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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- **ideas for my presentation:** too many to name them all — Yrjö Engeström, Thomas Herrmann, Shin'ichi Konomi, Tim Koschmann, Stefanie Lindstaedt, Chen-Chung Liu, Chee Kit Loi, Hiroaki Ogata, Gerry Stahl, Masanori Sugimoto, ……..

- **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

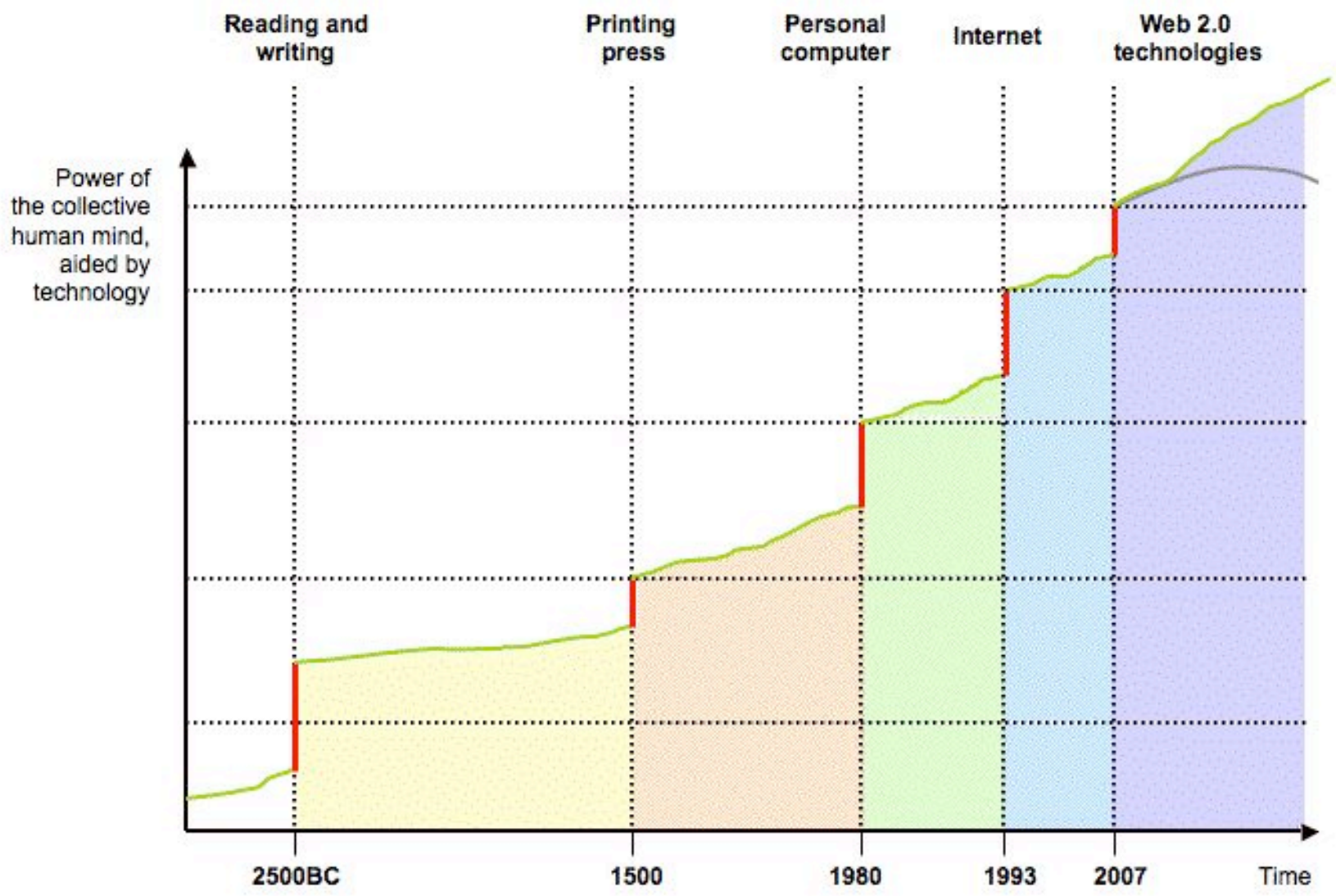
- **challenges for the CSCL community:** provide elements of a **transformational conceptual framework**
  - for lifelong-learning by focusing on how learning takes place when the answer is not known
  - supporting people in taking control of their own learning

