



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**

Working and Learning When the Answer is Not Known

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Overview

- Core Message
- History
- Working and Learning
- Design and Design Communities
- Co-Evolution: Beyond Gift-Wrapping and Techno-Determinism
- Some of our Contributions (L3D)
- Challenges Ahead for the CSCW Community

The Core Message

- **axiom:** learning is an essential part of work, particularly in contexts where the answer is not known
- **claim:** despite this critical role, learning has been largely ignored by the CSCW community
- **objective:** future research challenges for CSCW
 - give more attention to **learning**
 - **integrate** working with learning and collaboration
 - create **innovative media** to support this integration

An Example: The Envisionment and Discovery Collaboratory



CSCW and Learning

- the challenge put forward by the organizers: "**CSCW tradition has rarely seen workers as learners — provide some constructive criticism to that**"
- there are studies in CSCW that consider workers as learners (e.g., learning to use a CSCW system, new forms of collaboration)
- the design process for CSCW systems has **largely ignored workers as learners** in terms of designing systems for them

In the Spirit of a **Keynote Talk** – **A Critical View**

- **beyond utopian prophecies** (romanticizing the future)
 - technology will liberate us
 - things will be wonderful with new technologies

- **beyond gloomy prophecies** (glorifying the past)
 - technologies will oppress us
 - people succumb to techno-determinism (technology is the key factor in social change)

- **objective of my talk:** to provide (because “the answer is not known”)
 - a perspective (not a recipe)
 - an initial framework and a set of concepts
 - some challenges for **you** to think about

History of CSCW

“Those who cannot remember the past are condemned to repeat it.” — George Santayana

- Bush, V. (1945). "As We May Think." *Atlantic Monthly* **176**(1): 101-108.
- Engelbart, D. C. and W. K. English (1968). "A Research Center for Augmenting Human Intellect." *Proceedings of the AFIPS Fall Joint Computer Conference*, 395-410.
- Greif, I., Ed. (1988). "Computer-Supported Cooperative Work: A Book of Readings." San Mateo, CA, Morgan Kaufmann Publishers.
- Suchman, L. A. (1987). "Plans and Situated Actions." Cambridge, UK, Cambridge University Press.
- Grudin, J. (1990). "The Computer Reaches Out: The Historical Continuity of Interface Design." *Proceedings of CHI'90*. New York, ACM: 261-268.
- Fischer, G., J. Grudin, et al. (1992). "Supporting Indirect, Collaborative Design with Integrated Knowledge-Based Design Environments." *Human Computer Interaction, Special Issue on Computer Supported Cooperative Work* **7**(3): 281-314.

CSCW in 1988

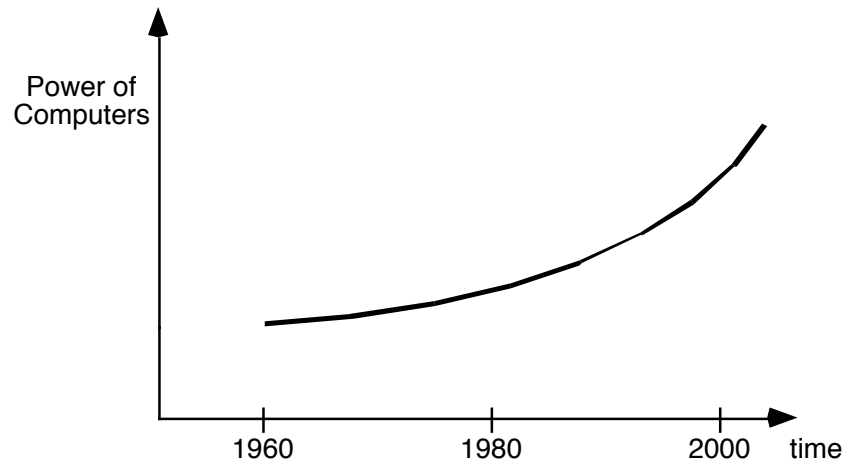
- **technology:** (the **CS** in CSCW)

