



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

Shared Understanding, Informed Participation, and Social Creativity

Objectives for the Next Generation of Collaborative Systems

Gerhard Fischer

Center for LifeLong Learning & Design (L³D)

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

Department of Computer Science and Institute of Cognitive Science

University of Colorado, Boulder

**COOP'2000: Fourth International Conference on the Design of Cooperative
Systems, Sophia Antipolis, France, May 23-26, 2000**

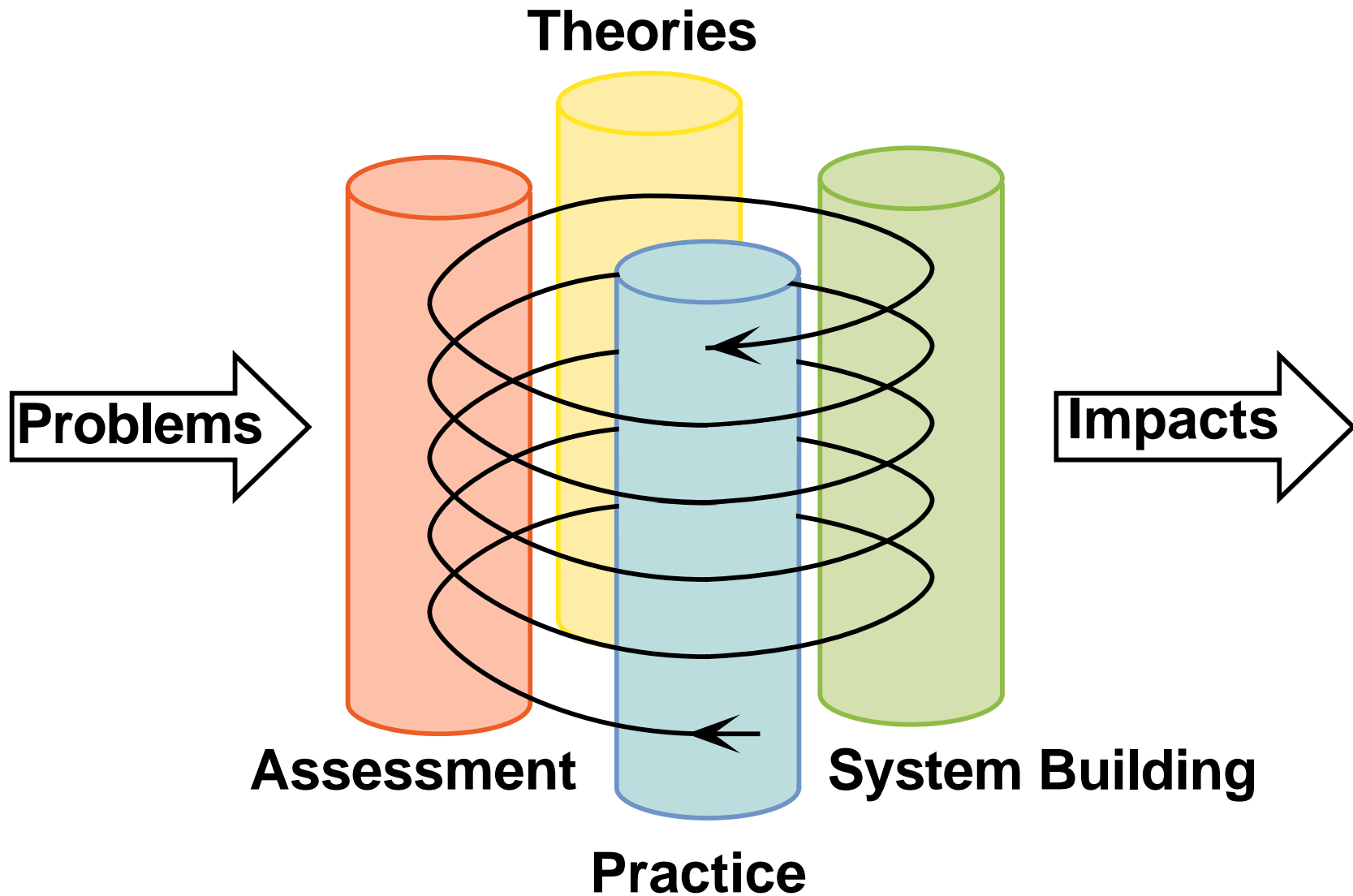
Thank You

- **former and current Ph.D. students**
- **members and visitors of the Center for Lifelong Learning & Design (L3D), Computer Science Department, and Institute of Cognitive Science, CU-Boulder — see presentation at COOP'2000 by:**
 - Tammy Sumner, Simon Buckingham Shum, Mike Wright, Nathalie Bonnardel
 - Skip Ellis
 - Thomas Herrmann and Kai-Uwe Loser
- **collaborating organizations and companies**
 - NYNEX Science & Technology
 - IBM Boulder and IBM Yorktown
 - DaimlerChrysler Research, Ulm
 - Boulder County Healthy Community Initiative, Boulder
 - Discovery Learning Center Design Team, CU-Boulder
- **COOP'2000 conference organizers for inviting me**
 - COOP'95: paper presentation
 - COOP'96 + COOP'98 & COOP'2000 program committee

Overview

- **Problems**
- **Collaborative Systems: an Integrated Approach**
 - Theoretical Framework
 - Systems / Examples
 - Practice
 - Assessment
- **Objectives**
- **Conclusions**

Collaborative Systems: An Integrated Approach



The Collective (Human) Mind

- **basic assumption:** people think, work, and learn in conjunction or partnership with others and with the help of culturally-provided tools and artifacts
- **practicality of a theory:** for a conceptual framework or theory of collaborative systems to be interesting, to inspire, to guide, and to inform the development of new media → it should contain some specifications on how social interaction can be *improved or altered in some significant way*
- **collaborative systems:** a *distributed cognition* view including concepts and objectives such as:
 - shared understanding
 - informed participation
 - social creativity

