  - human behavior is determined by the community's norms, rules and incentives which we have accepted when we decided to enter it

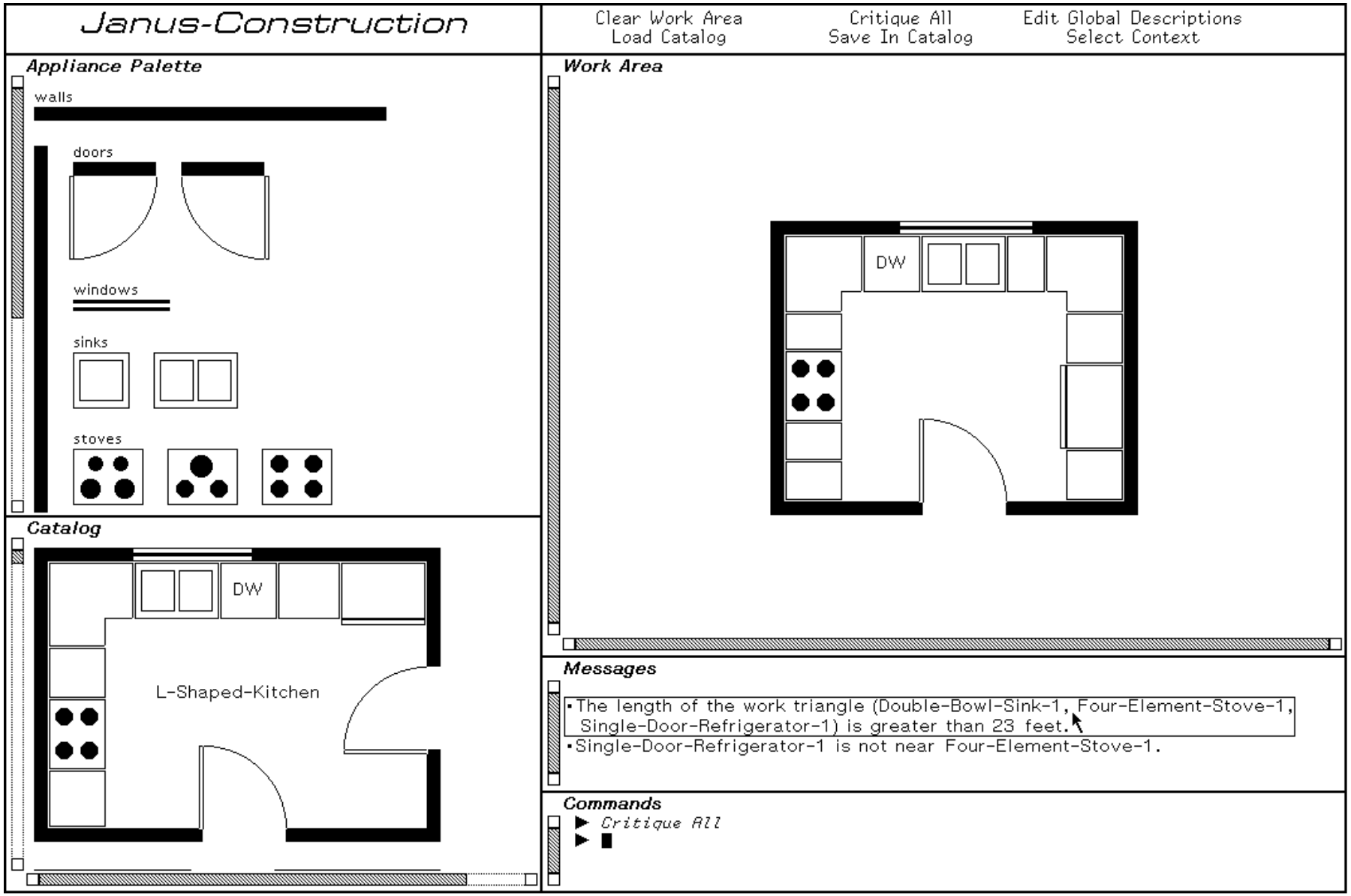
- **DODEs**: systems supporting CoPs
  (examples: kitchen design, computer network design)

Community of Practice

one accepted, well-established center (of expertise) and
a clear path of learning towards this center



A DODE for Kitchen Design: Construction



A DODE for Kitchen Design: Argumentation

Janus-Argumentation

Answer (Refrigerator, Sink, Stove)

The distance between sink, stove and refrigerator, the *work triangle*, should be less than 23 feet.

