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

Overview of Collaboration

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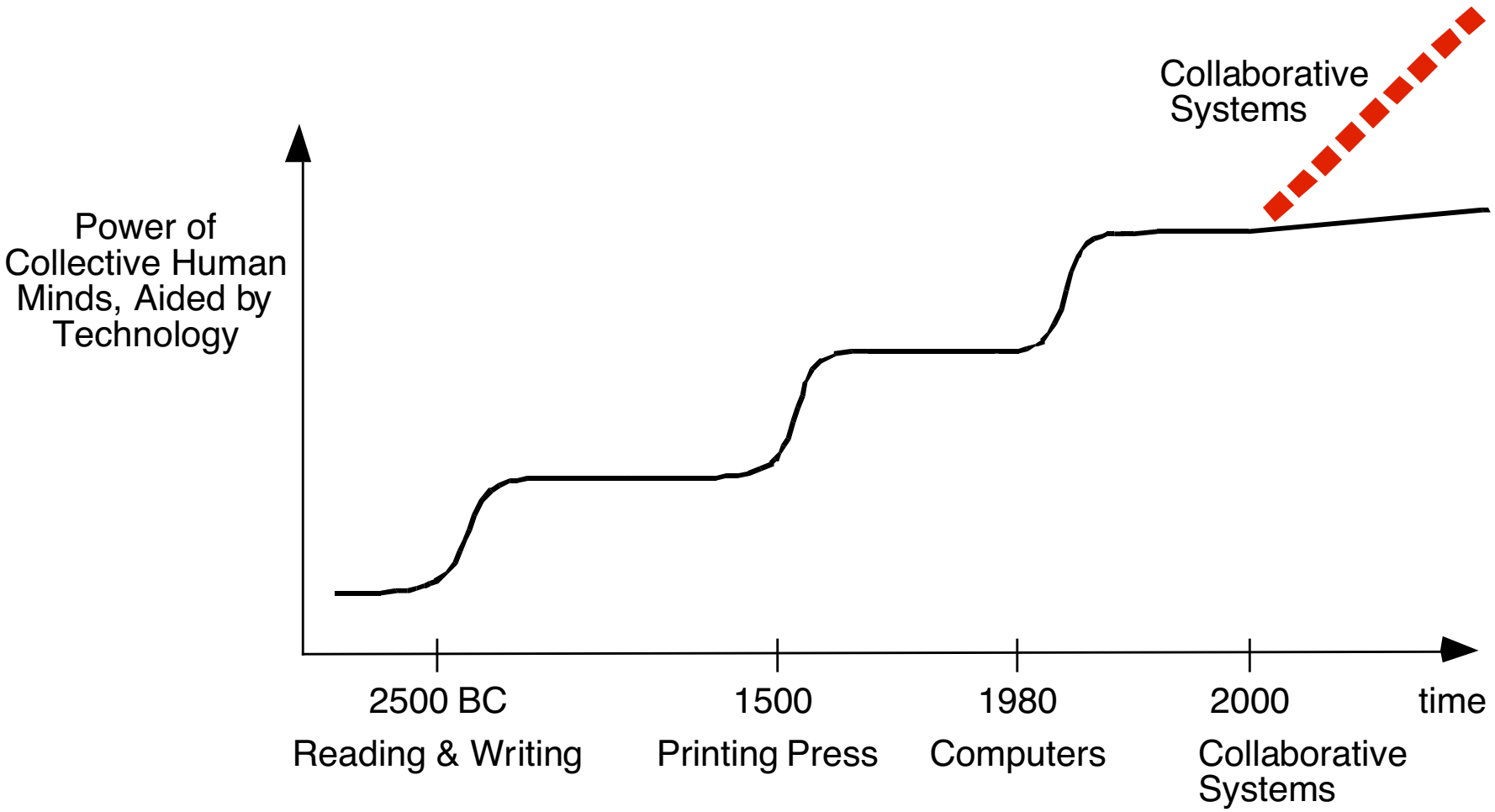
The Aided, Collective Human Mind — Exploiting the Social



Collaboration —With Whom

"Division of labor is a cultural universal"