- “the computer that amplifies an individual’s ability to calculate or write cannot usually be brought to a meeting” (Greif, p 5)
- “we are taking the computer into account in planning buildings that allow for network cables” (Greif, p 6)

- **work:** (the **CW** in CSCW)

- “CSCW research is examining ways of designing systems — people and computer systems — that will have profound implications for the way we work” (Greif, p 6)

The Tension between Human and Computational Power

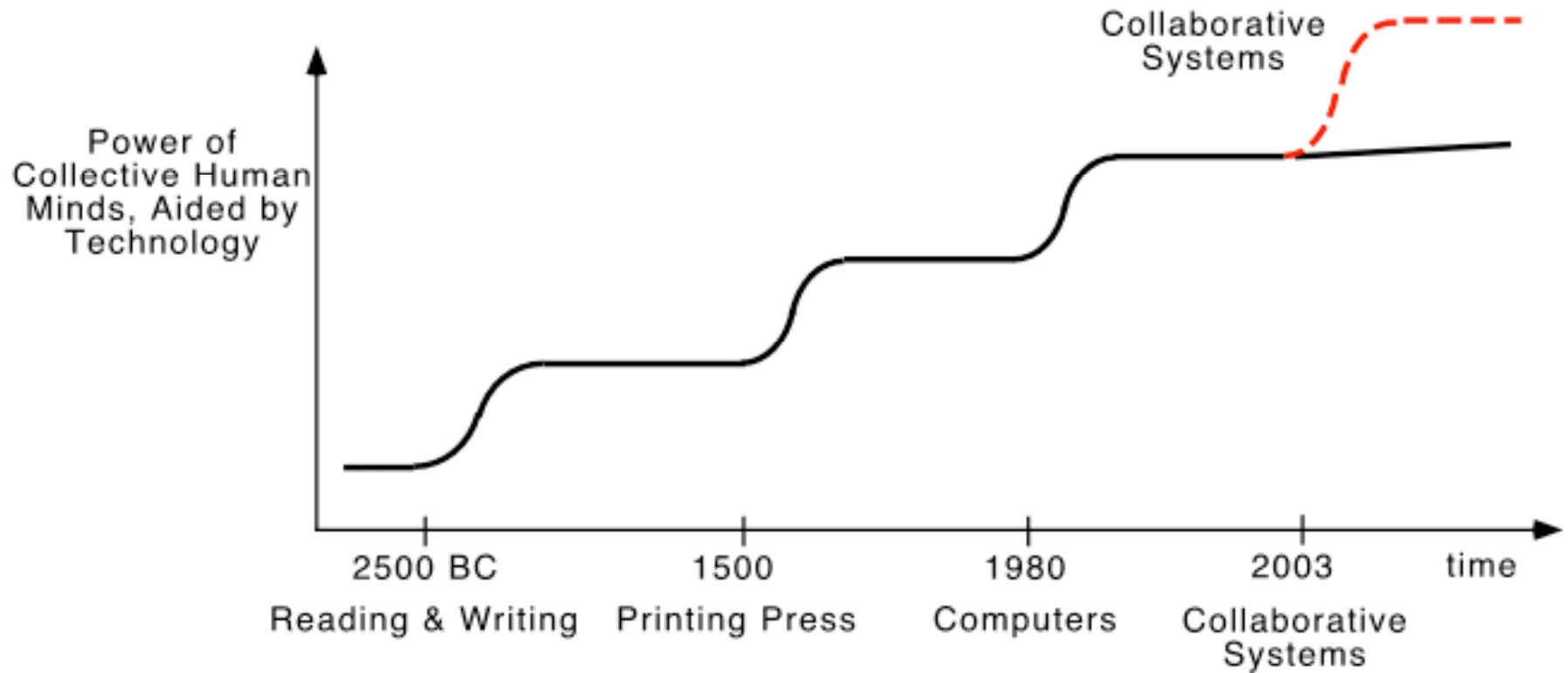


Computing power increases at an exponential rate



The power of the unaided mind remains constant over time

Distributed Cognition: The Aided, Collective Human Mind



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Working and Learning

- **work** (more about “work” in the panel tomorrow)
 - labor (eat, support a family) ↔ **work as a part of our human existence**
 - routine cognitive skills (supported by well-established processes) ↔ **design / creative tasks/ scholarly activity / knowledge worker**
 - **claim: my concept of learning is an integral part of this kind of work**

- **learning** is a part of our human nature (life-sustaining and inevitable) → by necessity: it must be an integral part of CSCW

- if we say that learning is important for CSCW, we have to be **more specific**:
 - what kind of learning?
 - which learning theories?