A Transformational Conceptual Framework

▪ school learning	→	**lifelong learning**
▪ unaided individual human mind	→	**distributed intelligence**
▪ reflective practitioner	→	**reflective community**
▪ community of practice	→	**community of interest**
▪ "gift-wrapping" and techno-determinism	→	**socio-technical environments**
▪ consumers	→	**active contributors (meta-design)**
▪ learning when the answer is known	→	**learning when no one knows the answer (social creativity)**

The Larger Context

Beyond the Unaided, Individual Human Mind



History

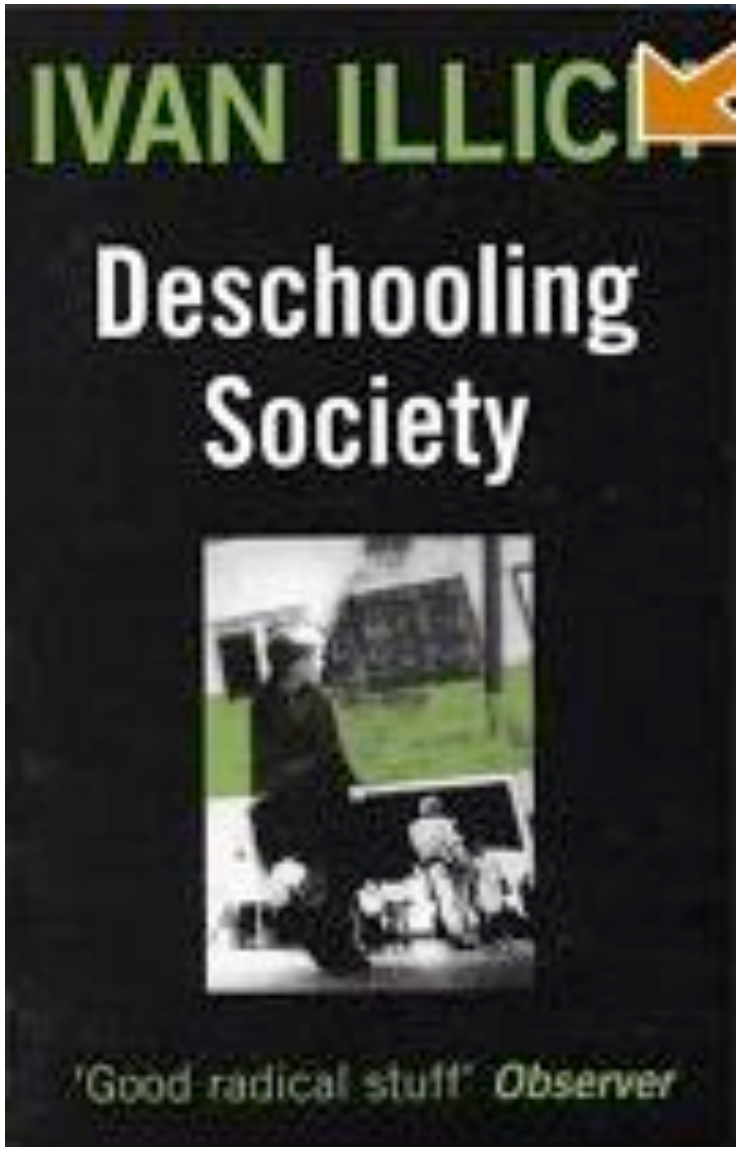
- Ivan Illich: *Deschooling Society* (1971) + Tools for Conviviality (1973) → learning webs

- Donald Schön: *The Reflective Practitioner: How Professionals Think in Action*. (1983) → reflection-in-action

- Herbert Simon: *The Sciences of the Artificial,* 3rd ed (1996) → design

- Seymour Papert: *Mindstorms: Children, Computers and Powerful Ideas* (1980) → constructionism

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
INVESTING IN AMERICA'S FUTURE
STRATEGIC PLAN
FY 2006-2011

National Science Foundation

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

- ***new programs:***
  - Science of Design (2005)
  - CreativeIT (2007)
  - Cyberinfrastructure Training, Education, Advancement, and Mentoring for Our 21st Century Workforce (2007)