L3D's Perspective

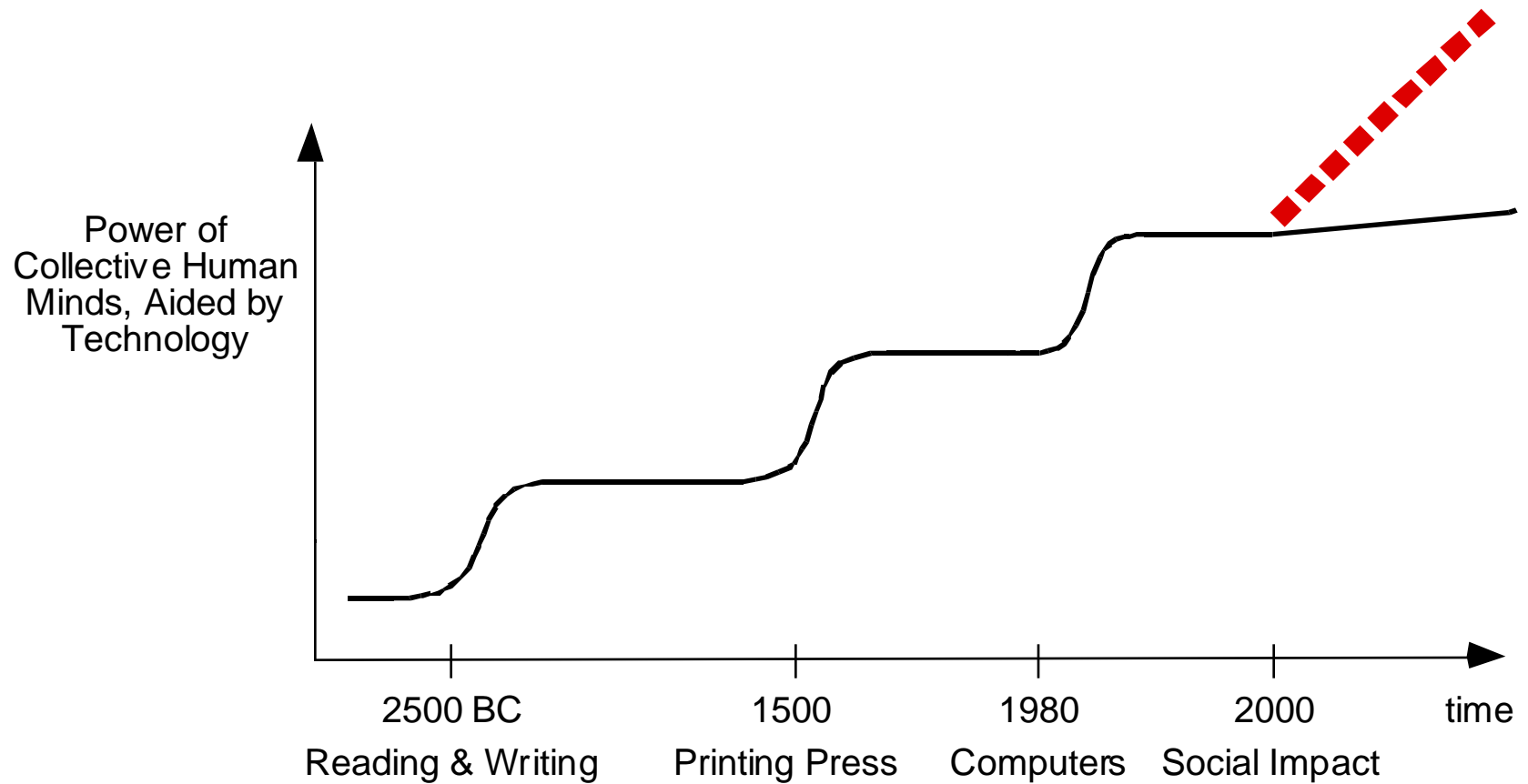
(creating a spectrum, rather than a replacement)

- learning is an individual process → **learning is a social activity**
- learning has a beginning and an end → **making learning a part of life**
- learning is separated from the rest of our activities → **integration of playing, working and learning**
- learning is the result of teaching → **learning emerges from collaborative problem solving and design**
- reflection in the mind → **the isolated mind is not powerful enough for reflection (conversations with externalizations, critiquing)**

Thinking, Learning and Working —The “Wrong” Image?