Learning: Current Theories

- learning is a process of **knowledge construction**, not of knowledge recording or absorption
- learning is **knowledge-dependent**; people use their existing knowledge to construct new knowledge
- learning is highly **tuned to the situation** in which it takes place
- learning needs to account for **distributed cognition** requiring to combine knowledge in the head with knowledge in the world
- learning is affected as much by **motivational issues** as by cognitive issues
- **learning and teaching are not inherently linked** (“much learning takes place without teaching” — but: “much teaching takes place without learning”)

Learning when the Answer is not Known

- **not known: in which sense?**

- global → **historical creativity** (the activity or the product is novel or original to society as a whole)
- local → **psychological creativity** (the activity or the product is personally novel and meaningful to the individual who produced it)

- **conjecture:**

- learning when the answer is known → classroom, access to the Internet
- learning when the answer is not known → work practices, design practices

- **classroom ↔ world**

- **in classroom:** everyone is taught the same thing
- **in the world:**
 - learners contribute in a variety of independent ways
 - learners are engaged in the pursuit of a socially meaningful enterprise, and the learning serves this engagement
 - learning is focused on: learning on demand, self-directed learning, collaborative learning, personally meaningful activities

Learning when the Answer is not Known

- **claim** (Yrjö Engeström, “Expansive Learning at Work: toward an activity theoretical reconceptualization”):

“In important transformations of our personal lives and organizational practices, we must learn new forms of activity which are not there yet. They are literally learned as they are being created. There is no competent teacher. Standard learning theories have little to offer if one wants to understand these processes.”

My Focus: Work = Design Problems

- **design** (Herbert Simon “Sciences of the Artificial”)
 - **natural science**: how things are
 - **design**: how things ought to be

- **design problems** require **learning** because they are
 - **complex** → requiring multidisciplinary approaches in which stakeholders from different disciplines have to **collaborate**
 - **ill-defined** → requiring the integration of problem framing and problem solving
 - **unique** (“a universe of one”) → **learning when the answer is not known**
 - **have no (single) answer** → argumentation

Design Communities: 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
- **Communities of Interest (Cols)**, defined as groups of people (typically coming from different disciplines) who share a common interest (e.g., solve complex design problems, engage in complex decision making)
- **more information:**
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)

▪ CoPs:

- **homogenous design communities:** practitioners who work as a community in a certain domain
- **examples:** architects, urban planners, research groups, software developers, software users, kitchen designers, computer network designers, voice dialog systems designers

▪ learning in CoPs:

- masters and apprentices
- legitimate peripheral participation (LPP) → one accepted, well-established center of expertise and a clear path of learning towards this center exist
- creates a notion of belonging and an identity

