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

Designing Socio-Technical Environments in Support of Meta-Design and Social Creativity

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- **larger community over many years**: NSF EHR-supported research groups, LIFE: Science of Learning Center, ELOC community, German/European Collaborators
Overview

- Basic Message
- The Larger Context
- Lifelong Learning
- Design and Meta-Design
- Social Creativity
- Example of a Socio-Technical Environment
- Challenges
- Conclusion
Basic Message

- **CSCL is too timid and not thinking radically enough**
  - by accepting too many established approaches (e.g.: a theory of human learning based solely on school learning is too limited);
  - by not embracing new learning opportunities (e.g.: exploiting the unique opportunities of social production in which all learners can act as active contributors in personally meaningful problems);
  - by not moving beyond “gift-wrapping” and “techno-determinism” to co-evolution of learning, new media, and new learning organizations

- **challenges for the CSCL community:** provide elements of a transformational conceptual framework
  - for lifelong-learning by focusing on how learning takes place when the answer is not known
  - supporting people in taking control of their own learning
A Transformational Conceptual Framework

- school learning $\rightarrow$ lifelong learning
- unaided individual human mind $\rightarrow$ distributed intelligence
- reflective practitioner $\rightarrow$ reflective community
- community of practice $\rightarrow$ community of interest
- “gift-wrapping” and techno-determinism $\rightarrow$ socio-technical environments
- consumers $\rightarrow$ active contributors (meta-design)
- learning when the answer is known $\rightarrow$ learning when no one knows the answer (social creativity)
The Larger Context
Beyond the Unaided, Individual Human Mind
History

Ivan Illich: Deschooling Society
Chapter on Learning Webs (1971)

- **reference services to educational objects** — facilitating access to things or processes used for formal learning

- **skill exchanges** — permitting persons to list their skills, the conditions under which they are willing to serve as models for others who want to learn these skills, and the addresses at which they can be reached

- **peer-matching** — a communications network which permits persons to describe the learning activity in which they wish to engage, in the hope of finding a partner for the inquiry

- **reference services to educators-at-large** — listed in a directory giving the addresses and self-descriptions along with conditions of access to their services
Why Now?
National Science Foundation

- 5 year strategic plan: terms and concepts
  - collaboration 17
  - creativity 6
  - innovation 26
  - exploration 11
  - discovery 27
  - STEM 9

- new programs:
  - CreativeIT (2007)
The CSCL Community

- **my question**: what do you consider the **MOST CHALLENGING AND MOST IMPORTANT ISSUE** for the CSCL community in 2007?
Selected Answers

- computers and schools are basically **incompatible**

- CSCL is being reinvented by the rapidly growing **web 2.0 community**; the interchange between these two communities should be fostered

- use CSCL to enhance students' capability for **creativity**

- CSCL has failed to settle on an agreed-upon **research agenda**

- develop **new methodologies** for CSCL

- do work that is relevant to the **important problems and issues** of today

- take learning as a phenomenon that is deeply rooted in its **broader institutional and practical contexts**

- there would be a lot of chaos when students design courses for themselves, at least in **Asian contexts**
CSCL = CS + CL

- **CS: computer supported**
  - intelligent tutoring systems / AI and Education → *closed world with full control*
  - clickers in classroom → “*gift-wrapping*”
  - multi-media for presentation and instruction → *consumer-oriented rich representations*
  - OLPC (=one laptop per child) / $100 computer → *digital divide*
  - Web 2.0 technologies → *social production, users-as-designers* (the technological “hot spot”?)

- **CL: collaborative learning**
  - giving all stakeholders a voice → *meta-design*
  - transdisciplinary collaboration → *social creativity*
  - teacher, learner = f{person} → f {context}

- **misunderstanding** between “*necessary*” and “*sufficient*”
  - all schools on the Internet
  - $100 computer
Co-Evolution: Beyond “Technology-Driven Developments” and “Gift-Wrapping”

Learning, working, and collaboration

New learning organizations

New media and new technologies
Lifelong Learning
Our Credo of Lifelong Learning

- **assumption:** If the world of working and living relies on collaboration, creativity, definition and framing of problems and if it requires dealing with uncertainty, change, and intelligence that is distributed across minds, cultures, disciplines, and tools

- **consequence:** then education should foster on competencies that prepare students for having meaningful and productive lives in such a world
Science of Learning

- “A decade of interdisciplinary research on everyday cognition demonstrates that school-based learning, and learning in practical settings, have significant discontinuities. We can no longer assume that what we discover about learning in schools is sufficient for a theory of human learning.” — Scribner and Sachs

- “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.” — Yrjö Engeström
Personal History

- **1994**: Center for LifeLong Learning & Design (L3D)

- **1995**: 1st CSCL conference — paper: “Distributed Cognition, Learning Webs and Domain-Oriented Design Environments”
WWW: From Broadcast to Collaboration Medium
(1996: Fischer, Ambach, Ostwald, Repenning)