The Aided, Collective Human Mind — Exploiting the Social



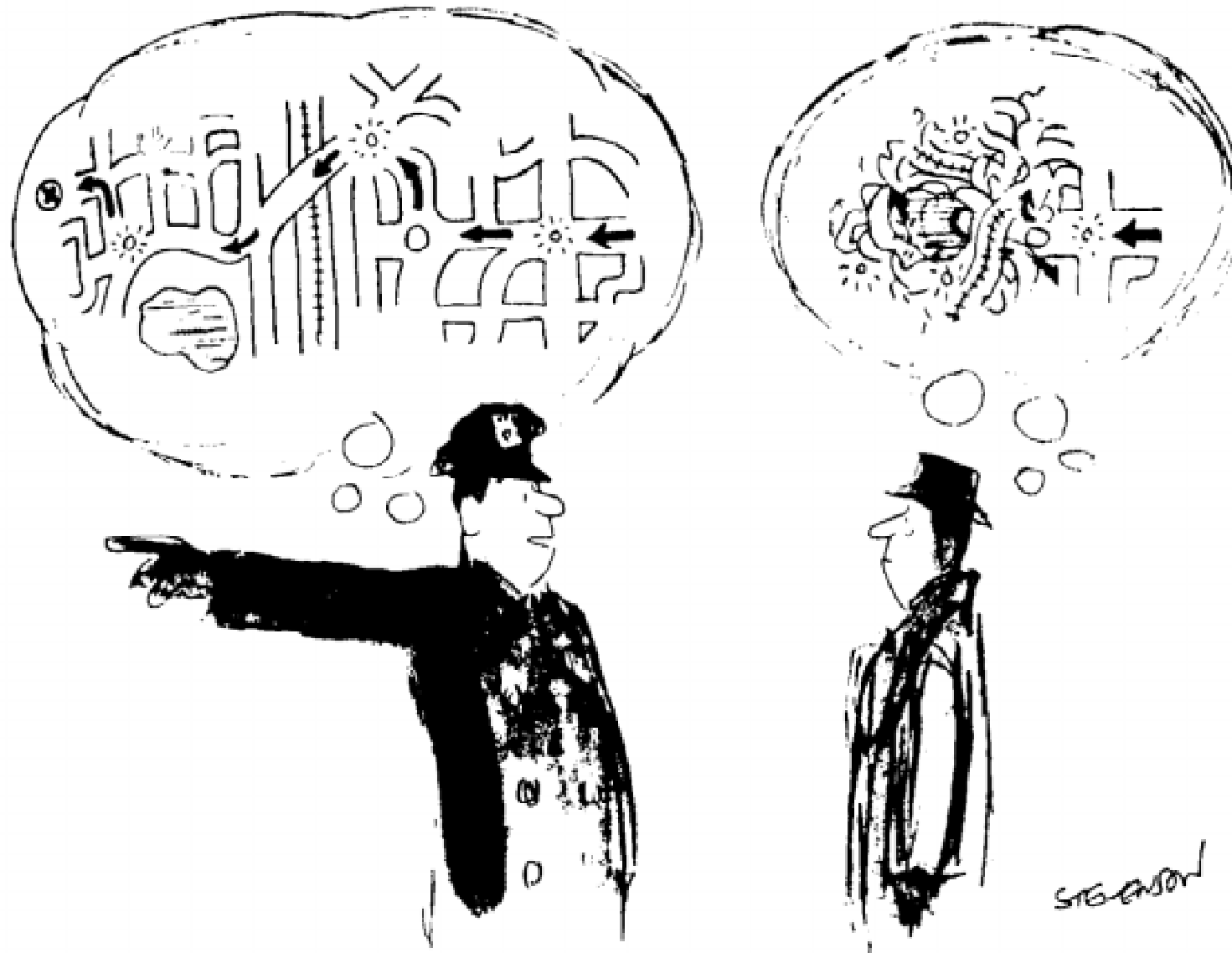
Collaboration—Among Whom: Communities of Practice, Communities of Interest and Learning Webs

- **communities of practice (CoP)**, defined as groups of people who share a professional practice and a professional interest (Lave, Wenger)
- **communities of interest (CoI)**, defined as groups of people (typically coming from different disciplines) who share a common interest, such as to frame and solve a problem or to design an artifact (Envisionment and Discovery Collaboratory)
- **learning webs** —*Ivan Illich: “Deschooling Society” (1971); Chapter 6: “Learning Webs”*
 - **learning webs**, defined as: “empower all who want to share what they know to find those who want to learn it from them”
 - a visionary view of today’s networked society **twenty years before the WWW**
 - illustrating a deeper understanding of the real problems than most of the info-enthusiasts of today

Shared Understanding

- **shared understanding** is an act of knowing who will use the information and for what purpose (→ user modeling)
- **distributed cognition**: the heart of intelligent human performance is not the individual human mind but groups of minds in interaction with each other and minds in interactions with tools and artifacts
- fundamental difference between distributed cognition as it operates
 - for the aided individual human mind → often functions well because the required knowledge that an individual needs is distributed between her/his head and the world
 - for groups of minds → a “group has no head”—therefore externalizations are critically more important

Shared Understanding in Real Life



External Representations

- cause us to move from vague mental conceptualizations of an idea to more **concrete representations** of them
- **reveal ideas and assumptions** that beforehand were only tacit
- provide a means for stakeholders to interact with, react to, negotiate around, and build upon ideas → **“conversation with the materials, reflection-in-action”** (D. Schön: *“The Reflective Practitioner”*, 1983)
- provide a concrete grounding upon which to create a common language of understanding → **boundary objects** (defined as: objects that serve to coordinate the perspectives of various constituencies for some purpose)
- **claim:** a major challenge in the design of externalizations for collaboration is to create boundary objects (e.g., participatory design, human-centered design, brokering) → **design for participation, not just for use or access**

Informed Participation

- **claim:** one of the major roles of new media is not to deliver predigested information to individuals, but to provide the opportunity and resources for social debate and discussion
- for many (design) problems: the knowledge to understand, frame, and solve these problems does not exist, but is **collaboratively constructed and evolved** during the process of solving them
- **access** to existing information (often seen as the major advance of new media) is a very limiting concept
- **challenge:** support *informed participation* by allowing stakeholders to incrementally acquire ownership in problems and contribute actively to their solution

Social Creativity

- **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 G. Fischer: “Beyond ‘Couch Potatoes’: From Consumers to Designers”*)
- **externalizations/oeuvres** (*see J. Bruner: “The Culture of Education”*)
 - can be analyzed, criticized, incrementally improved
 - can serve as boundary objects creating mutual understanding between different cultures
- **individual and/versus social creativity:** not a binary choice → explore the relationship between the individual and the social

Examples of Systems Supporting Collaboration

The Envisionment and Discovery Collaboratory (EDC)

