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

Overview of Collaboration

Gerhard Fischer and Leysia Palen
Spring Semester 1999

February 1, 1999

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)
- *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, standard examples (communities of practices, cases)
- *critics and agents* — e.g., shared knowledge of the task at hand, information volunteering (intrusiveness, information volunteering)

Collaboration: A Necessity for Design and Learning

Traditional versus New Models of Working (Design) and Learning

	Traditional	New
paradigm	knowledge transmission	knowledge construction
learning	classroom	on demand
tasks	system driven (canonical)	user/task driven
social structures	individuals in hierarchical structures	collaborative in flat structures (communities of practice)
work style	standardize	improvise
information spaces	closed, static	open, dynamic
breakdowns	error to be avoided	opportunity for innovation and learning
communication	top-down	peer-to-peer

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) and 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

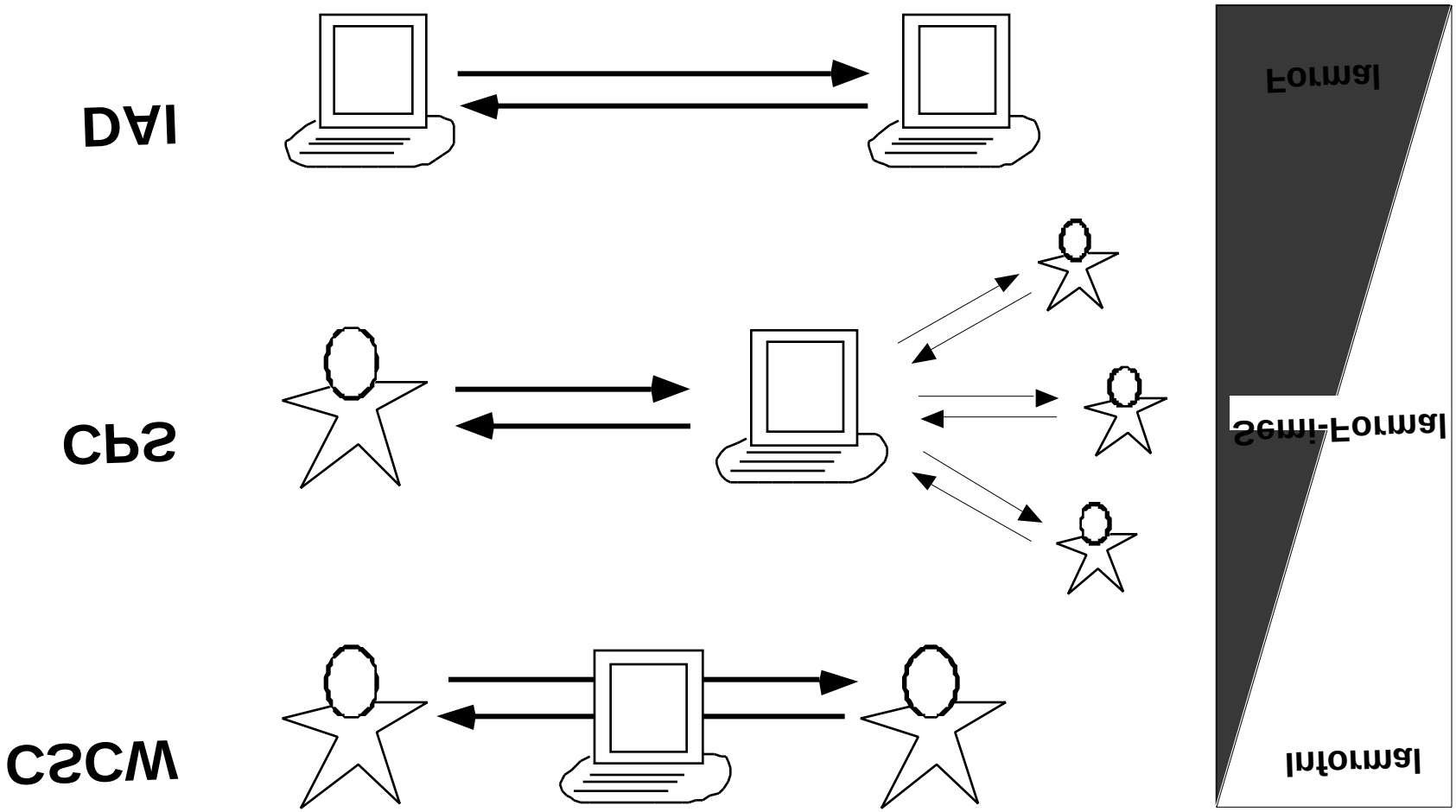
Classification of Collaborative Systems

- **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

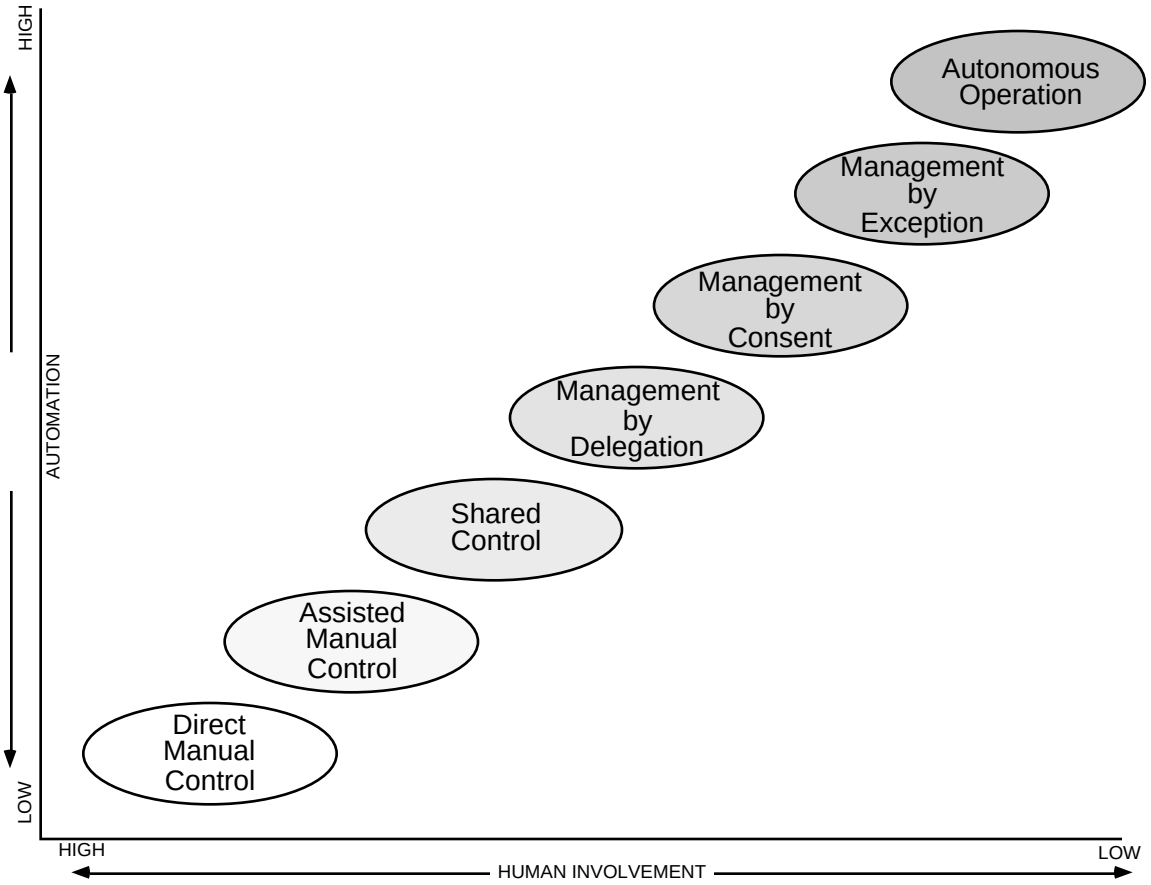
Premise: The pilot bears the ultimate responsibility for the safety of any flight operation.

Axiom: The human operator must be in command

Corollaries:

1. To command effectively, the human operator must be involved
2. To be involved, the human operator must be informed
3. The human operator must be able to monitor the automated systems
4. automated systems must therefore be predictable
5. the automated systems must also be able to monitor the human operator
6. each element in the system must have knowledge of the other's intent

Dimensions of “Human-Centered Automation”