- ***ourselves*** — e.g., capturing our thoughts of the past → reflexive CSCW
- ***all stakeholders*** — e.g., clients, designers, customers, users → symmetry of ignorance, communities of interest (CoI)
- ***colleagues*** — e.g., supporting long-term, indirect collaboration → collaborative work practices, design rationale
- ***tools*** — e.g., knowing which tools exist, how they can be used, how they can be tailored to our specific needs → high-functionality applications
- ***domains*** — e.g., domain abstractions (ontologies), standard examples → communities of practices (CoP), catalog examples, cases
- ***critics and agents*** — e.g., shared knowledge of the task at hand, information volunteering → intrusiveness, information volunteering

Distributed Cognition

- **between:**
  - **socially** (human beings) → challenge: increase in socially shared cognition and practice — Wittgenstein: *"If a lion could speak would we understand him?"*
  - **technologically** (humans and things/computational artifacts)
  - **temporally** (across time)
  - **spatially** (across space)

- **advantage of humans:**
  - shared understanding
  - background knowledge

- **advantage of things** (Illich, p 125)**:**

  "a thing is available at the bidding of the user — or could be — whereas persons formally become a skill resource only when they consent to do so, and they can also restrict time, place, and methods as they choose."

  → the "Nobel Prize Winner" fallacy