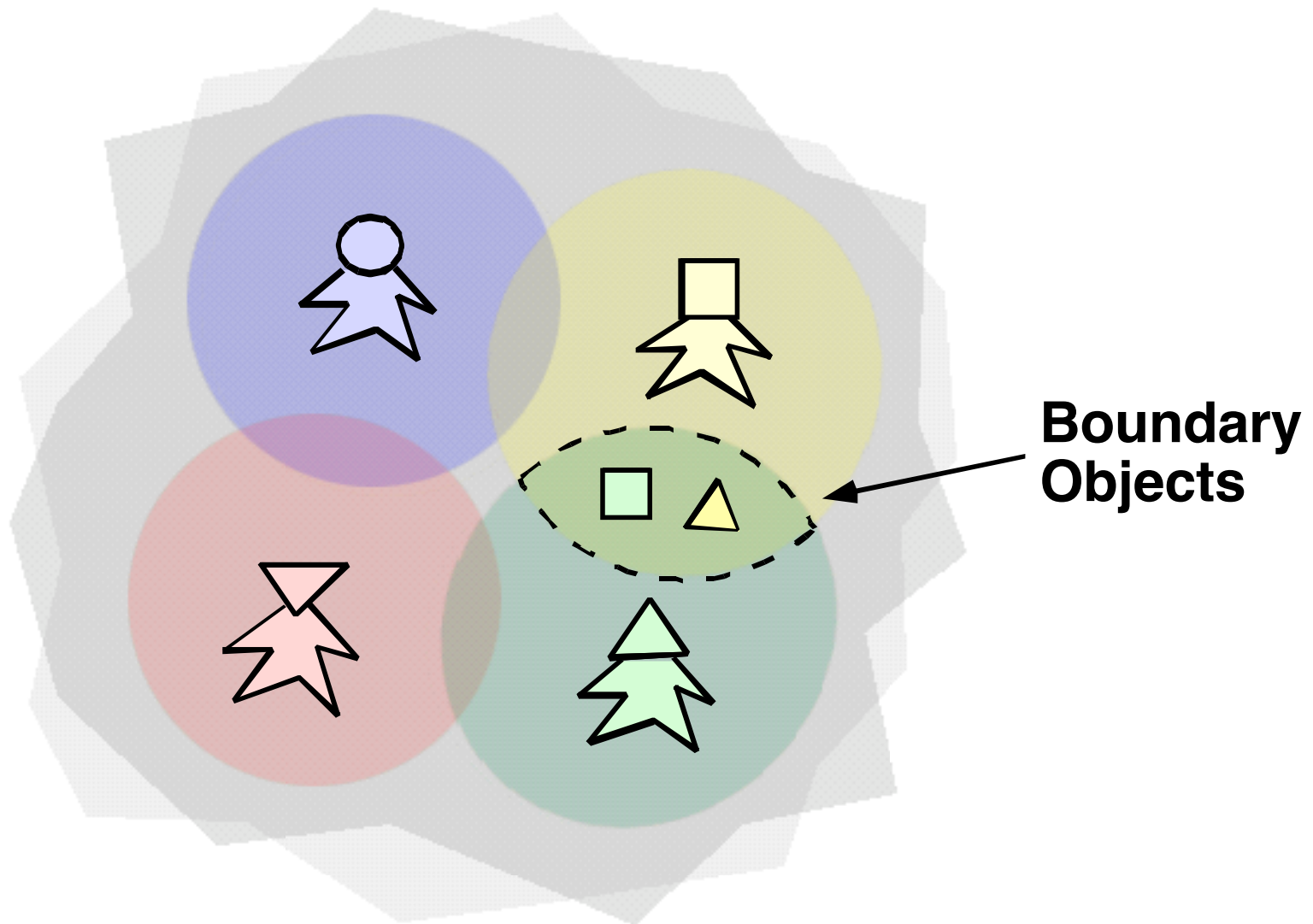
▪ **problems:** “*group-think*” → when people work together too closely in communities, they sometimes suffer illusions of righteousness and invincibility

▪ **systems:** domain-oriented design environments (e.g.: kitchen design, computer network design, voice dialogue design,

Communities of Interest (Cols)

- **Cols**
 - **heterogeneous design communities**: 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
 - **bring together diverse cultures** (academia and from industry, software designers and software users)
- **learning in Cols:**
 - establish a common ground → develop a common language
 - building a shared understanding of the task at hand → negotiation of meaning
 - learning to communicate with others who have a different perspective → boundary objects
 - primary goal: not “moving toward a center” (CoP) but **“integrating diversity and making all voices heard”**

Cols: Social Creativity and Boundary Objects



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Beyond “Gift-Wrapping” and “Techno-Determinism”: The Co-Evolution between Learning and Media