The CSCL Community

- **my question:** what do your 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**

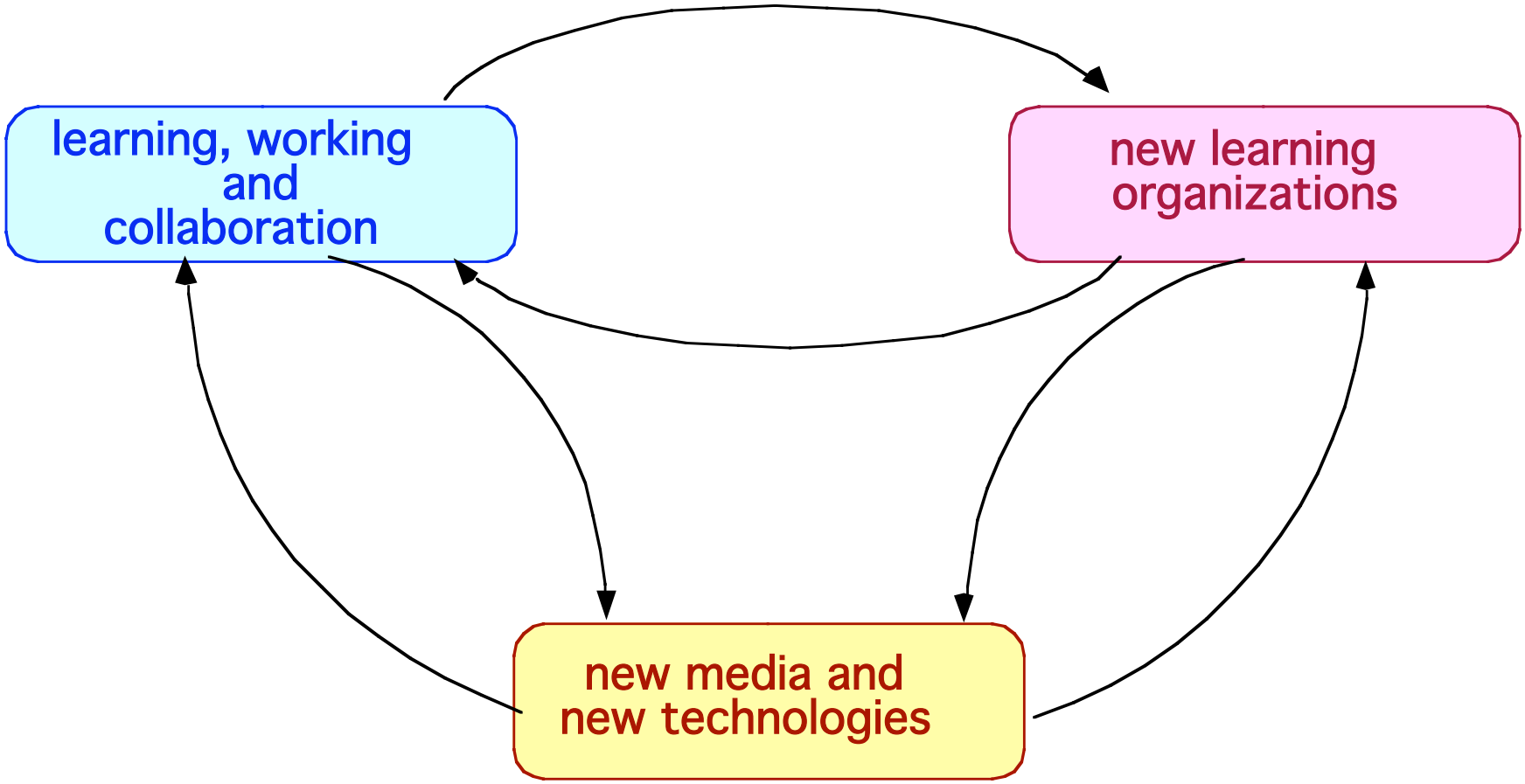
CSCL = CS + CL

- **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"