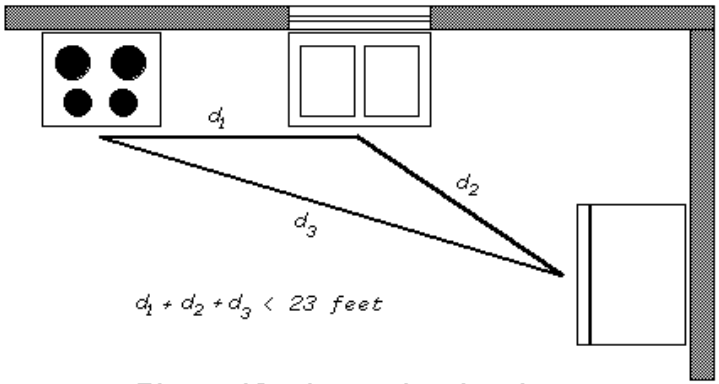


Figure 10: the work triangle

Argument (Walking Distance)

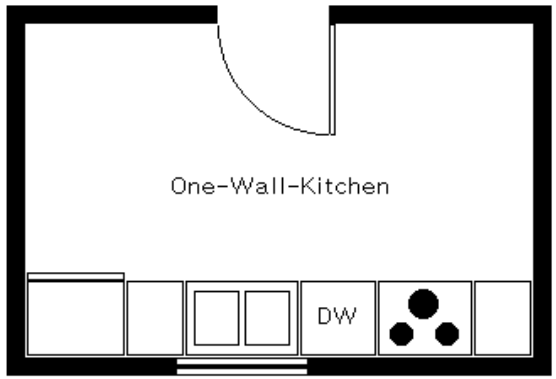
The work triangle is an important concept in kitchen design. The work triangle denotes the center front distance between the three main appliances: *sink*, *stove* and *refrigerator*. This length should be less than 23 feet to avoid unnecessary walking and to ensure an efficient work flow in the kitchen!

Argument (Small Room)

In small kitchens where the work triangle is less than 16 feet.

Viewer: Default Viewer

Catalog Example



The length of the work triangle (Stove, Refrigerator, Sink) is less than 23 feet.

Visited Nodes

⇒ Answer (Refrigerator, Sink, Stove) Section

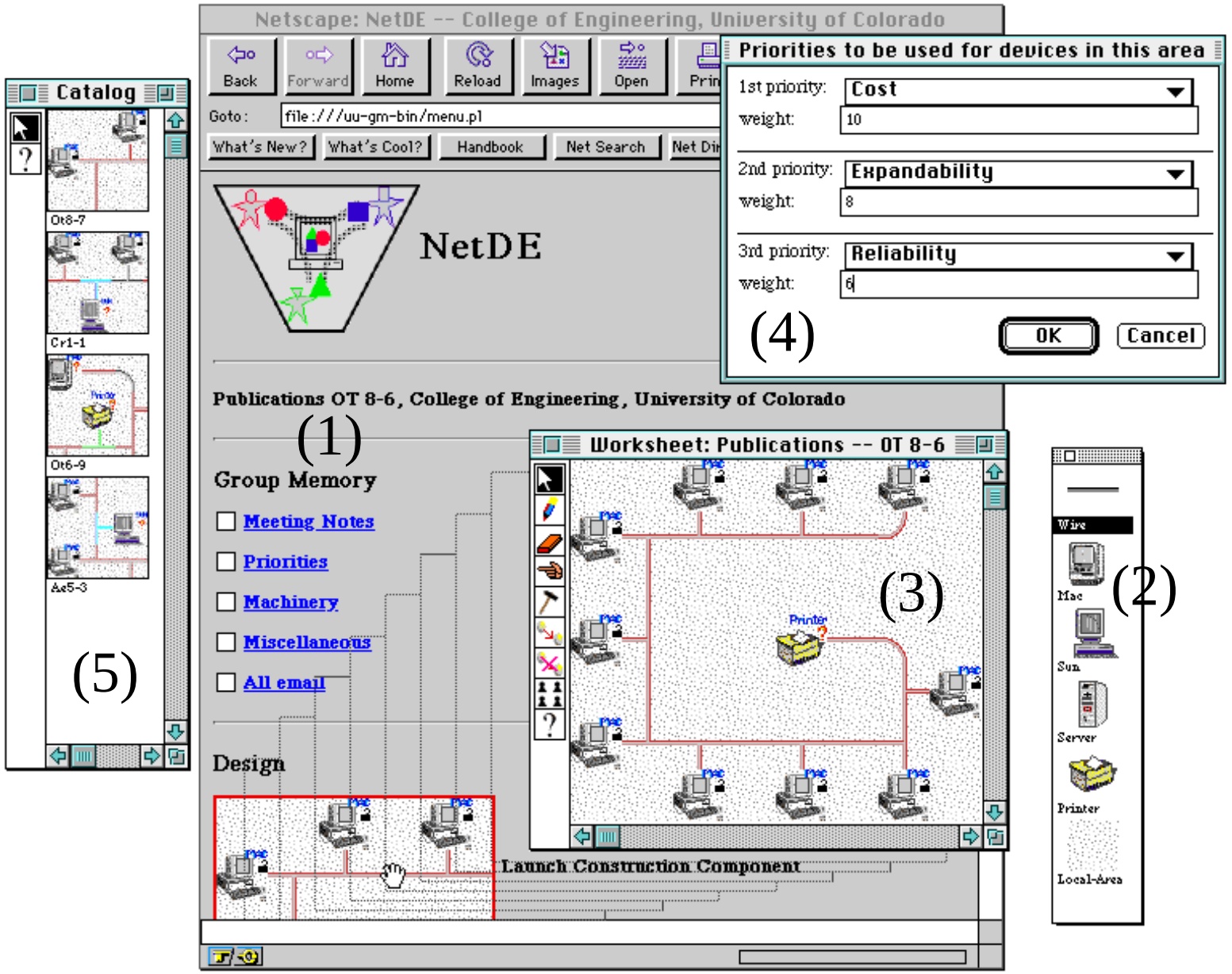
Commands

Show Example: "Answer (Refrigerator, Sink, Stove)"
Show Example Answer (Refrigerator, Sink, Stove)

Show Outline
Search For Topics
Show Argumentation
Show Context

Resume Construction
Show Construction
Show Example
Show Counter Example

A DODE for Computer Network Design



Communities of Interest (CoIs)

—

Heterogeneous Design Communities

"Innovations come from outside the city wall."