M1
The Web as Broadcast Medium

M2
Broadcast with Feedback

M3
Evolutionary and Collaborative Design

Delegation
Feedback (via email or forms)
Distributed Collaboration
Design and Collaborative Design

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

- the need for **collaborative design** because design problems are
  - complex → requiring **social creativity** in which stakeholders from different disciplines have to collaborate
  - ill-defined → requiring the integration of problem framing and problem solving
  - have no (single) answer → argumentation support, consideration of trade-offs, feeling comfortable with ambiguity
  - unique (“a universe of one”) → requiring learning when no one knows the answer
Meta-Design = Design for Designers

- **meta-design explores:**
  - the invention and design of a culture in which participants can **express themselves** and engage in personally meaningful activities

- **meta-design requires**
  - designers giving up some **control** at design time
  - **active contributors** (and not just passive consumers) at use time

- **meta-design raises research problems of fundamental importance**
  including
  - new **design methodologies**
  - a new understanding of **collaboration, motivation, innovation and creativity**
  - the design of innovative **socio-technical environments**

- provides a theoretical framework for **Web 2.0 technologies**
Design Time and Use Time

- **Key**
  - System developer
  - User (representative)
  - End user

- **Time**
  - Design time
  - Use time

- **Worlds**
  - World-as-imagined
  - World-as-experienced

- **Activities**
  - Prediction
  - Planning
  - Reality
  - Situated action

Gerhard Fischer

CSCL, 2007
Meta-Design: A Framework for Effective, Large Scale, Distributed, Collaborative Efforts


- **integration of consumer and producer roles** → Fischer, G. (2002) “Beyond 'Couch Potatoes': From Consumers to Designers and Active Contributors”
What Do Meta-Designers Do?

- they use their own creativity to create socio-technical environments in which other people can be creative

- they underdesign
  - by creating contexts and content creation tools rather than content
  - by creating technical and social conditions for broad participation in design activities
  - by supporting ‘hackability’ and ‘remixability’

- examples for meta-design: Web 2.0 Technologies
  - Wikis
  - Google-SketchUp + 3D Warehouse + Google Earth
  - Second Life
  - Open source
SketchUp — a 3D Modeling Environment for Content Creation
3D Warehouse: a Web 2.0 Environment

http://sketchup.google.com/3dwarehouse/

- **features:**
  - search, share, and store 3D models created in SketchUp
  - models include: buildings, houses, bridges, sculptures, cars, people, pets, ...
  - download the 3D models to be modified in SketchUp
  - if the model has a location on earth → download it and view it in Google Earth
  - share 3D models by uploading them from SketchUp

- **challenges:**
  - what will motivate people to participate?
  - participation requires to learn SketchUp → create learning environments for SketchUp
3D Warehouse

- **Tsim Sha Tsui Clock Tower**
  - by Google
  - ★★★★★ (1 rating)
  - Tsim Sha Tsui Clock Tower,...
  - View in Google Earth

- **1500 Walnut Street**
  - by Google
  - This building located at 1500...
  - View in Google Earth

- **Marriott Marquis**
  - by Google
  - This Hotel in Atlanta rises...
  - View in Google Earth

- **Milwaukee Art Museum**
  - by Google
  - ★★★★★ (6 ratings)
  - The history of the Milwaukee...
  - View in Google Earth

- **Figueroa at Wilshire**
  - by Google
  - Albert C. Martin and...
  - View in Google Earth

- **CPL Harold Washington Library Center**
  - by Google
  - ★★★★★ (6 ratings)
  - This monumental building,...
  - View in Google Earth

- **Hearst Residence (Hearst Castle)**
  - by Google
  - ★★★★★ (2 ratings)
  - San Francisco architect Julia...
  - View in Google Earth

- **CitySpire Center**
  - by Google
  - ★★★★★ (2 ratings)
  - Designed by Murphy/Jahn, Inc....
  - View in Google Earth
Downtown Denver in 3D
Social Creativity
Learning When No One Knows the Answer

- **design problems are unique** → learning from the past is not enough

- **sources for new knowledge:**
  - conceptual collisions (LIFE Center)
  - epistemological pluralism: diversity in how we think; e.g.: formal thinking versus bricolage (LOGO community)
  - distributed intelligence (Salomon, Hutchins, ……)
  - boundary objects (Star, …………)
  - symmetry of ignorance (Rittel, L3D)
  - emergence
Social Creativity

- complex design problems are systemic problems; *they seldom fall within the boundaries of one specific domain* → they require the participation and contributions of several stakeholders with various backgrounds

- “An idea or product that deserves the label ‘creative’ arises from the synergy of many sources and not only from the mind of a single person”
  — Mihaly Csikszentmihályi

- “Invention is a social process: it rests on the accumulation of many minor improvements, not the heroic efforts of a few geniuses” — Karl Marx
Distances in Social Creativity: Limitations or Opportunities?