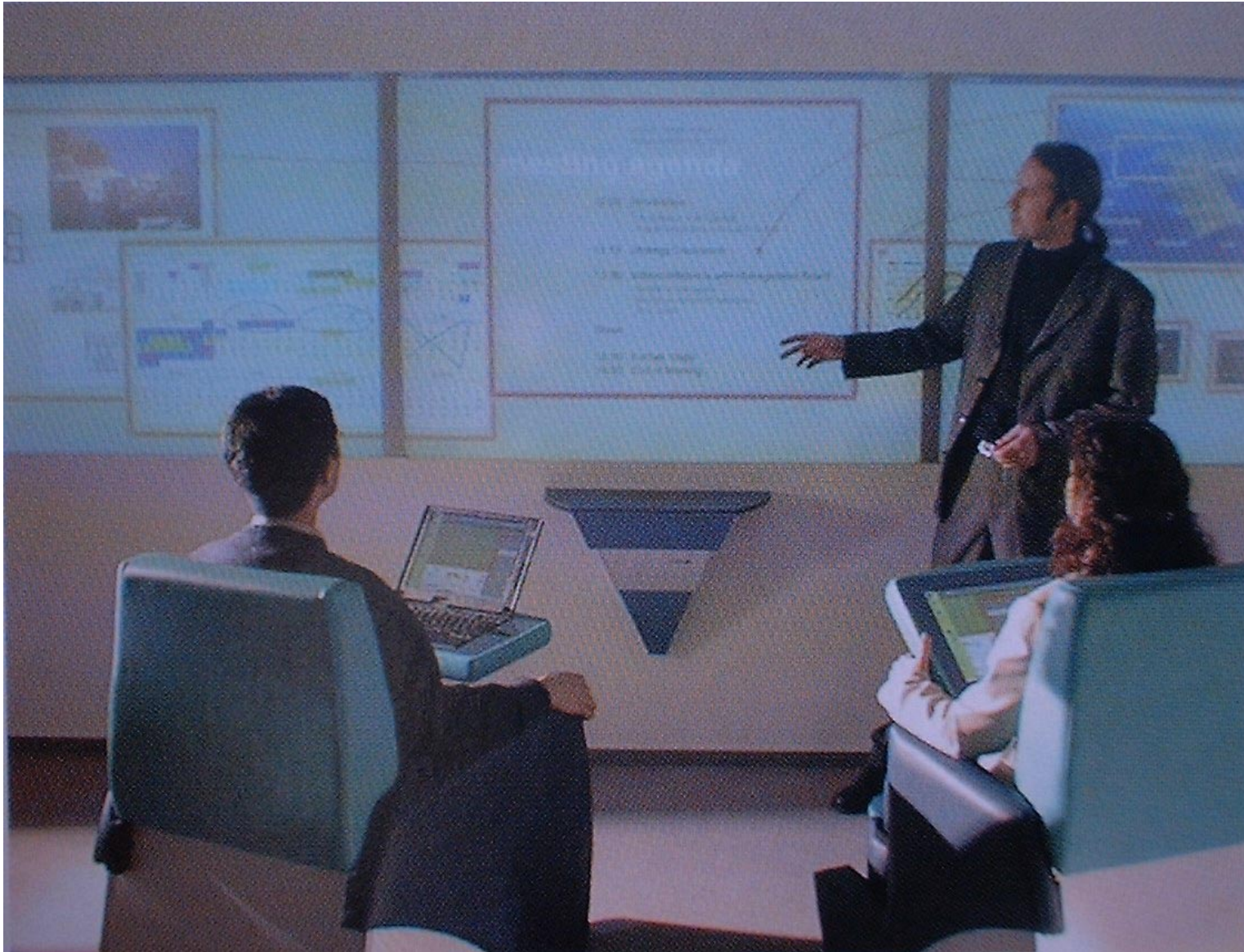
<http://www.cs.colorado.edu/~l3d/systems/EDC>

- **creating shared understanding through collaborative design**
 - symmetry of ignorance, mutual competence, and breakdowns as sources of opportunity
- **integration of physical and computational environments**
 - hardware: electronic whiteboards, crickets
 - software: AgentSheets, Dynasites
 - beyond the screen: immersive environments
- **support for:**
 - communities of interest
 - reflection-in-action
 - negotiation support (see G.Martin, F.Détienne, E. Lavigne “Confrontation of Points of View”)

The Envisionment and Discovery Collaboratory



i-Land — GMD Project “Workspaces of the Future”



“Open Source” and “Open Systems”

- **an intellectual paradigm requiring a new mindset**
 - objective: leverage is gained by engaging the whole world as a talent pool
 - from users/consumers → co-designers/active contributors
- **some examples of decentralized, evolvable information repositories**
 - open source: collaborative development of software
 - the scientific method/enterprise itself
 - insight: “software/knowledge is not a commodity to be consumed but is a collaboratively designed and constructed artifact”
- **some characteristics:**
 - evolutionary design of complex systems
 - success stories so far: technically sophisticated developers not end-users

Social Capital

- the incentive to be a good colleague, to contribute and receive knowledge as a member of a community (see Expert Exchange, Illich's Learning Webs, the scientific community, the open source community)
- **hacker milieu (and academia) as gift culture:** human beings have an innate drive to compete for social status (see Eric Raymond: "Homesteading the Noosphere" at <http://www.tuxedo.org/~esr/writings/homesteading/>)
 - in gift cultures, social status is determined not by what you control but by *what you give away*
 - prestige is a good way (and in a pure gift economy, the *only* way) to attract attention and cooperation from others
 - "*utilization is the sincerest form of flattery*"
 - **claim:** free-market capitalism is the globally optimal way to cooperate for economic efficiency → the reputation-game gift culture is the globally optimal way to cooperate for generating and checking evolving high-quality creative work

Organizational Learning and Organizational Memories

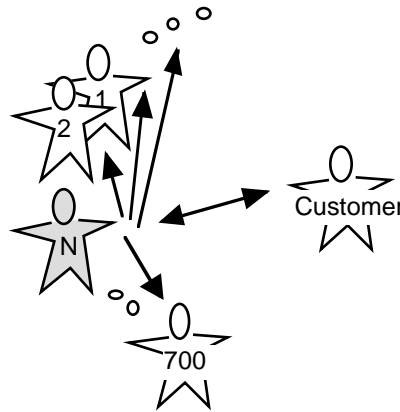
- **organizations** = interconnected communities of practice
- **organizational learning**: focuses on recording knowledge gained through experience (in the short term), and actively making that knowledge available to others when it is relevant to their particular task (in the long term)
- **organizational memories**: record knowledge for the purpose of making this knowledge useful to individuals and projects throughout the community of practice and into the future
- **content**: reuse, best practices, design patterns, narratives