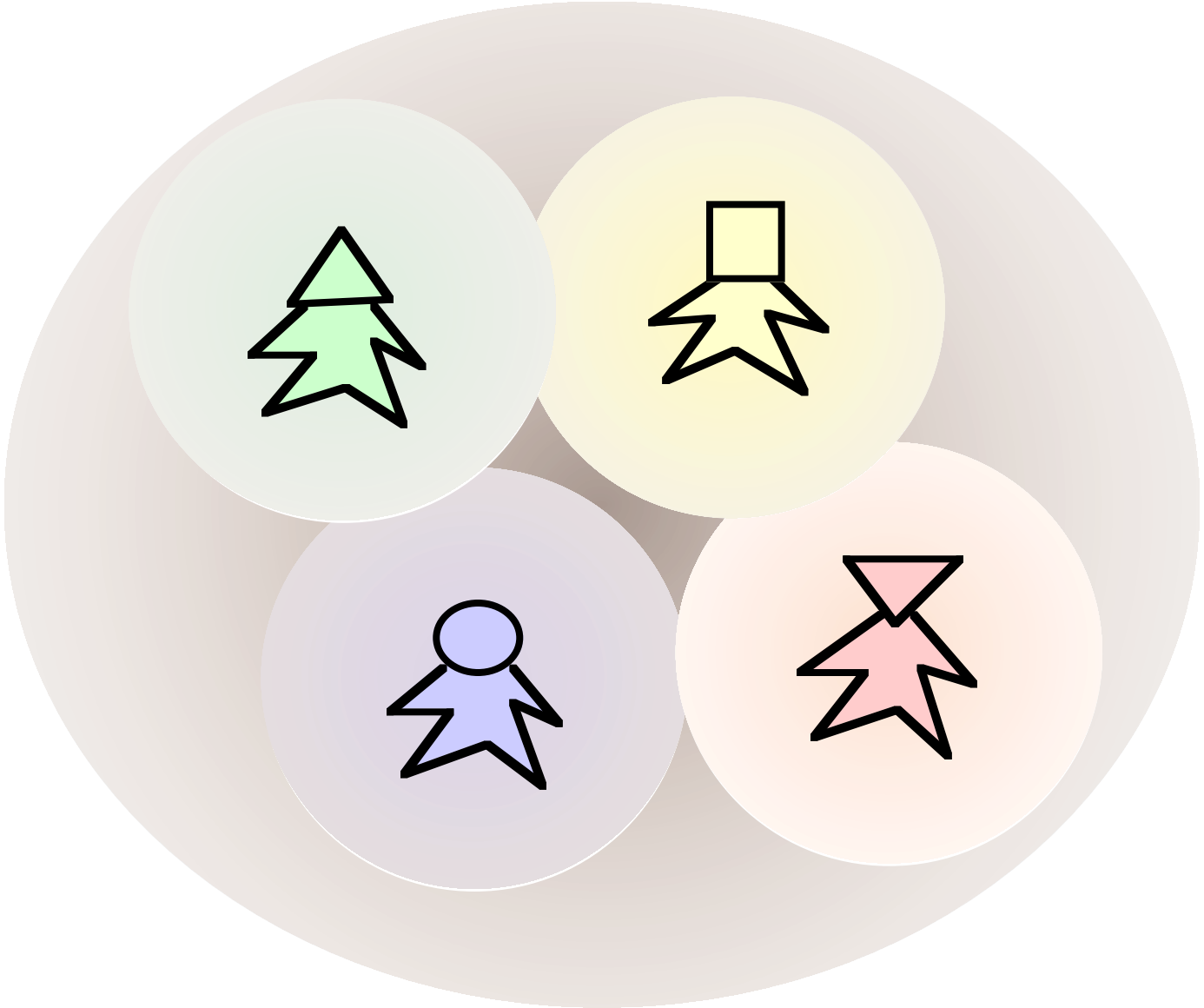
- **CoIs** = bring different CoPs together to solve a problem