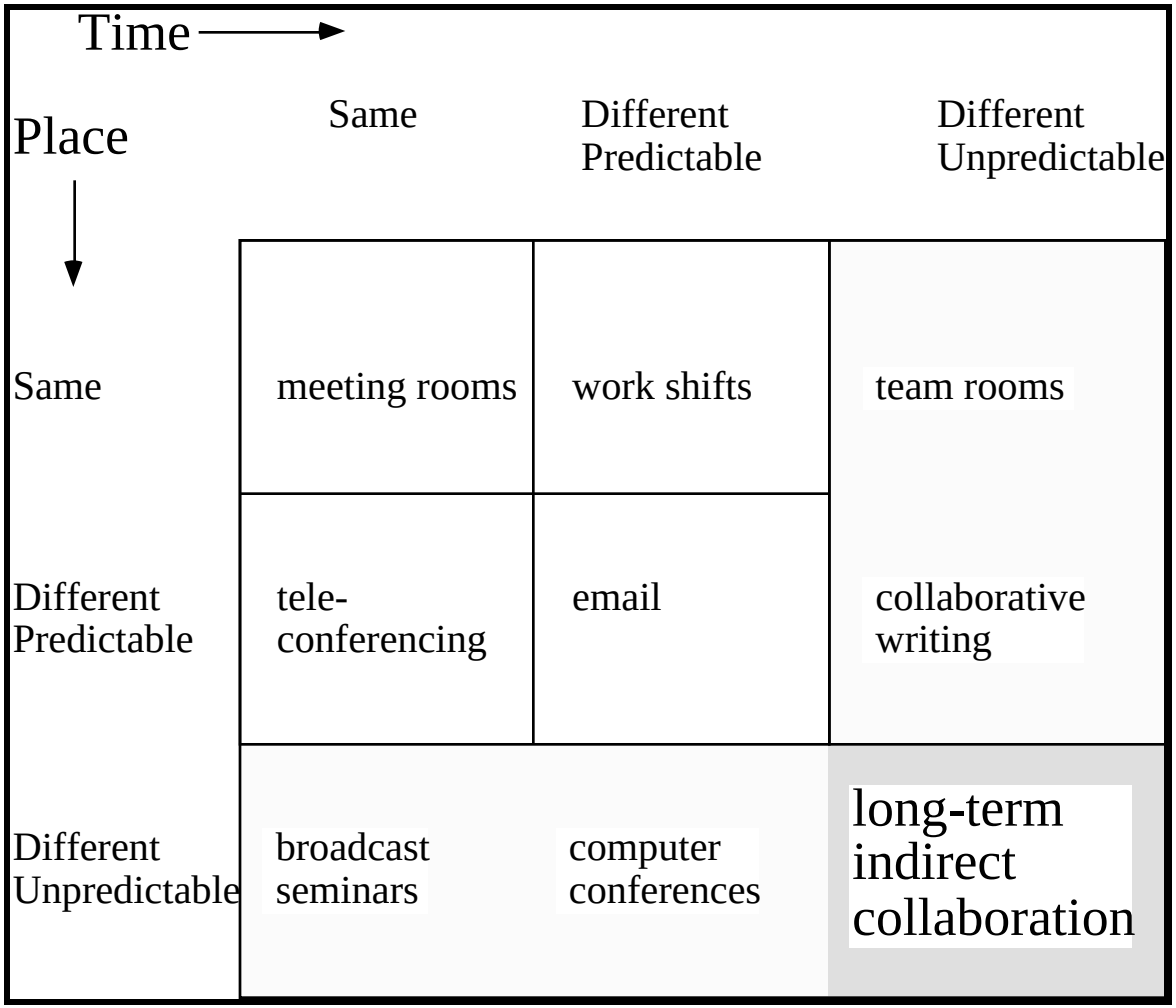
Supporting Indirect, Long-Term Collaborative Design

- **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

see: 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

(Bonnie Nardi: “A Small Matter of Programming”)

- 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, ...)

Example of Shared Evolvable Information Repositories

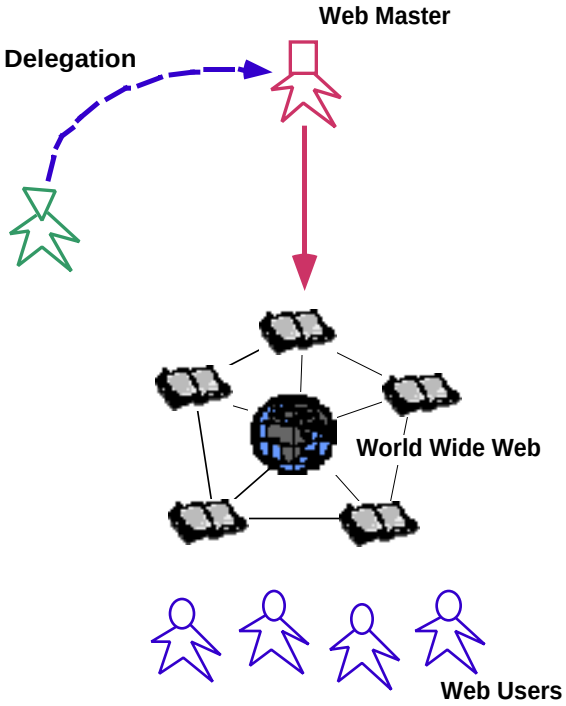
- **Gamelan**
  - one of the first and largest of the community repositories of knowledge
  - primary users of Gamelan: Java developers
  - http://www.gamelan.com