*“One cannot do philosophy with smoke signals”
— Neil Postman*

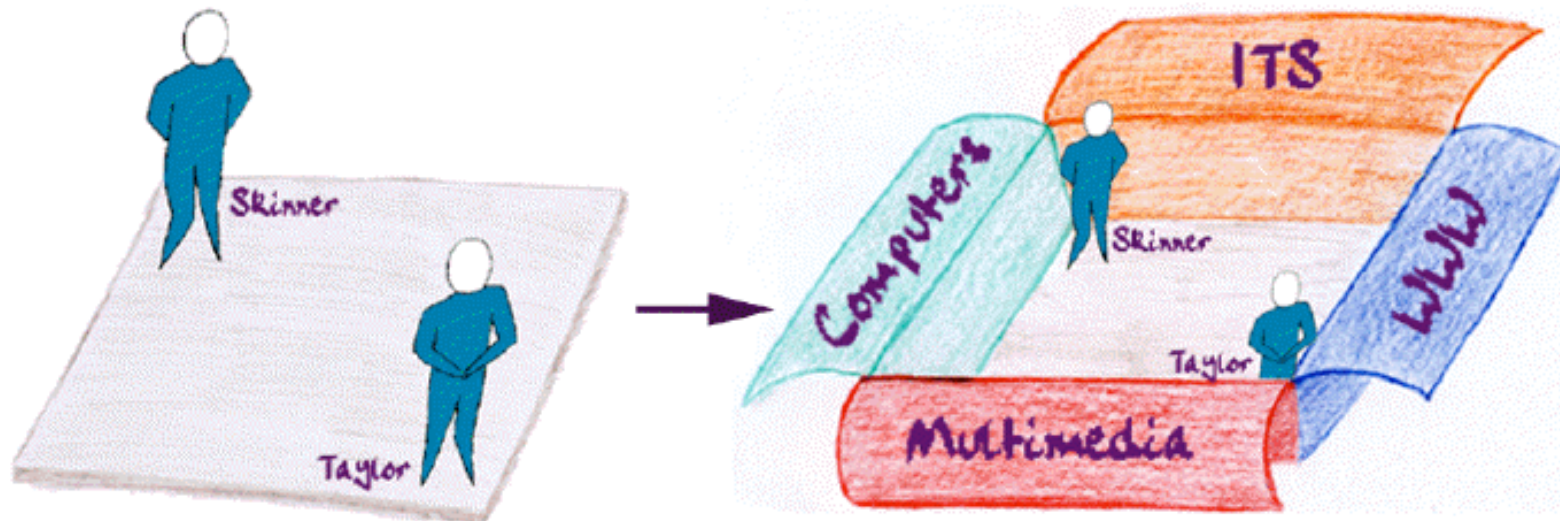
- **“gift wrapping”** dominates many information technologies approaches in CSCW and CSCL

- **claim:** current computer systems do not support
 - creativity and imagination
 - contextualized learning and learning on demand
 - integration of working and learning
 - collaborative learning

- **challenge:** design new civic discourses, because one of the major roles for new media and new technologies is
 - **not** to deliver predigested information to individuals
 - but to provide the opportunity and resources for **social debate and discussion**
 - **the “Google” story:** retrieving an answer \leftrightarrow debating possible answers