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

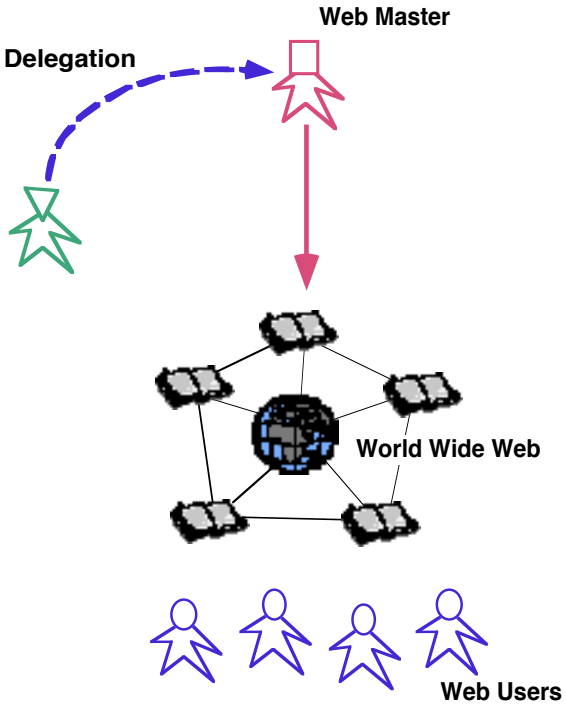
Personal History

- **I994:** Center for **LifeLong Learning** & **Design** (L3D)

- **1995: 1st CSCL conference** —paper: *"Distributed Cognition, Learning Webs and Domain-Oriented Design Environments"*

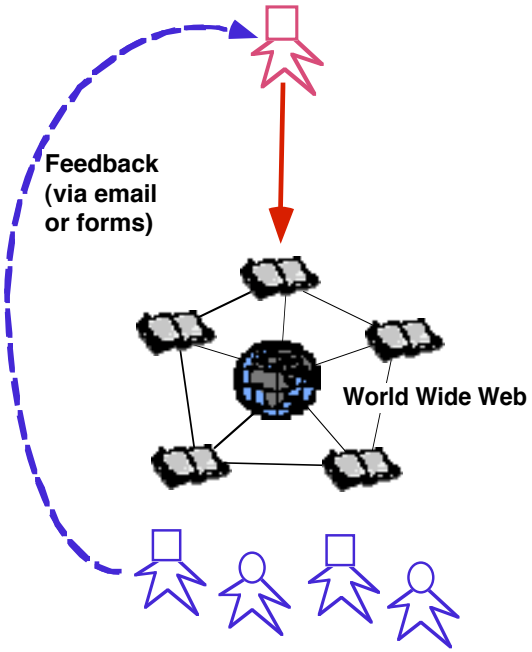
WWW: From Broadcast to Collaboration Medium

(1996: Fischer, Ambach, Ostwald, Repenning)