- **spatial dimension**: shared location → shared concerns; *success model*: open source communities
- **temporal dimension**: learning from the past; *success model*: reuse and redesign
- **conceptual dimension**: exploiting *symmetry of ignorance, conceptual collisions, epistemological pluralism and breakdowns* as sources for innovation; *success models*: Communities of Practice (CoPs) and Communities of Interest (Cols)
- **technological dimension**: a new understanding of *distributing intelligence* and the identification of *basic skills* in the 21st century
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, software users, kitchen designers, computer network designer,

- **learning:**
  - masters and apprentices
  - legitimate peripheral participation (LPP)

- **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)
Heterogeneous Design Communities

- **Cols** = 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

- **diverse cultures**: people from academia and from industry, software designers and software users, students and researchers from different cultures

- **fundamental challenges**:  
  - establish common ground by creating boundary objects  
  - build a shared understanding of the task at hand  
  - learn to communicate with others who have a different perspective  
  - primary goal: not “moving toward a center” (such as LPP in CoP) but “integrating diversity and making all voices heard”
A Socio-Technical Environment

Envisionment and Discovery Collaboratory (EDC)

(major developers: Ernesto Arias and Hal Eden)

- the EDC supports:
  - collaborative design (e.g. in: urban planning, emergency management)
  - social creativity → learning when no one knows the answer
  - meta-design → a version of SimCity in which content is generated by users

- the EDC and CSCL
  - CS: table-top, computationally enriched physical objects, visualization
  - CL: Cols, emergence, boundary objects, reflection in action, reflective communities
The Envisionment and Discovery Collaboratory
Face-to-Face Collaboration around the EDC Action Space
Boulder City Council and University of Colorado Regents
Sketching Support in the EDC
Buildings Sketched into a Google-Earth Client
Emerging Insight: Illustrating Multiple Walking Distances
Integrating Individual and Social Creativity: Caretta
(collaboration with Masanori Sugimoto, University of Tokyo)
Other Examples from L3D’s Research

- **Agentsheets (Alexander Repenning)** → Behavior Exchange

- **Digital Libraries (Tammy Sumner et al)** → Community Evolution (Meta-Design)

- **Courses-as-Seeds (started in 1997)**
  - based on the seeding, evolutionary growth, reseeding (SER) model
  - supported by Wikis
  - [http://l3d.cs.colorado.edu/~gerhard/courses/](http://l3d.cs.colorado.edu/~gerhard/courses/)
  - more in my paper in the proceedings

- **Transdisciplinary Collaboration** (collaboration with Sharon Derry)
  - successful collaboration **creates new forms of knowledge** outside or in between disciplines and in the process **transforms the disciplinary identities** of the collaborating researchers
Challenges

- reflective communities
- “long tail” opportunities
- learning from each other
Reflective Practitioners → Reflective Communities

Large Conceptual Distance — Limited Common Ground
Software Professionals Acquiring Domain Knowledge
Domain Experts Acquiring Media Knowledge
From Reflective Practitioners to **Reflective Communities**

(supported by transdisciplinary collaboration)
Exploiting “Long Tail” Opportunities

—

The Long Tail

The Long Tail

<table>
<thead>
<tr>
<th>TOTAL INVENTORY</th>
<th>* inventory in a typical store</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rhapsody</strong></td>
<td>735,000 songs</td>
</tr>
<tr>
<td><strong>Wal-Mart</strong></td>
<td>39,000 songs*</td>
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<tr>
<td><strong>Amazon</strong></td>
<td>2.3 mil books</td>
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<tr>
<td><strong>Barnes &amp; Noble</strong></td>
<td>130,000 books*</td>
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<tr>
<td><strong>Netflix</strong></td>
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</tr>
<tr>
<td><strong>Blockbuster</strong></td>
<td>3,000 DVDs*</td>
</tr>
</tbody>
</table>
The Other End: Cultural Literacy
A New Synergy: Basic Knowledge/Skills and Long-Tail

- **basic skills**: learning to learn, learning on demand, meta-cognitive skills, soft skills (different from Hirsch “cultural literacy”)

- **long-tail**:  
  - interest  
  - passion  
  - self-directed learning  
  - intrinsic motivation  
  - personally meaningful problems  
  - interesting example → movie: “October Sky”

- **extensive coverage** needed for supporting the infinite numbers of interesting topics — will be facilitated by a “meta-design” culture) → examples:  
  - Wikipedia  
  - 3D objects in Google Earth / 3D Warehouse
Learners and Teachers
School and Cultural Literacy
Teacher, Learner = f\{person\} → f \{context\}

- today’s students are “digital natives” and belong to the “n-gen” culture—they engage in Facebook, Second Life, Flickr, YouTube, World of Warcraft, Wikipedia, Open Source, ……→ pedagogy of mutuality (Bruner), symmetry of ignorance
Conclusion: “Let Us Be Less Timid”

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

- **George Bernard Shaw:** "The reasonable man adapts himself to the world. The unreasonable man persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man."

- **Machiavelli:** “People who want to change institutions, have all those as their enemies who have done well under the old conditions”

- **Winston Churchill:** “This is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning.”