Gift-Wrapping

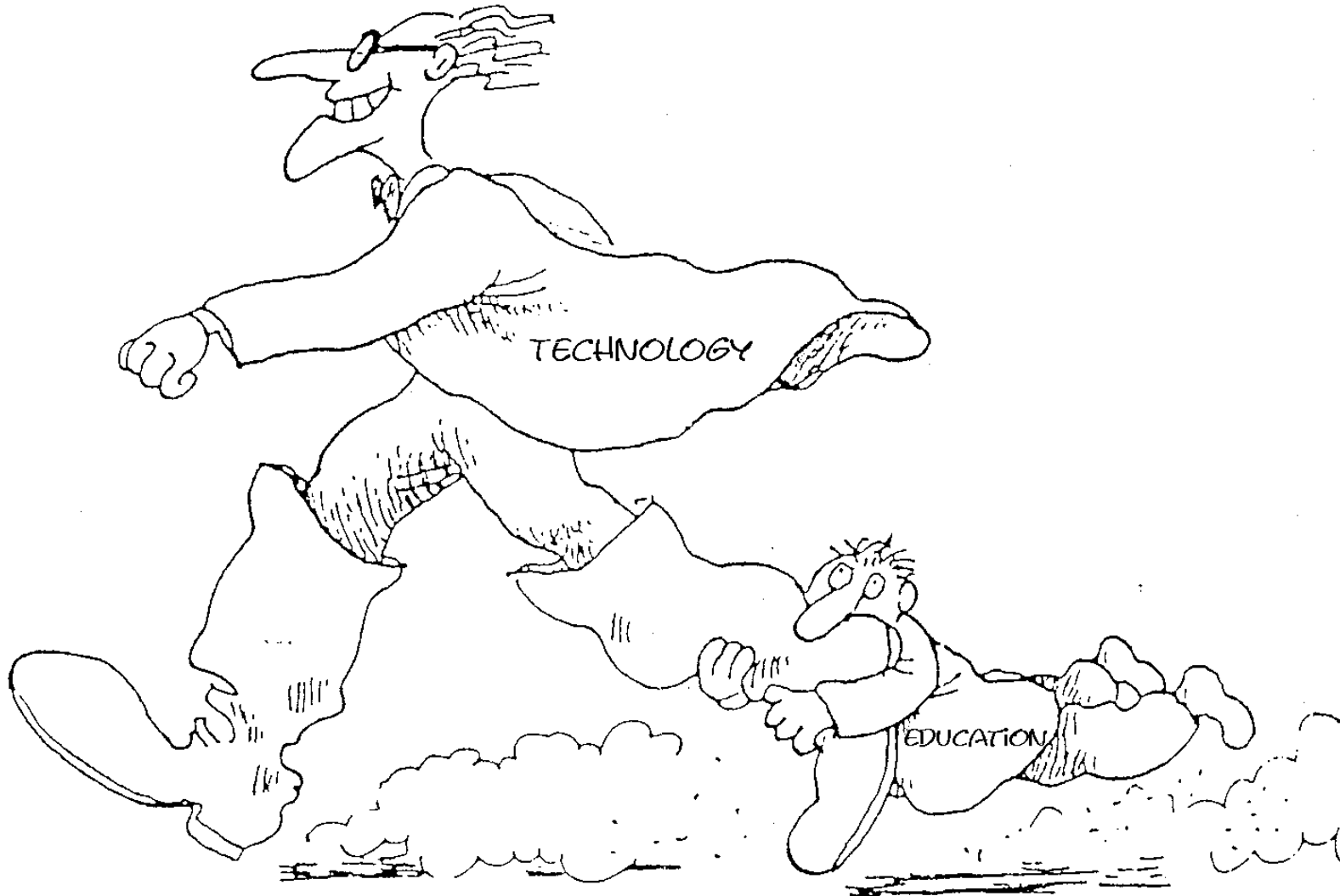
Adding Technology to Existing Educational Practice