- **membership** in CoIs 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

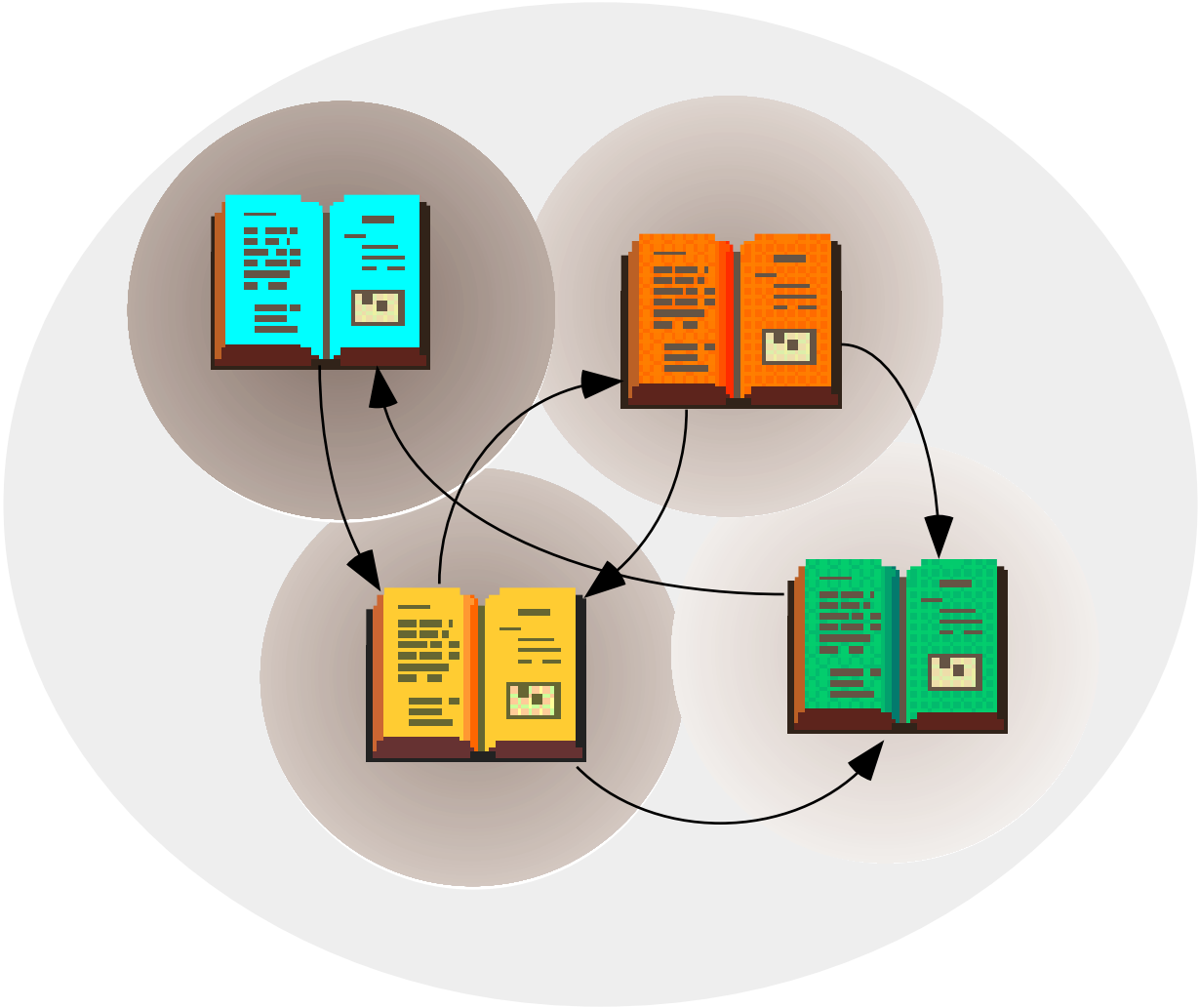
- **fundamental challenges:**
  - establish a common ground
  - building a shared understanding of the task at hand
  - learning to communicate with and learn from others who have a different perspective and a different vocabulary for describing their ideas

CoIs: Bringing Together Multiple CoPs



CoIs: Multiple Centers of Expertise and Shifting Objectives

several centers of expertise which emerge, change and drift and
no single, clear path of learning



Social Creativity and "Symmetry of Ignorance"