Examples of Organizational Memory Systems

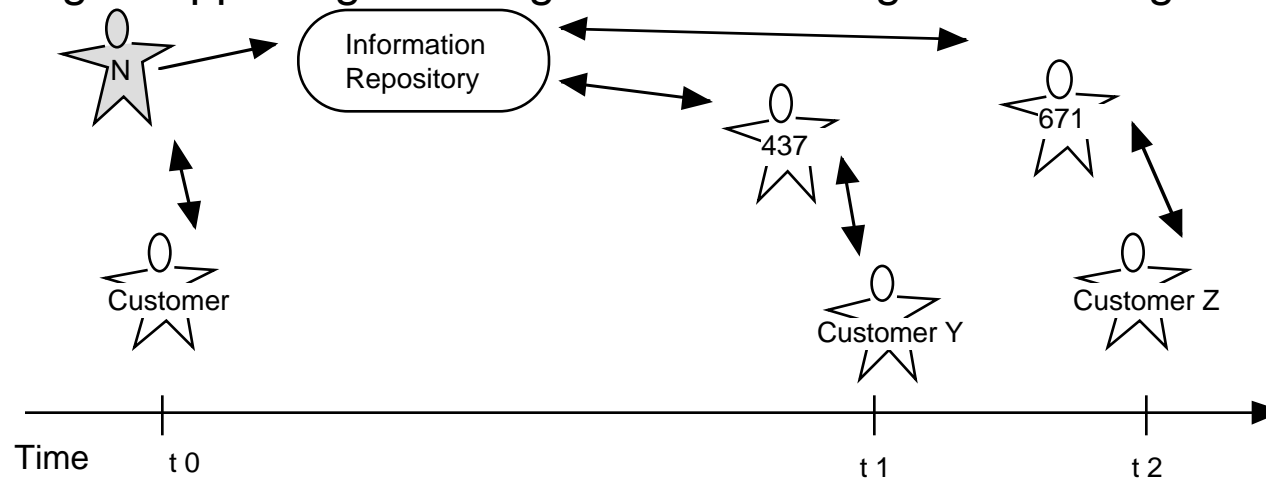
- **Endnote** (database of references) experience in L3D
- **Digital Document Discourse Environment (D3E)** (Tamara Sumner et al)
- **GIMMe** (the Group Interactive Memory Manager; Stefanie Lindstaedt)
- **Knowledge Depot** (Bea Zimmerman, Bell Atlantic (formerly NYNEX) and David Redmiles, UC Irvine)
- **Dynasites** (Jonathan Ostwald): virtual libraries, “courses as communities”
- **Experience Journals** (MERL: Mitsubishi Electric Research Laboratories, Cambridge)
- **Experience Factories** (DaimlerChrysler Research, Ulm, Germany)
- **1200 Help Desk People** (IBM Services, Boulder)

Example: 1200 Help Desk People

- broadcasting leads to information overflow of decontextualized information



- the challenge: supporting the integration of working and learning



Organizational Learning and Organizational Memories

Issues and Requirements

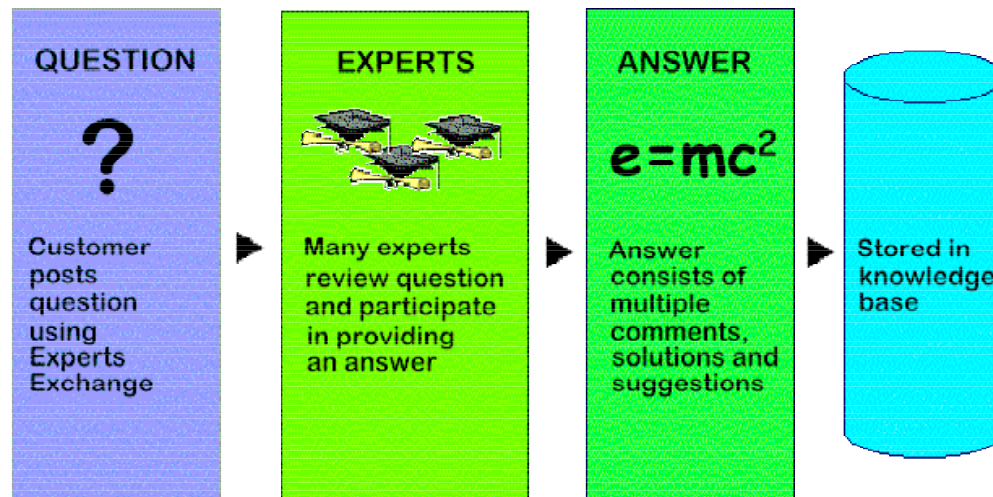
- **fundamental misunderstanding:** scarce resource is not information, but human attention — because information consumes the attention of its recipients
→ **wealth of information creates a poverty of attention**
- need to serve work by **making information relevant to the task at hand** → **Latent Semantic Analysis (Tom Landauer)**
- need to be extended and updated as they are used to **support work practices**
→ **incremental formalization (Frank Shipman)**
- need to be **reorganized** in order to integrate and structure evolving information
→ **reseeding (Eric Scharff)**
- a **process model to support this:** **the Seeding, Evolutionary Growth, Reseeding Model**

Knowledge Sharing: The “Knowledge Management” Myth

- **some myths about "knowledge management" (John Thomas, IBM):**
 - we can simply "capture" the knowledge of a thirty-year expert in explicit form so we can fire the expert and hire someone with no relevant skills off the street who can now use the "knowledge base" to perform like an expert
 - in the ideal company, all knowledge will be captured worldwide and instantly fed via high band-width lines to a central place where globally optimal decisions can be made for the entire company and fed back out to the periphery for implementation
- **knowledge \leftrightarrow information** (see Brown/Duguid, “The Social Life of Information”) — some distinctions
 - knowledge usually entails a knower
 - knowledge appears harder to detach than information
 - knowledge is something what we digest rather than merely hold
- **consequence:** an attention to knowledge (rather than just to information) requires an attention to people

Example: Experts Exchange

<http://www.experts-exchange.com>



Filling the knowledge gap: “Problem solvers use knowledge gained from education and experience to reach their ends. Often there are gaps in their knowledge that must be filled first. This kind of knowledge, particularly in rapidly changing fields, can be difficult to find. At Experts Exchange we use a collection of experts, known as ‘distributed expertise’ to fill the gaps. Up until now, distributed expertise has been expensive and limited to activities such as research and development teams.”