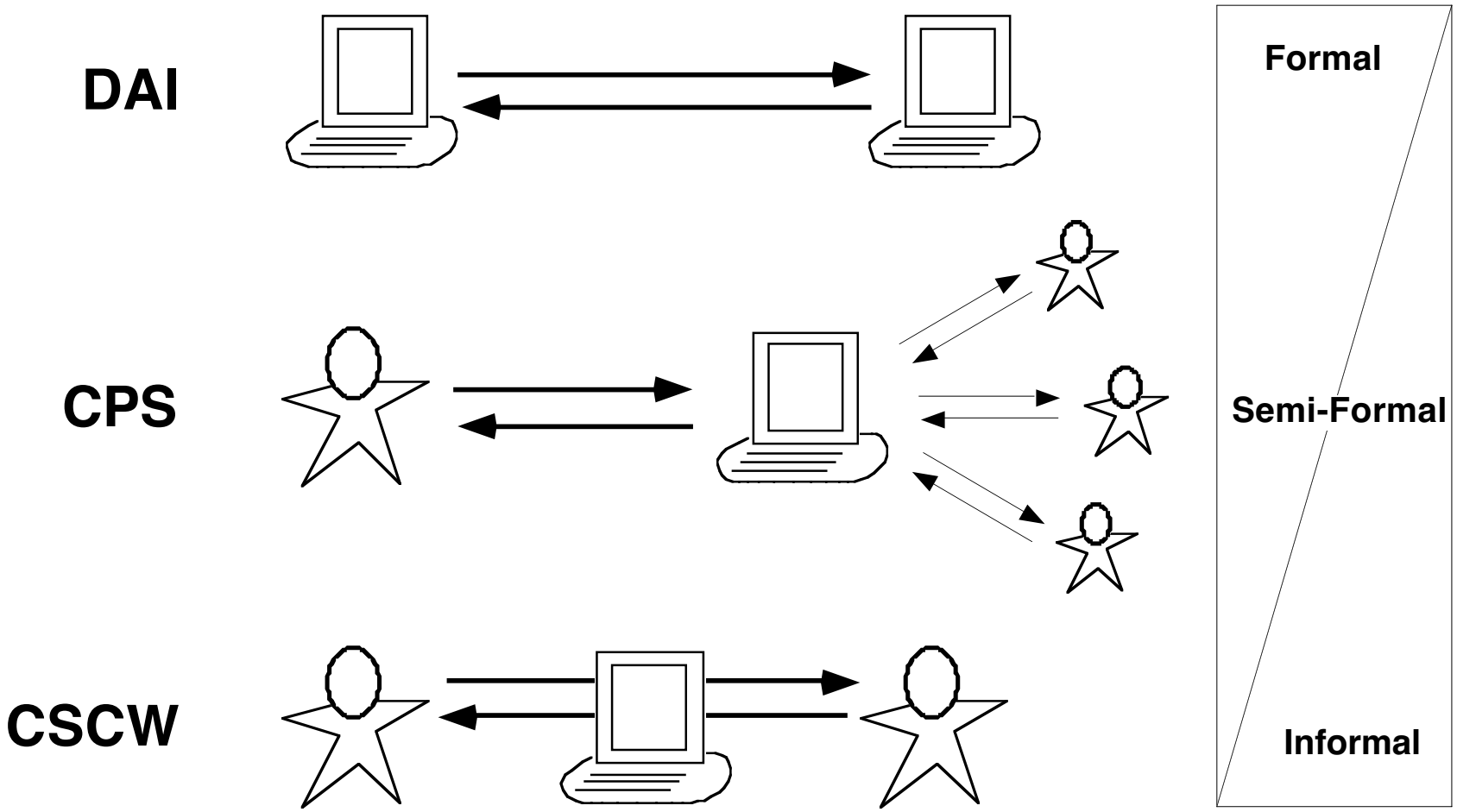
Classification of Collaborative Systems

- **Distributed Computing / Distributed AI (DAI)**
  - computers and computers
  - all information must be interpretable by computer

- **Collaborative (Design) Environments**
  - computers and humans
  - mixture between interpretable and computer-mediated information structures

- **Computer-Supported Cooperative Work (CSCW) and Learning (CSCL)**
  - humans and humans
  - computer-mediated
  - most information is not interpretable by computers

Classification of Collaborative Systems



Two Major Approaches in Human-Computer Collaboration

L. Terveen "An Overview of Human-Computer Collaboration"

- **complementary approach**
  - based on the asymmetry between human and computer
  - claim: the design of the collaboration is not only a problem of simulating human to human collaboration but of inventing engineering alternatives to interaction related properties

- **emulation or replacement approach (**for example: use of natural language, speech, ...)

- **collaborative human-computer systems require**
  - to specify a division of labor between human and computer (what part of the task should be exercised by human beings and/or by the computer?)
  - to design a communication protocol that can be used to coordinate and mutually enhance the efforts of the participants

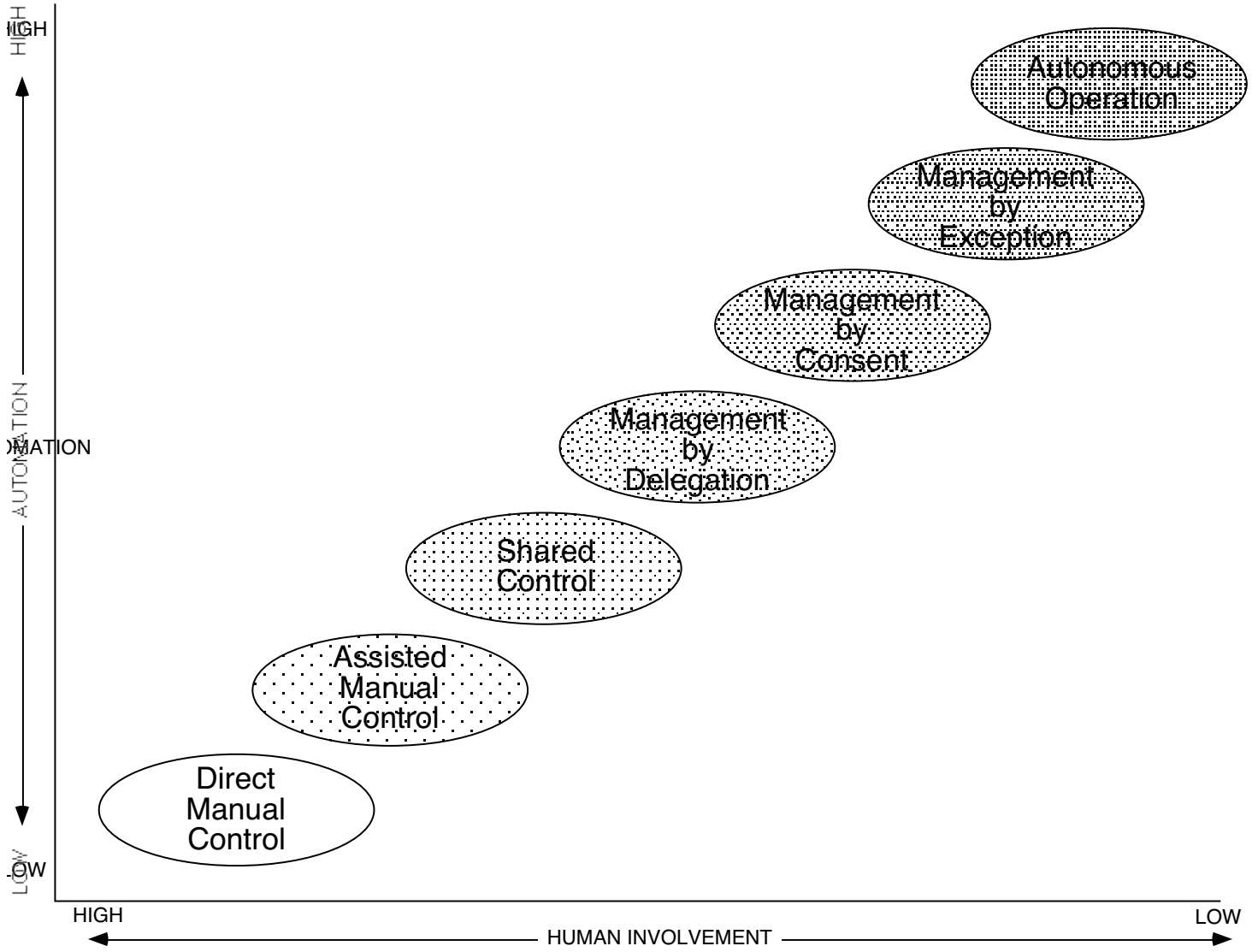
Example: Principles of Human-Centered Aircraft Automation