—

Sources of Power for CoIs

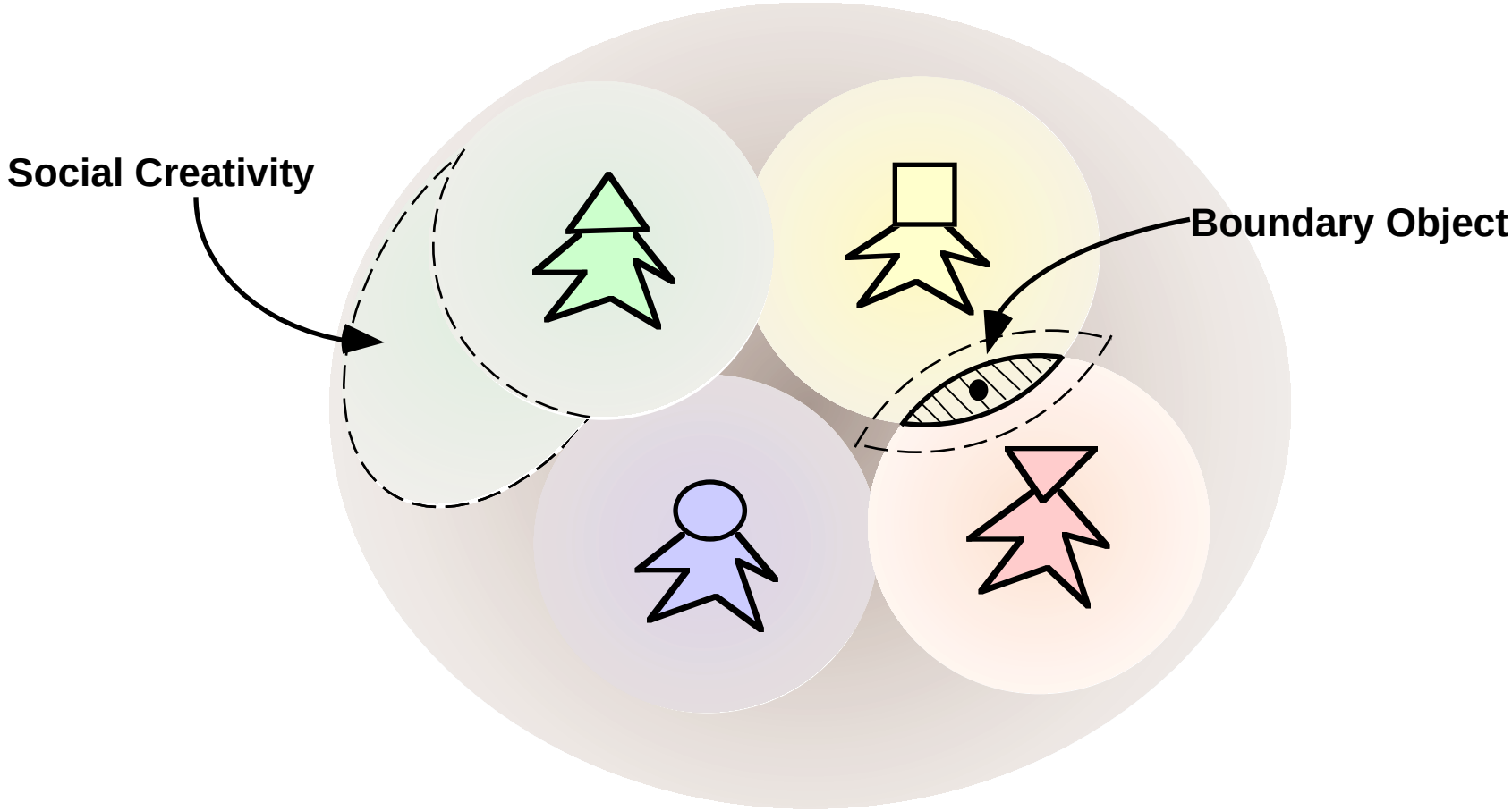
- **the Renaissance scholar does not exist anymore** — the individual human mind is limited (there is insufficient time to become a Renaissance scholar today — learners are forced to make choices, focus attention, and specialize)

- **distinct domain of human knowledge exist** (C. P. Snow) — of critical importance: mutual appreciation, efforts to understand each other, increase in socially shared cognition and practice

- **a "group has no head"** — externalizations are critically more important for groups and organizations than for individuals

- **create boundary objects** (shared objects to "talk about" and to "think with") by exploiting the *"symmetry of ignorance"* as an opportunity for mutual learning

CoIs: Social Creativity and Boundary 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 CoI
  - the interaction between users and (computational) environments
  - see: Star, S. L. (1989): "The Structure of Ill-Structured Solutions: Boundary Objects and Heterogeneous Distributed Problem Solving." In L. Gasser & M. N. Huhns (Eds.), Distributed Artificial Intelligence, CA, pp. 37-54

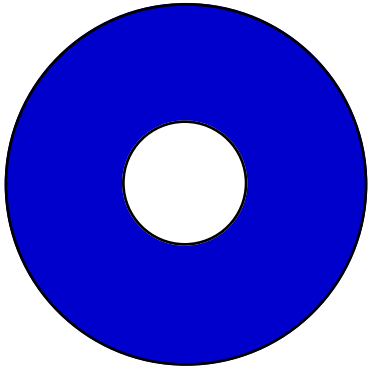
- perform a **brokering role** involving translation, coordination and alignment between the perspectives of different CoPs

- **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 (see: Ostwald, J. (1996): *Knowledge Construction in Software Development: The Evolving Artifact Approach*, Ph.D. Dissertation, Department of Computer Science, University of Colorado at Boulder)