The Virtual Knowledge Community behind the Experts Exchange

- **some common elements:**

- an incentive structure
- an economy including a currency for exchange
- the accumulation of wealth and status
- dealing with anti-social behavior
- construction of identity

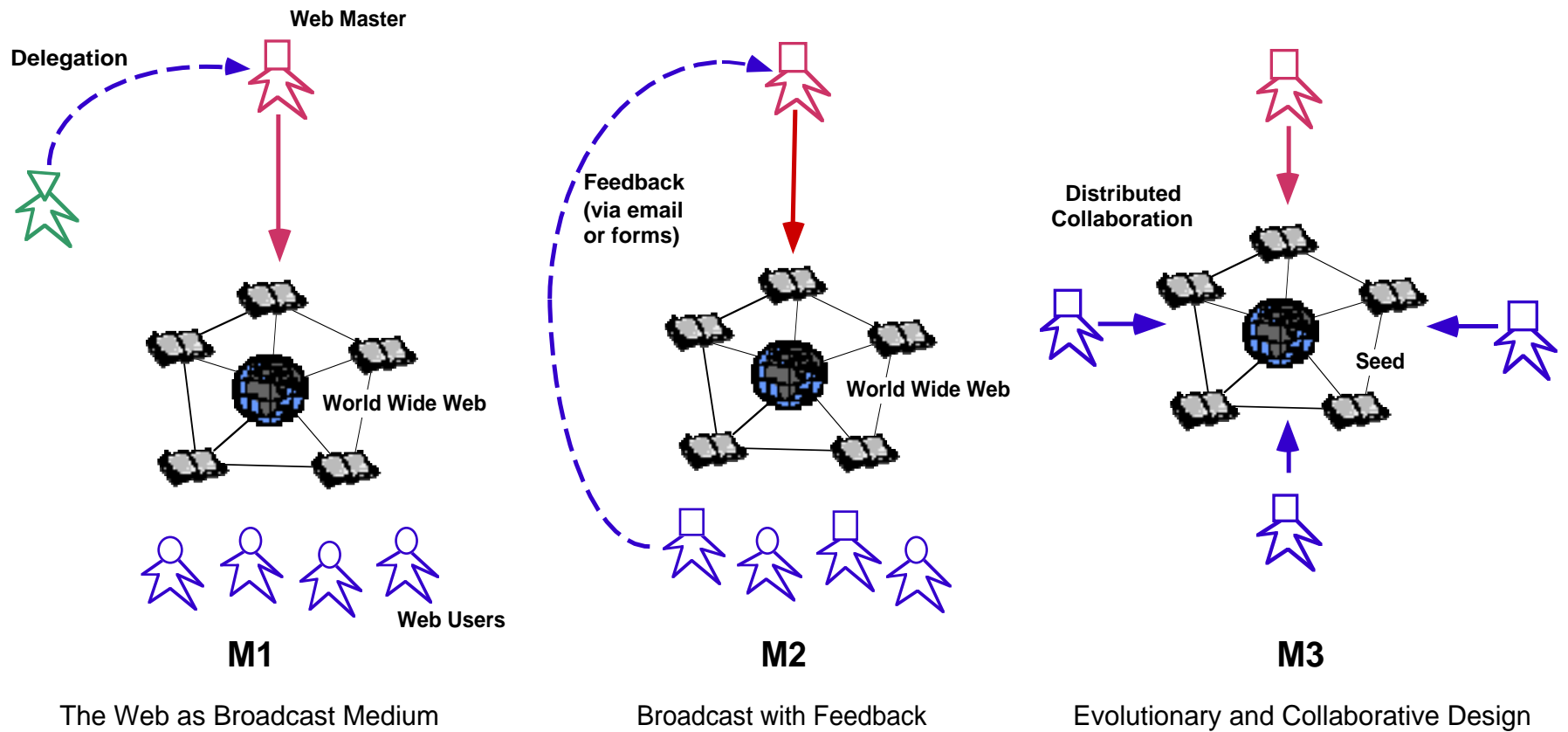
- **the economy of Experts Exchange:**

- is based on knowledge, with credits used as currency
- with a limited supply of credits available, the invisible hand of free markets is used to allocate the knowledge available
- wealth is measured as the accumulation of knowledge credits