- **Premise:** The pilot bears the ultimate responsibility for the safety of any flight operation.

- **Axiom:** The pilot must be in command

- **Corollaries**:
  - to command effectively, the pilot must be involved
  - to be involved, the pilot must be informed
  - the pilot must be able to monitor the automated systems
  - automated systems must therefore be predictable
  - the automated systems must also be able to monitor the pilot
  - each element in the system must have knowledge of the other's intent

Dimensions of "Human-Centered Automation"



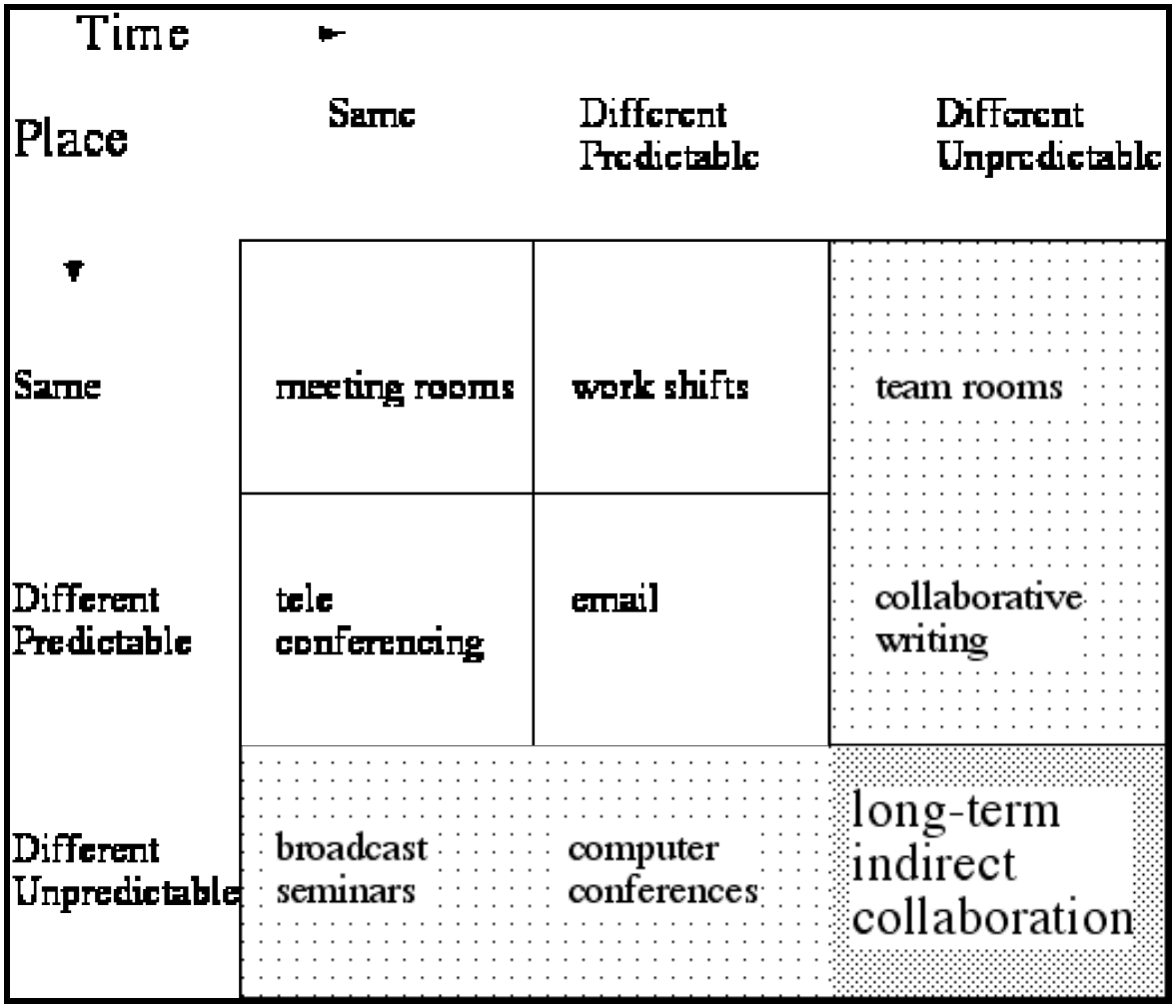
Supporting Indirect, Long-Term Collaborative Design