The Gap between Situation and System Models

Situation Model

ring
doughnut
tire
wheel
washer



Application Units

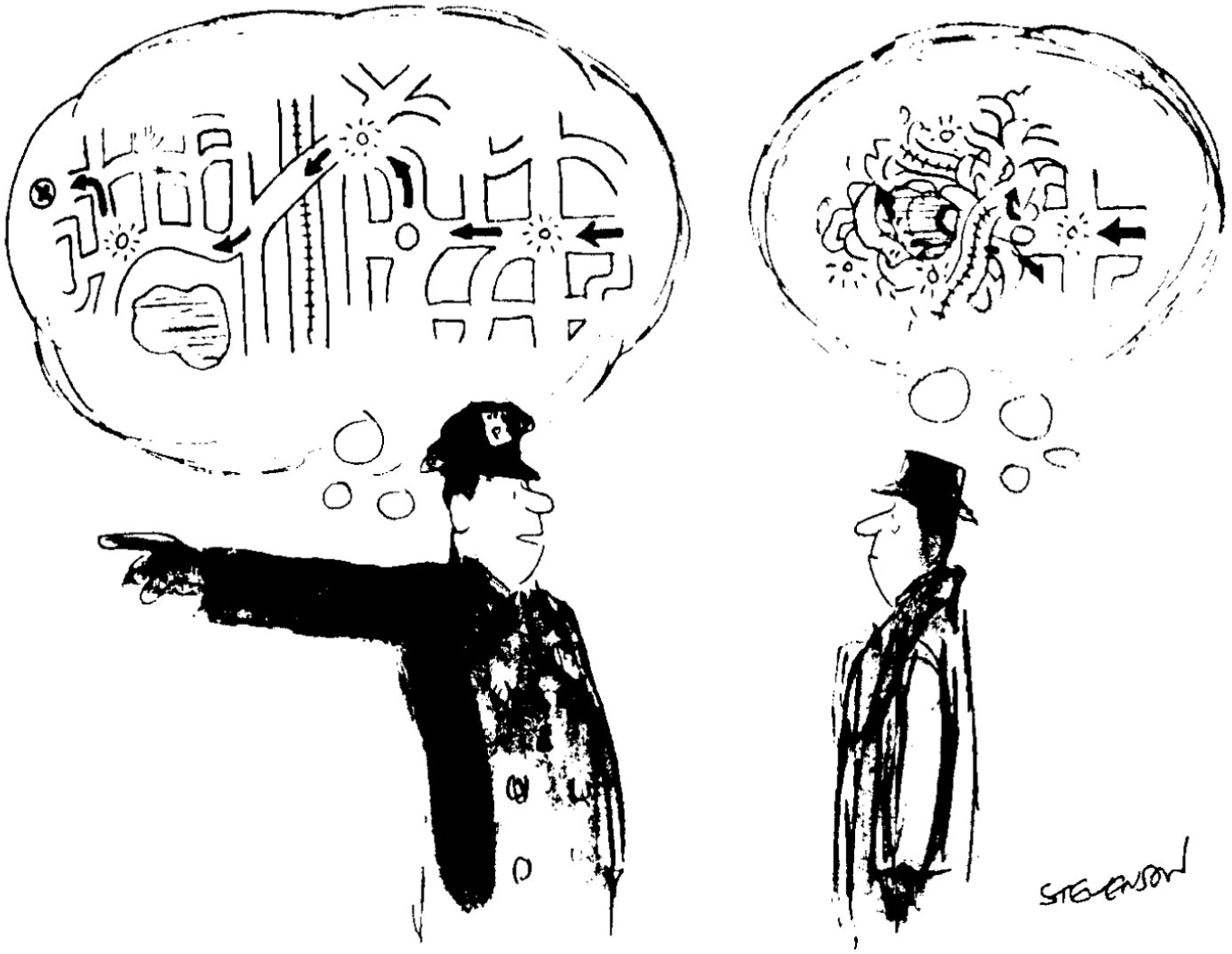
System Model

- Symbolics:
(graphics: draw-cricle
x-center y-center radius inner-radius)

- Fortran package:
CALL BLCIR (xcntr,ycntr,radius)
CALL SHADE (xcrds, ycrds, npts,angle,
gaps,ngaps,0,0)

Implementation Units

Communication Problems Based on Missing Boundary Objects



The Envisionment and Discovery Collaboratory (EDC)

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

- **creating shared understanding through collaborative design**
  - symmetry of ignorance, mutual competence, and breakdowns as sources of opportunity

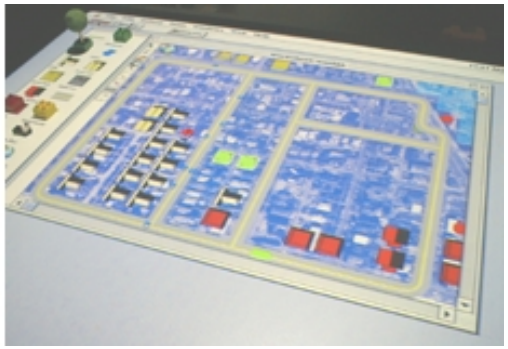
- **integration of physical and computational environments**
  - support and exploit face-to-face collaboration
  - hardware: touch-sensitive electronic whiteboards, crickets
  - software: AgentSheets, DynaSites
  - beyond the screen: immersive environments

- **support for reflection-in-action**
  - action space: AgentSheets, Visual AgenTalk
  - reflection space: DynaSites, WWW

- **open system —** seeding, evolutionary growth, reseeding process model

The Envisionment and Discovery Collaboratory (EDC)