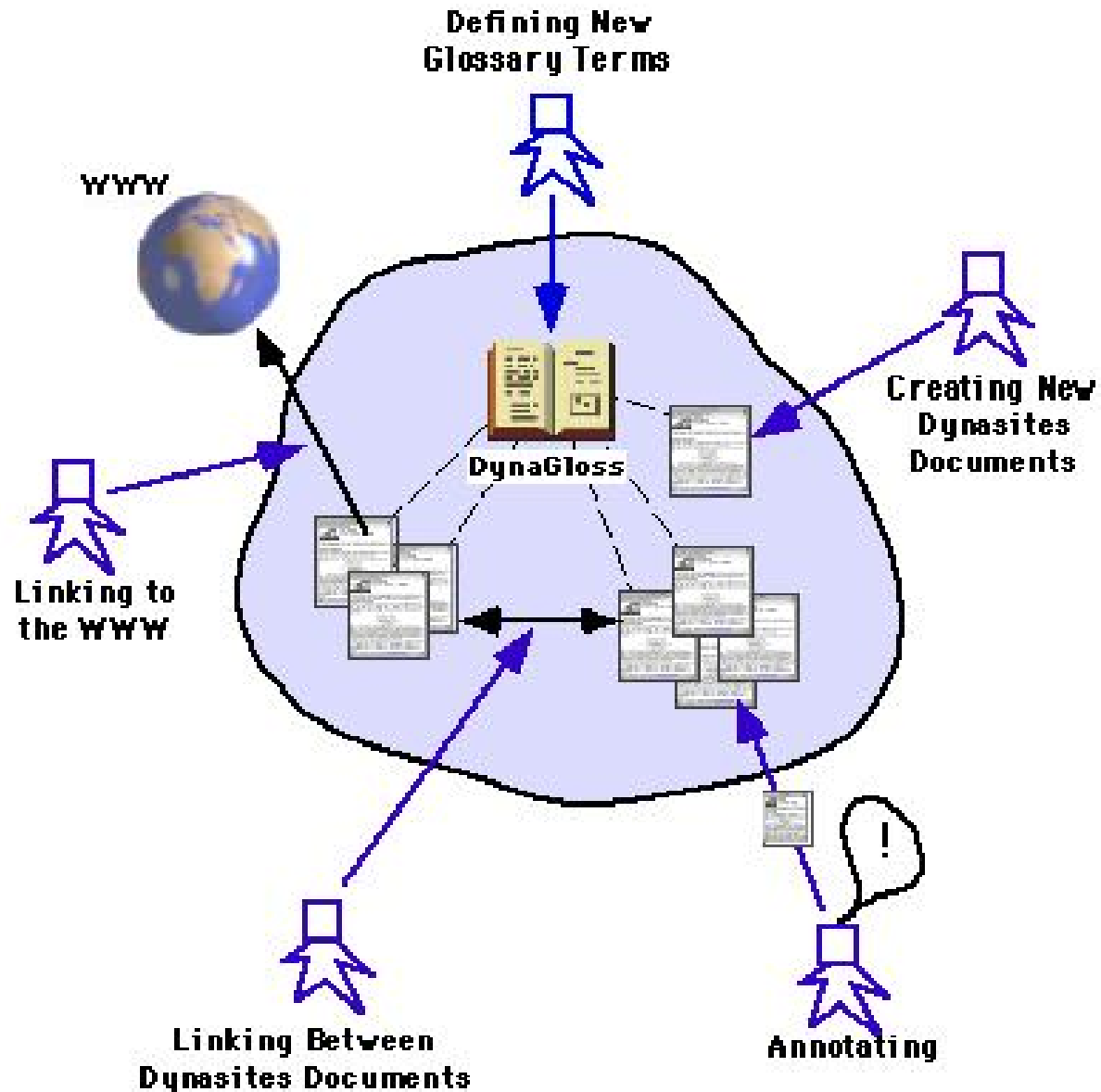
- **what's in it for the experts?**

- the experts are the heart of Experts Exchange, which was created by and for experts → *at Experts Exchange you become an expert solely by answering questions well*
- **benefits:**
 - * *recognition* — by accumulating points an expert obtains tangible evidence of their expertise, that can be used in resumes or letters of recommendation
 - * *potential compensation* — *service is free; however, we expect that as our customer base grows we will obtain some commercial customers who will be delighted to pay our very reasonable rates*

Making the World Wide Web a Medium for Collaborative, Evolutionary Design



DynaSites Information Spaces: Living, Linked and Dynamic



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 organization) 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.

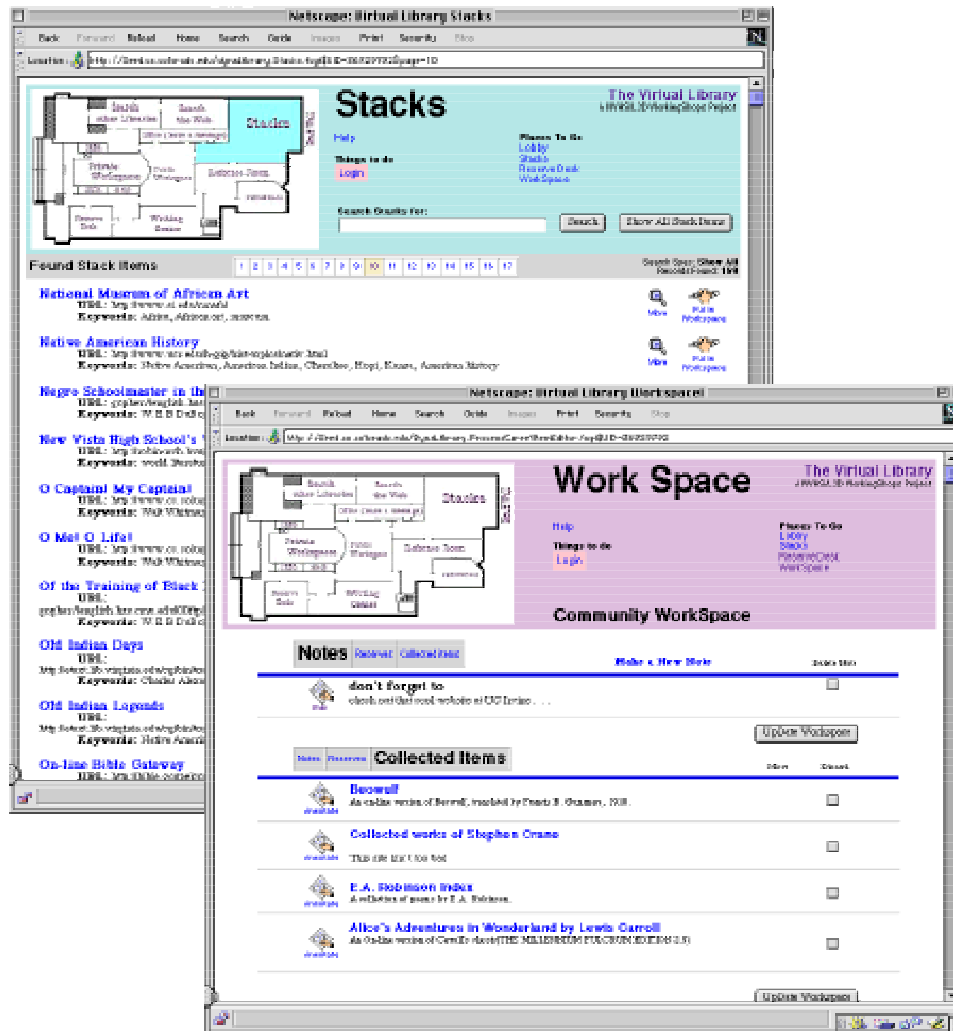
Author: Joe Last Edit Date: 8/19/98; 12:45:22 AM

[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 FFUproject)
- [Living Design Memory: Framework, Implementation, Lessons Learned](#) (in Sources)
- [Work Promised](#) (in OMOLProject)
- [General Goals](#) (in OMOLProject)