- **why**
  - direct communication is impossible, impractical or undesirable
  - communication is shared around artifacts and information space evolution
  - designers need to be informed within the context of their work on real-world design problems

- **lessons learned**
  - people do not know what they do not know → information delivery techniques need to complement information access techniques
  - information access: browsing is not good enough in large information spaces and queries cannot be articulated → use the artifact itself as a query

more information: G. Fischer, J. Grudin, A. Lemke, R. McCall, J. Ostwald, B. Reeves and F. Shipman: "Supporting Indirect, Collaborative Design with Integrated Knowledge-Based Design Environments", Special Issue on Computer Supported Cooperative Work,in Human-Computer Interaction Journal, Vol. 7, No. 3, 1992, pp. 281-314

Different Dimensions of CSCW



Collaborative Work Practices

Nardi, B. A. (1993) *A Small Matter of Programming,*
The MIT Press, Cambridge, MA

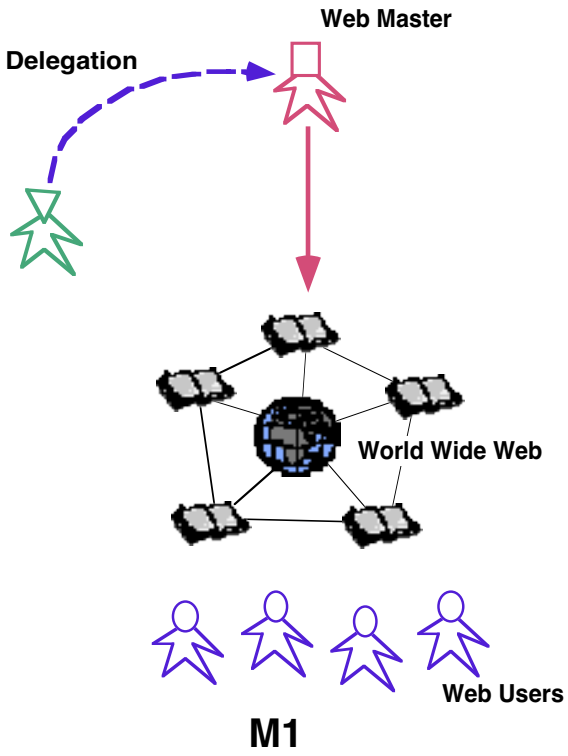
- from individual to groups (programming communities of cooperating users)

- continuum of (programming) skill from end users to “local developers / power users / gardeners “ to programmers
  - end-users = little programming education; no interest in computers per se
  - local developers = domain experts with programming knowledge and interest
  - programmers = professionally educated

- example domains: high-functionality applications (word processors, spreadsheets, multi-media environments)