- **Educational Object Economy**
  - collection of Java objects designed specifically for education
  - target users: teachers and developers interested in producing educational software
  - http://www.eoe.org

- **Netscape Communicator**
  - distributed development and centralized integration
  - http://www.mozilla.org

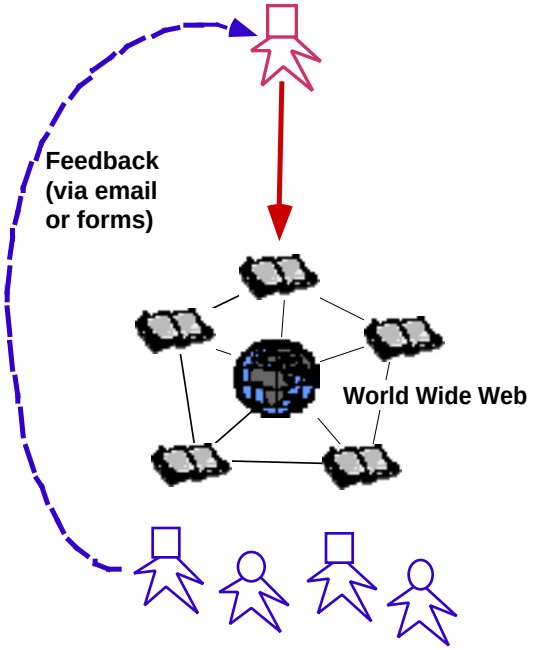
- **Cathedral and Bazaar**
  - Linux operating system
  - http://earthspace.net/~esr/writings/cathedral-bazaar/cathedral-bazaar.html

WWW: From Broadcast to Collaboration Medium



M1

The Web as Broadcast Medium



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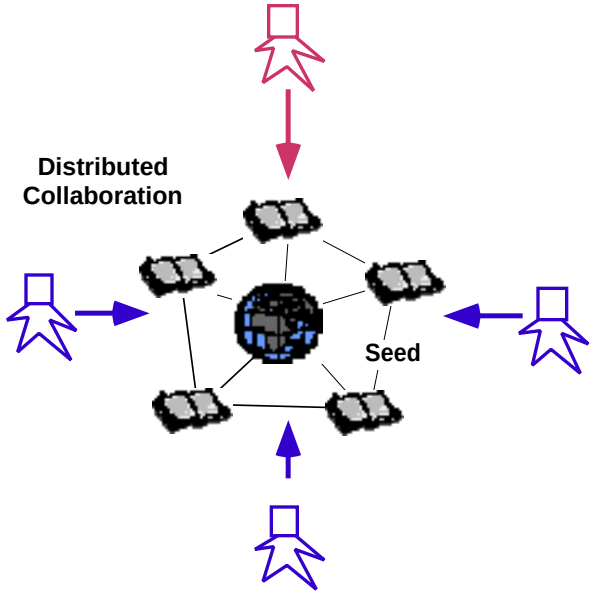
Broadcast with Feedback



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Evolutionary and Collaborative Design

Organizational Learning

- human mind is limited (requires distributed cognition) — there is only so much we can remember and there is only so much we can learn
- change (requires lifelong learning)
- symmetry of ignorance (requires communication, mutual learning and mutual understanding)
- learning is a new form of labor (requires learning on demand)
- to avoid that organizations get stuck in the status quo and in their own successes

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:
  - Sources
  - Dynagloss
- 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?
- corporate 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 / Organizational Learning

- How do we get people to share, and what should they share?
- What is the relation between organizational learning and individual learning?
- What are success stories for collaboration / organizational learning?
- What kind of processes are needed to support organizational learning?
- learning organization: but individuals learn — how exactly does the organization learn
  - - collaborative work practices (complement each other knowledge)
  - - external artifacts (products, processes, group memories)
- we cannot postulate a “new person” who will do the kinds of tasks people now resist just because they are required by new systems.
- 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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- Resnick, L. B., Levine, J. M., & Teasley, S. D. (Eds.) (1991) Perspectives on Socially Shared Cognition, American Psychological Association, Washington, D.C.

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Upcoming Events

- **Wednesday, Feb 3:**
  The Rest of the Story: Supporting the Collaborative Construction of Knowledge
  John C. Thomas, IBM T.J. Watson Research Center

  Socially Translucent Systems: Social Proxies, Persistent Conversation, and the Design of Babble
  Wendy A. Kellogg, IBM T.J. Watson Research Center

- **Monday, Feb 8:**
  Putting Working Document Collections Online
  Lucy Suchman, XEROX PARC

- **Wednesday, Feb 10:**
  Developing Collaborative Applications on the Web
  Andreas Girgensohn, Fuji Xerox Palo Alto Laboratory