The Envisionment and Discovery Collaboratory



Boundary Objects and the EDC

- **physical and computational languages to "think-with" and to "act-with"** —a common language meaningful to all stakeholders
- **simulations** —dynamic feedback meaningful to all stakeholders
- **reflection spaces** —explicit information helping stakeholders remember what they have learned and to consider other perspectives
- **open, evolvable tools** — capturing important information not anticipated at system design time by encouraging a culture of participation, that addresses the open-ended nature of problems

The Participate-In-The-Action (PITA) Board

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

- supporting alternative ***processes*** (in addition to the EDC) to create ***content***

Differences between DODEs and the EDC

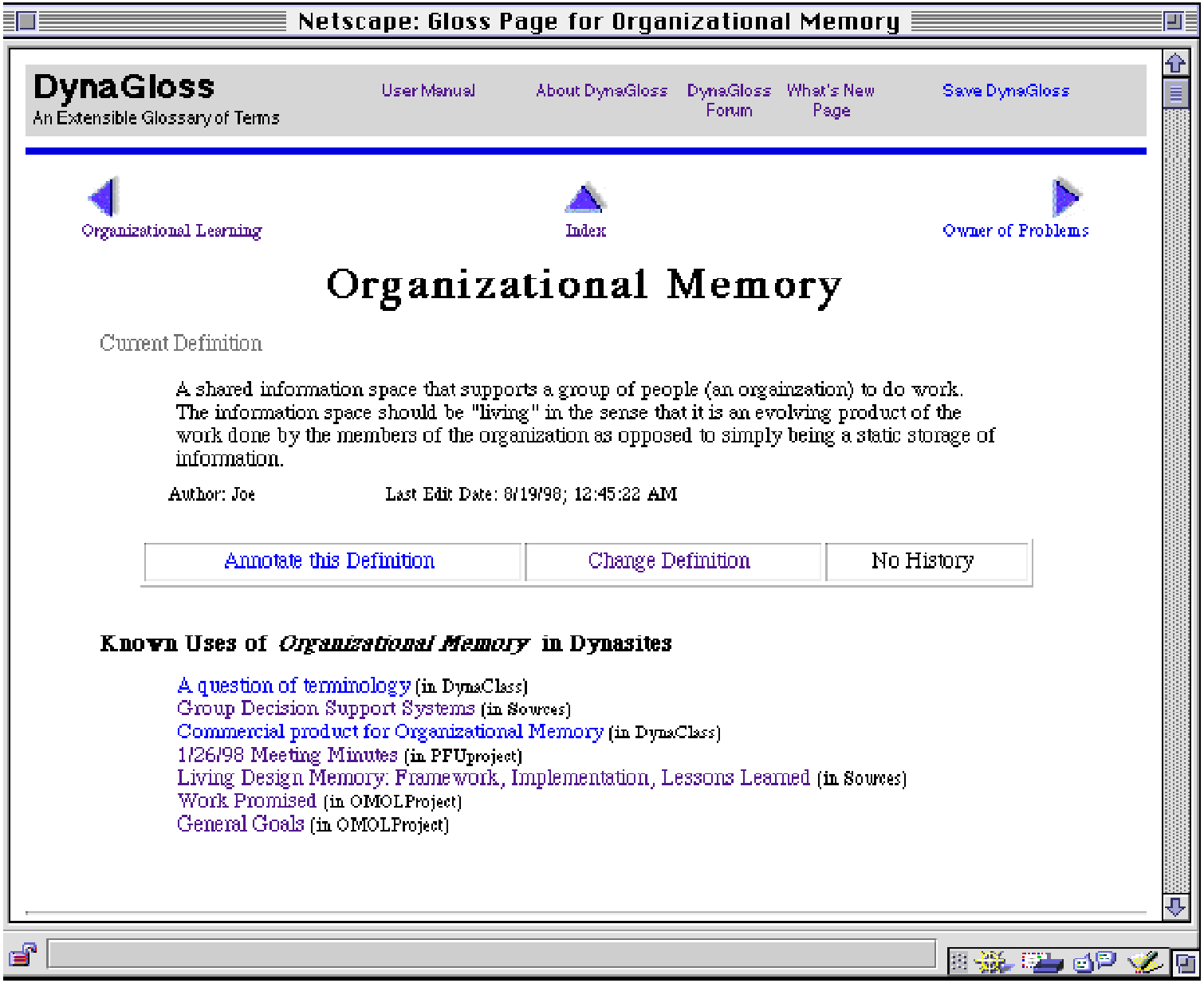
User Communities	Problems and Artifacts	Knowledge Development	Interaction	Support
CoPs	different tasks in the same domain and uniform representations	refinement of *one* knowledge system	indirect (through systems and artifacts)	DODEs
CoIs	multiple domains and different representational schemes	synthesis and mutual learning through the integration of *multiple* knowledge system	face to face, mediation by physical and computational objects	EDC