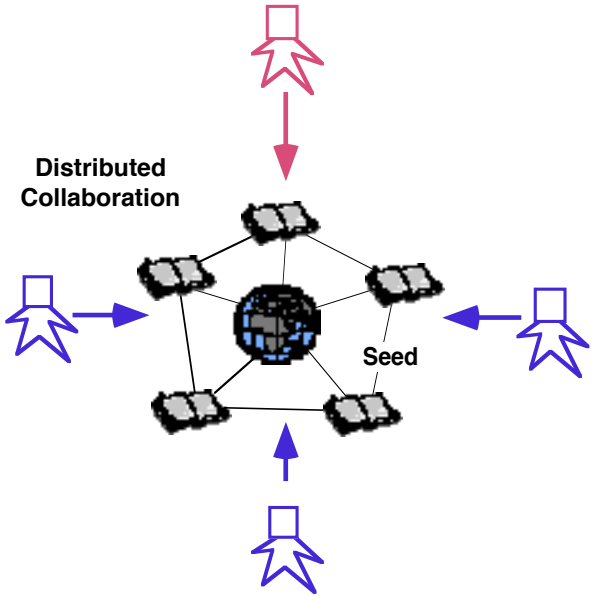
M1

The Web as Broadcast Medium



M2

Broadcast with Feedback



M3

Evolutionary and Collaborative Design

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

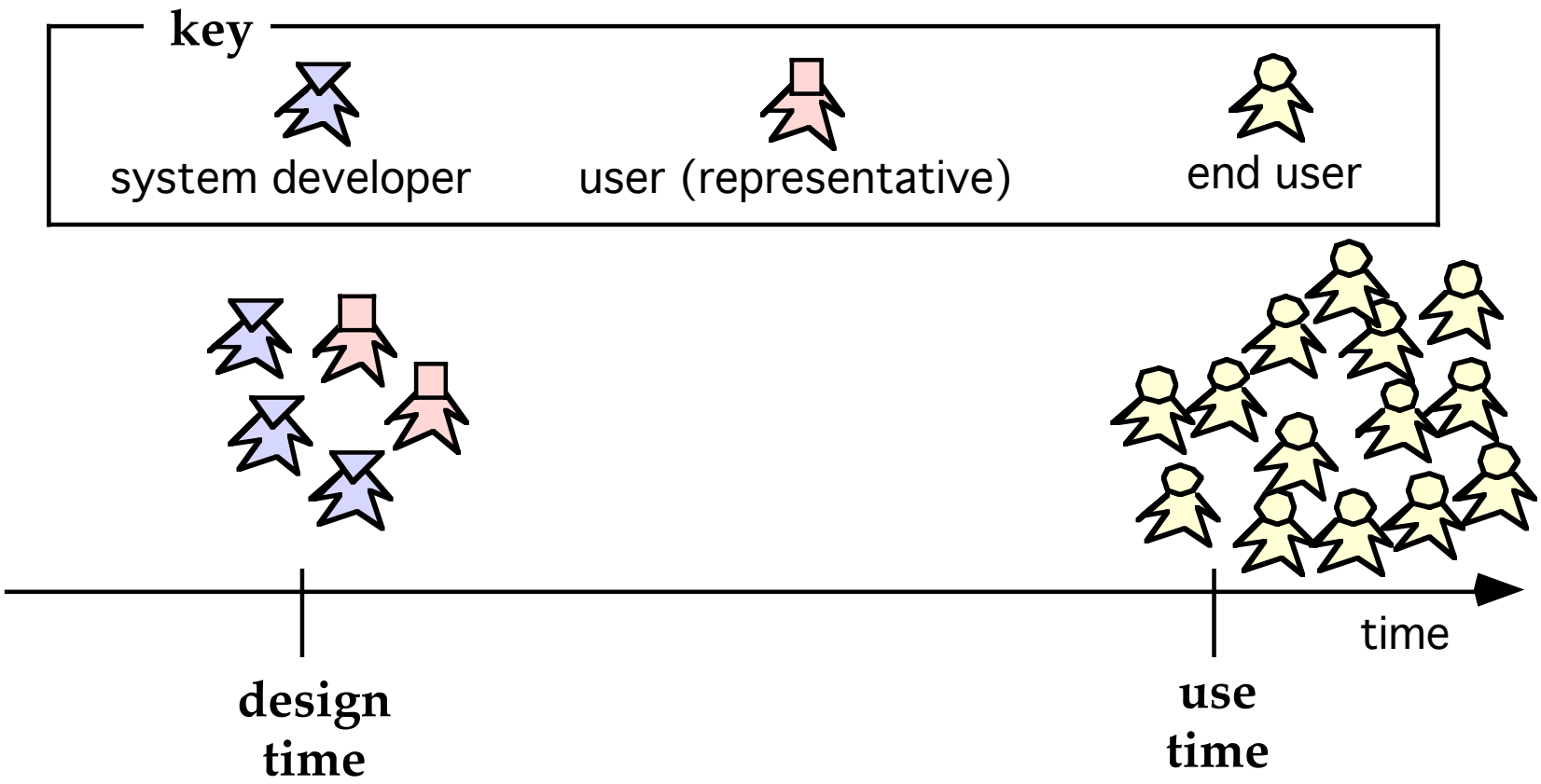
- **meta-design explores:**
  - the invention and design of a culture in which participants can **express themselves** and engage in personally meaningful activities

- **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



world-as-imagined
prediction
planning

world-as-experienced
reality
situated action

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

- **social production** → Benkler, Y. (2006) "*The Wealth of Networks: How Social Production Transforms Markets and Freedom"*

- **democratizing innovation** → von Hippel, E. (2005) "*Democratizing Innovation"*

- **mass collaboration** → Tapscott, D and Williams, A. (2006): *"Wikinomics: How Mass Collaboration Changes Everything"*

- **integration of consumer and producer roles** → Fischer, G. (2002) *"Beyond 'Couch Potatoes': From Consumers to Designers and Active Contributors"*