The Dynasites Virtual Library



Practice

- **L3D's "Undergraduate Research Apprenticeship Program (URAP)"**
 - models: Ph.D. students, community feeling in sports
 - challenges: scalability, cost-effectiveness
- **courses of the future: *supporting evolving learning communities***
 - <http://www.cs.colorado.edu/~l3d/courses/atlas-2000/>
 - lessons learned: to create a community requires more than using collaborative technologies → change of mindsets
 - mismatches between
 - * active, self-directed learners and "sage on the stage" teachers
 - * passive learners and "guide on the side" teachers
- **a video illustrating collaborative learning environment**
 - a design environment for a programmable brick → for details see: <http://www.legomindstorms.com/>
 - children in the classroom → design studio of tomorrow
 - getting the mother involved
 - learning by designing and by being articulate about it

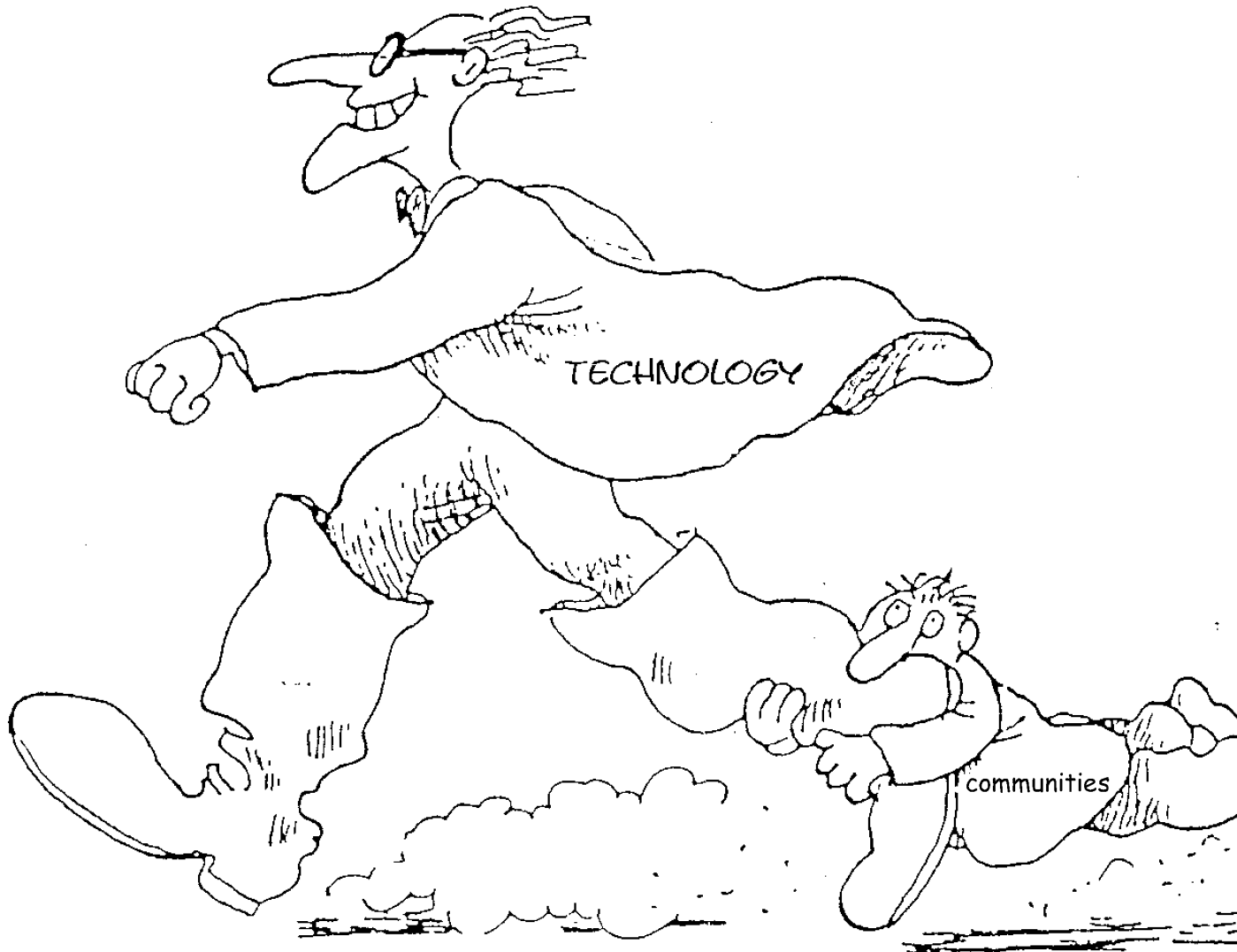
Assessment Dimensions

- **what will make people want to share?** → requires: culture change, new mindsets, new reward systems
- **“who is the beneficiary and who has to do the work?”** (J. Grudin) → organizational rewards
- **self-application of this idea to L3D:**
 - we attempt to design our community in a creative fashion that the value gained by the individual to contribute to the social is greater than the effort expended
 - experiences with organizational memories and collaborative work have exposed two barriers to creating and using 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 — More Than New Technologies

- **“collaborative systems will not work in a non-collaborative society”**
a student’s observation in a class using technologies to enhance peer-to-peer learning, sharing of information, self-evaluation, etc.
- **“the paradise of shared knowledge isn’t just happening. Knowledge isn’t shared because management does not want to share authority and power”** (Zuboff “The Age of the Smart Machine”, 1988)
- **social periphery** (Brown/Duguid: “The Social Life of Information”, 1999)
 - defined as: the communities, organizations, and institutions that frame human activities
 - they are vital to how we all live and work, but are too often overlooked in the information age
- **new learning experiences: *learning about* → *learning to be***

**Collaboration = f{Media, Technology} ↔
Media, Technology = f{Collaboration}**



Conclusions

- **objectives for the next generation of collaborative systems**
 - **shared understanding:** to exploit the power of communities and collaboration
 - **informed participation:** to participate in the shaping of the future and not just being shaped
 - **social creativity:** rethinking learning, importance of motivation in addition to cognition
- **the challenge:** the **co-evolution** between new communities, new approaches to collaboration, and new media and technologies
- **the future is not out there to be “discovered”, but it has to be invented and designed**
 - our institutions are designs
 - our designs are influenced by our understanding, perspectives and theories