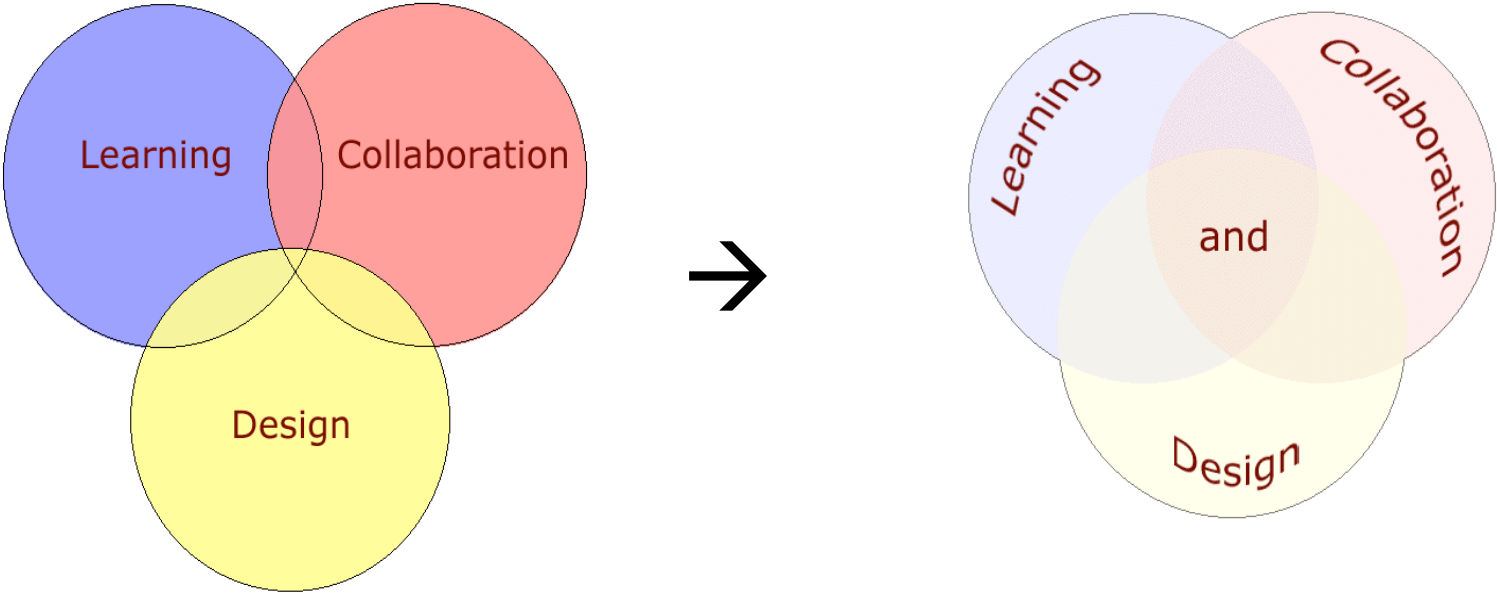
Current Education

Current Education
wrapped in Technology

Techno-Determinism



Co-Evolution of Design, Learning and Collaboration and their Changing Nature through New Media



CSCW: Beyond Gift-Wrapping

- **design = a dialectical process between tradition and transcendence (Pelle Ehn)**
 - **tradition:** CSCW emphasizes the value of workplace studies and how a deep understanding of people's work in situ can inform system design
 - **transcendence:** design should be done for users' work as it is currently done, or whether it should be done to innovate work → transcendence is closely tied to learning and considering workers as learners

- **beyond “gift-wrapping”:**
 - gift-wrapping is important and necessary, but it should not be the ultimate goal
 - “the copier did not merely replace carbon paper → it transformed the way people used documents to organize work” (John Seely Brown)
 - “the invention of technology does not coincide with the innovations produced with that technology” (Alan Kay)

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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 (distributed cognition, social creativity)**
 - knowledge in the head → knowledge in the world
 - access → informed participation
- **generic → specific (“universe of one”)**
 - design → meta-design (adaptive, adaptable, situated)
 - general → customization, personalization
- **“gift-wrapping” with new media → co-evolution of new media, new theories about working, learning, and collaborating**

The Broader Context

- **Ivan Illich:** tools for conviviality, deschooling, deprofessionalization, learning webs
- **Donald Schön:** reflective practitioner (faced with the unpredictable situation of professional practice, a professional does more than just apply knowledge learned in school), reflection-in-action
- **Scandinavian Tradition towards System Design:** participatory design, avoiding to deskill workers
- **activity theory:** describe phenomena at different levels (tasks, activities, communities, social organization), expansive learning and knotworking (Yrjö Engeström)
- **distributed cognition:** collaboration and media as extensions of individual humans

Learning: Current Theories → Specific System Developments

- learning is a process of **knowledge construction**, not of knowledge recording or absorption → *reflection-in-action, argumentation*
- learning is **knowledge-dependent**; people use their existing knowledge to construct new knowledge → *differential descriptions, user models, personalization*
- learning is highly **tuned to the situation** in which it takes place → *human problem-domain communication, domain-oriented design environments*
- learning needs to account for **distributed cognition** requiring to combine knowledge in the head with knowledge in the world → *learning on demand, using on demand, Envisionment and Discovery Collaboratory*
- learning is affected as much by **motivational issues** as by cognitive issues → *gift cultures, an interest is a terrible thing to waste*
- **learning and teaching are not inherently linked** → *learning when the answer is not known, informed participation*