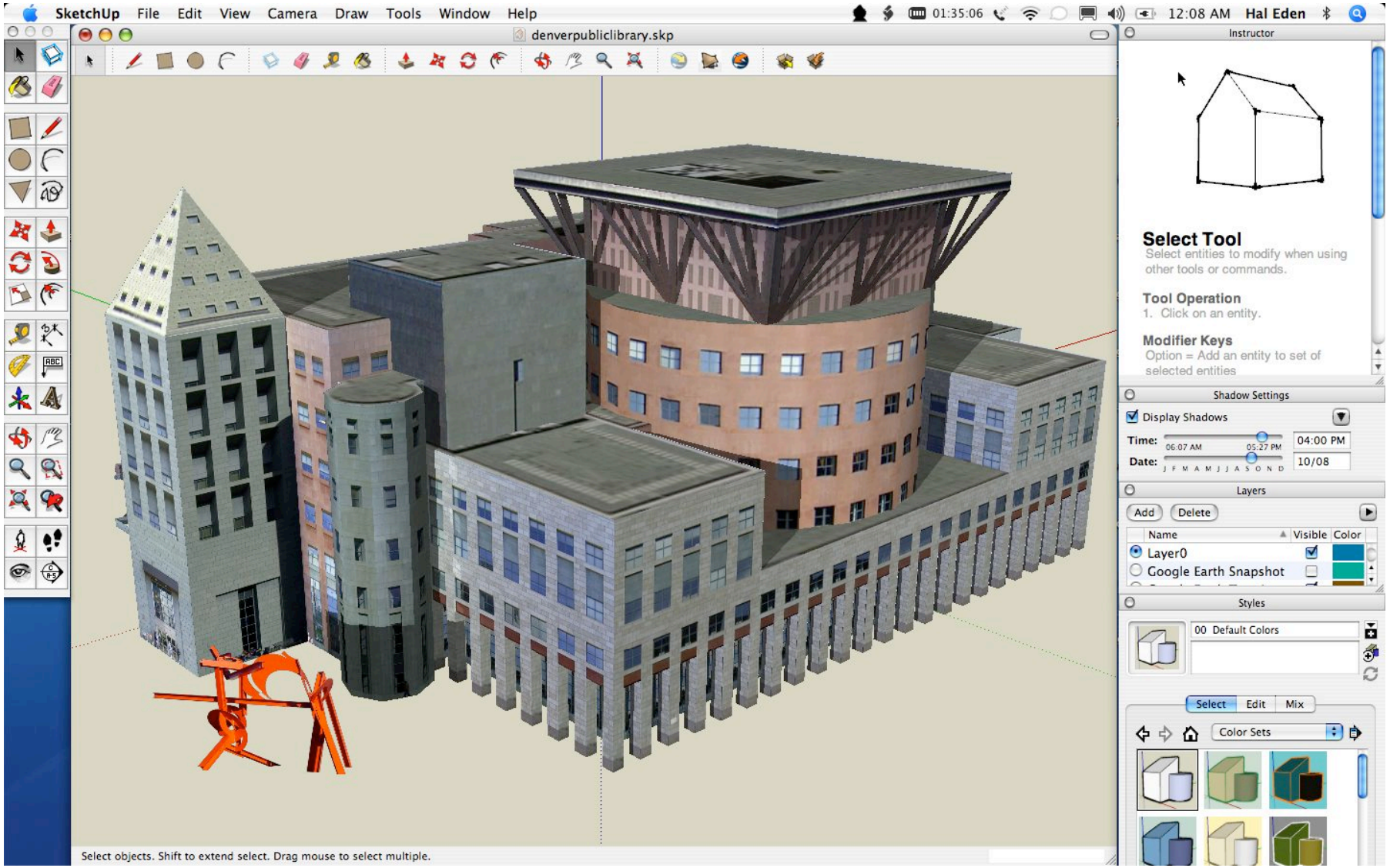
What Do Meta-Designers Do?