http://Seed.cs.colorado.edu/dynasites.Documentation.fcgi$node=dynasites.doc.home

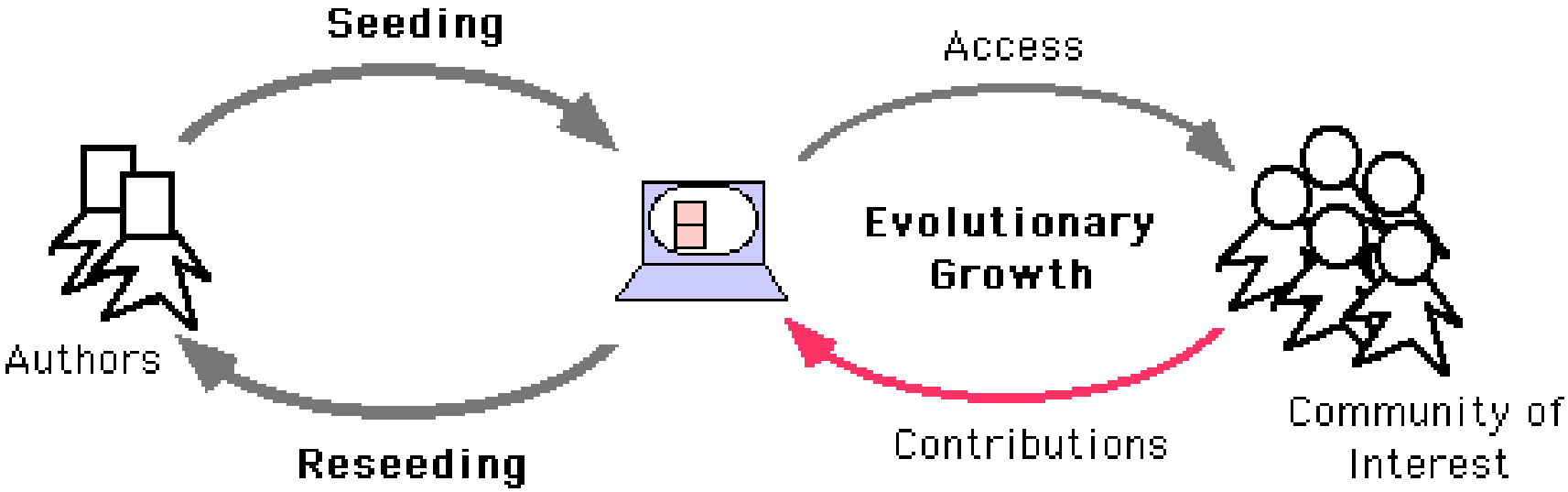
- dynamic, extensible and integrated web-based information spaces

- supports the collaborative creation and evolution of artifacts through which communication can take place

- **examples:**
  - **Dynagloss** — a decentralized, dynamically evolved space of concepts
  - **Living Book** — an information space evolving as a side effect of interaction between readers
  - **DynaClass** —a DynaSites document type developed for class discussions and workshops


Netscape: Gloss Page for Organizational Memory
DynaGloss
An Extensible Glossary of Terms
User Manual
About DynaGloss
DynaGloss Forum
What's New Page
Save DynaGloss
Organizational Learning
Index
Owner of Problems
Organizational Memory
Current Definition
A shared information space that supports a group of people (an orgainzation) to do work. The information space should be "living" in the sense that it is an evolving product of the work done by the members of the organization as opposed to simply being a static storage of information.
Author: Joe
Last Edit Date: 8/19/98; 12:45:22 AM
Annotate this Definition
Change Definition
No History
Known Uses of Organizational Memory in Dynasites
A question of terminology (in DynaClass)
Group Decision Support Systems (in Sources)
Commercial product for Organizational Memory (in DynaClass)
1/26/98 Meeting Minutes (in PFUproject)
Living Design Memory: Framework, Implementation, Lessons Learned (in Sources)
Work Promised (in OMOLProject)
General Goals (in OMOLProject)

The LivingBook Model



- **LivingBook:**
  - aims to blur the traditional **distinction between readers and authors**
  - engages a **community of interest** who will enrich the seed with new ideas and new connections to related information
- **seed:** a starting point for conversations and debates of the ideas it contains
- **evolutionary growth:** use will result in a growth of the information space
- **reseeding:** periodically, the LivingBook will be **reseeded** to incorporate the new ideas and information constructed during the evolutionary growth phase

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)

- **the Center for LifeLong Learning and Design (L^3D)**
  http://www.cs.colorado.edu/~l3d/
  - a CoP based on a shared history and the use of concepts and system developments as shared reference points
  - makes every conscious effort to exploit the strengths of CoIs
  - creates a community without “boundaries” and with “no walls around it”
  - co-evolution of theories, systems, practice, and assessment

Conclusions

- CoPs and CoIs are **two important forms of communities**
- the **knowledge systems** supporting CoPs and CoIs are different
- CoIs pose a number of **new challenges**
  - we need to find ways (e.g., boundary objects) to deal with cross-cutting identities, different value systems, and different notations
  - diversity causes difficulties, but it also provides unique opportunities
  - the dual goal of creating an object understandable by every participating stakeholder and at the same time making an important contribution to a specific CoP is not easily achieved
  - CoIs support pluralistic societies which can cope with complexity, contradictions, and a willingness to allow for differences in opinions
- **in summary the basic message of my presentation:**

some initial frameworks, systems, and reflections how "to exploit the symmetry of ignorance in COIs as a source for social creativity"