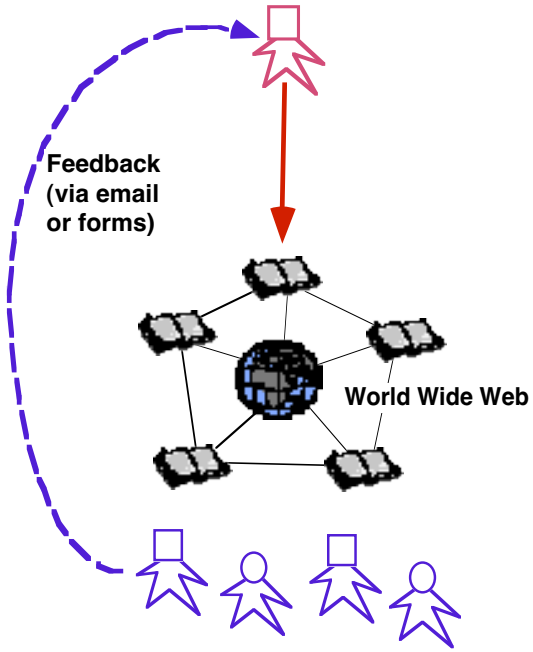
- prerequisite for the development of collaborative work practices and programming communities:
  - use of a common software system
  - modification components (macros, embedded language, ...)

WWW: From Broadcast to Collaboration Medium



M1

The Web as Broadcast Medium



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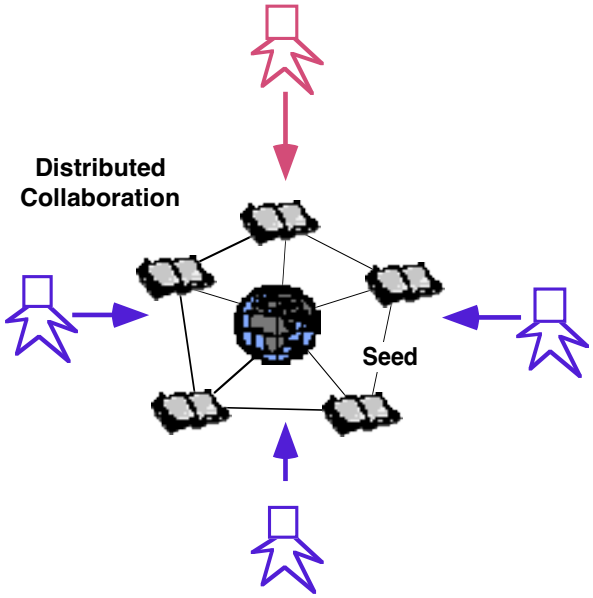
Broadcast with Feedback



M3

Evolutionary and Collaborative Design

Example of Shared Evolvable Information Repositories

- **DynaSites** at http://Seed.cs.colorado.edu/dynasites.documentation.fcgi
- **Swiki** (collaborative websites) → http://swiki.cs.colorado.edu:3232/dlc/40
- **Expert Exchange:** http://www.experts-exchange.com/
- **Phoaks** ("People Helping One Another Know Stuff"): http://www.phoaks.com/
- **Open Source — Eric Raymond → see:** http://www.tuxedo.org/~esr/writings/cathedral-bazaar/
- **Open Systems =** ***"open source for the rest of us"*** — Eric Scharff

Open Systems

- **model: open source an intellectual paradigm requiring a new mindset**
  - 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 → seeding, evolutionary growth, reseeding (SER) model
  - success stories so far: with technically sophisticated developers (e.g., Unix Shell, Linux), not end-users

- **social capital and gift cultures:** social status is determined not by what you control but by what you give away

Self-Analysis of L3D as a Learning Organization

- homogenous versus heterogeneous computing environment
- collaborative work practices (power-user, local developers)
- jointly created and evolved information repositories:
  - Dynagloss
  - Endnote
  - Websites of Center, Research Project
  - Websites of Courses
- establish and share work practices and information:
  - information producers: “who do I tell?”
  - information consumers: “who do I ask?”

Reinterpreting Motivation at a Collaboration Level

- who is the beneficiary and who has to do the work?
- organizational memories: what will make employees want to share?
- people need to make explicit what they know and take the trouble to enter it into the system
- collaboration depends on a social and economic system which values altruism
    - capitalism is selfish
    - claim: *"until the free distribution of knowledge is rewarded economically, there is little incentive for individuals and organizations to share information"*

Questions about Collaboration

- How do we get people to share, and what should they share?
- What is the relation between collaborative learning and individual learning?
- What are success stories for collaboration?
- Which kind of processes are needed to support collaborative learning?
- learning organization (but: individuals learn) → how exactly does the organization learn?
  - collaborative work practices (complement each others knowledge)
  - external artifacts (products, processes, group memories)
- how much can we get a "free lunch" by capturing and repackaging information that already exists? (e.g., recommender systems (such as PHOAKS), extracting information from bookmarks, ...)

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