Some L3D's Contributions and Developments

- **Envisionment and Discovery Collaboratory (E. Arias and H. Eden)** — computational support in face-to-face meetings for communities of interest
- **Web2gether (R. dePaula)** — social networks (teachers, parents) caring for people with cognitive disabilities
- **Living Organizational Memories (J. Ostwald)** — collaboratively evolved information repositories
- **CodeBroker (Y. Ye)** — software reuse as a CSCW/CSCL problem
- **DLESE (T. Sumner)** — digital libraries evolved by their users

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

Social Creativity and Meta-Design

- **social creativity:**
 - the Renaissance scholar does not exist anymore — the individual human mind is limited
 - distinct domain of human knowledge exist → of critical importance: mutual appreciation, efforts to understand each other, increase in socially shared cognition and practice (Snow, C. P. (1993) “The Two Cultures”)
 - asymmetry of ignorance

- **meta-design:** create new media that allow users to act as designers and be creative

Individual and Social Creativity

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

- **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)
 - tension between creativity and organization: elements of organization (e.g., workflow systems) can stifle creativity
- **social creativity:**
 - requires designers not consumers
 - requires externalizations/oeuvres to serve as boundary objects

Meta-Design

- **meta-design**

- create new media that allow users to act as designers and be creative
- is the creation of context rather than content
- puts the tools rather than the object of design in your hands
- does not define a product, but the conditions for a process of interaction

- **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”

- **more information:**

Gerhard Fischer: “Beyond 'Couch Potatoes': From Consumers to Designers and Active Contributors”, *First Monday*, volume 7, number 12 (December 2002),
[http://firstmonday.org/issues/issue7_12/fischer/index.html]

Meta-Design: Beyond User-Centered Design and Participatory Design

- **user-centered design:**
 - analyze the needs of the users
 - understand the conceptual worlds of the users
- **participatory design**
 - involve users more deeply in the process as co-designers by empowering them to propose and generate design alternatives
 - focus on system development at design time by bringing developers and users together to envision the contexts of use
- **limitations of user-centered design and participatory design:** despite the best efforts at design time, systems need to be *evolvable*
 - to fit new needs
 - account for changing tasks
 - incorporate new technologies
- **meta-design:** a design methodology for problems “when the answer is not known”

The Envisionment and Discovery Collaboratory



Meta-Design Aspects in the Envisionment and Discovery Collaboratory: Closed versus Open Systems

- **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

- **user control:**
 - end-user modifiability
 - conviviality: putting owners of problems in charge

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Looking Ahead: Predicting the Future

*"This is not the end.
It is not even the beginning of the end.
But it is, perhaps, the end of the beginning."*

Winston Churchill

Opportunities

- **learning and CSCW** → opportunity for a “win-win” situation, a truly symbiotic relationship
 - rejuvenate learning with a grounding in CSCW
 - rejuvenate CSCW with a learning perspective

- **CSCL ↔ CSCW: what can these disciplines learn from each other?**
 - **CSCL from CSCW:** lack of emphasis on “trust + privacy + social capital”
 - **CSCW from CSCL:** learning is a new form of work, design for learners

- **CSCL + CSCW:**
 - **a joint conference in the future?**
 - promote the **integration of working and learning:** a neglected topic of both disciplines

Conclusions

- the future is not out there to be “discovered” — it has to be **invented and designed**

- **not only:**
 - by info-enthusiasts, based on techno-determinism
 - by limiting ourselves to gift-wrapping

- **contributions of the CSCW community:**
 - explore the **fundamentally new possibilities and limitations** of computational media on how we work, learn, and collaborate
 - develop a **social critique** of changing technologies
 - give more attention to **learning**
 - **integrate** working with learning and collaboration
 - design **innovative media** to support this integration
 - support **individual and social creativity**