- 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

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

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

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

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

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

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

CitySpire Center
by Google
★★★★★ (2 ratings)
Designed by Murphy/Jahn, Inc....
View in Google Earth

CU Boulder in 3D

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 (CoIs)

- **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 (CoIs)

Heterogeneous Design Communities

- **CoIs =** bring different CoPs together to solve a problem

- **membership** in CoIs 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

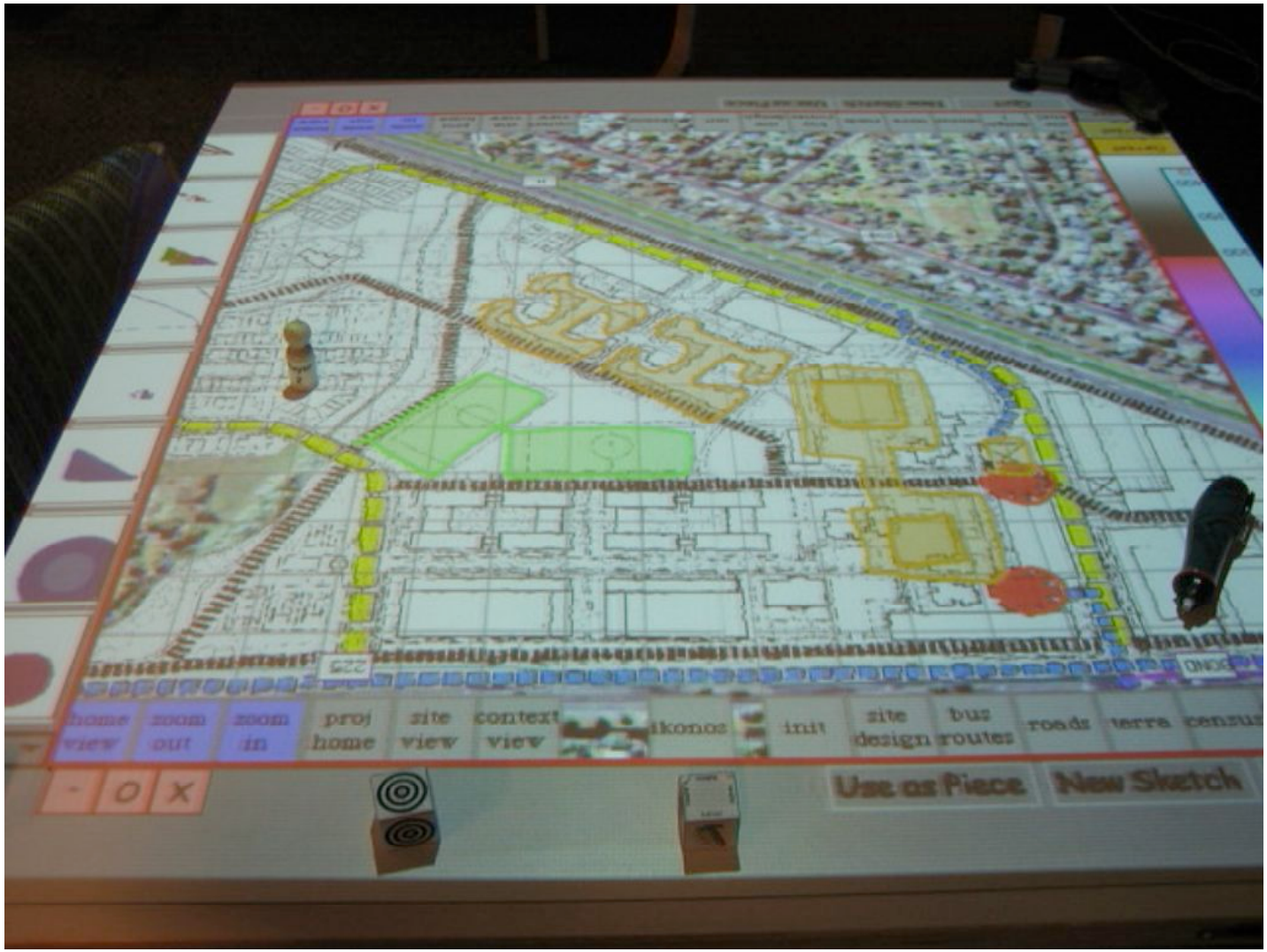
- **the EDC and CSCL**
  - **CS:** table-top, computationally enriched physical objects, visualization
  - **CL:** CoIs, emergence, boundary objects, reflection in action, reflective communities

The Envisionment and Discovery Collaboratory

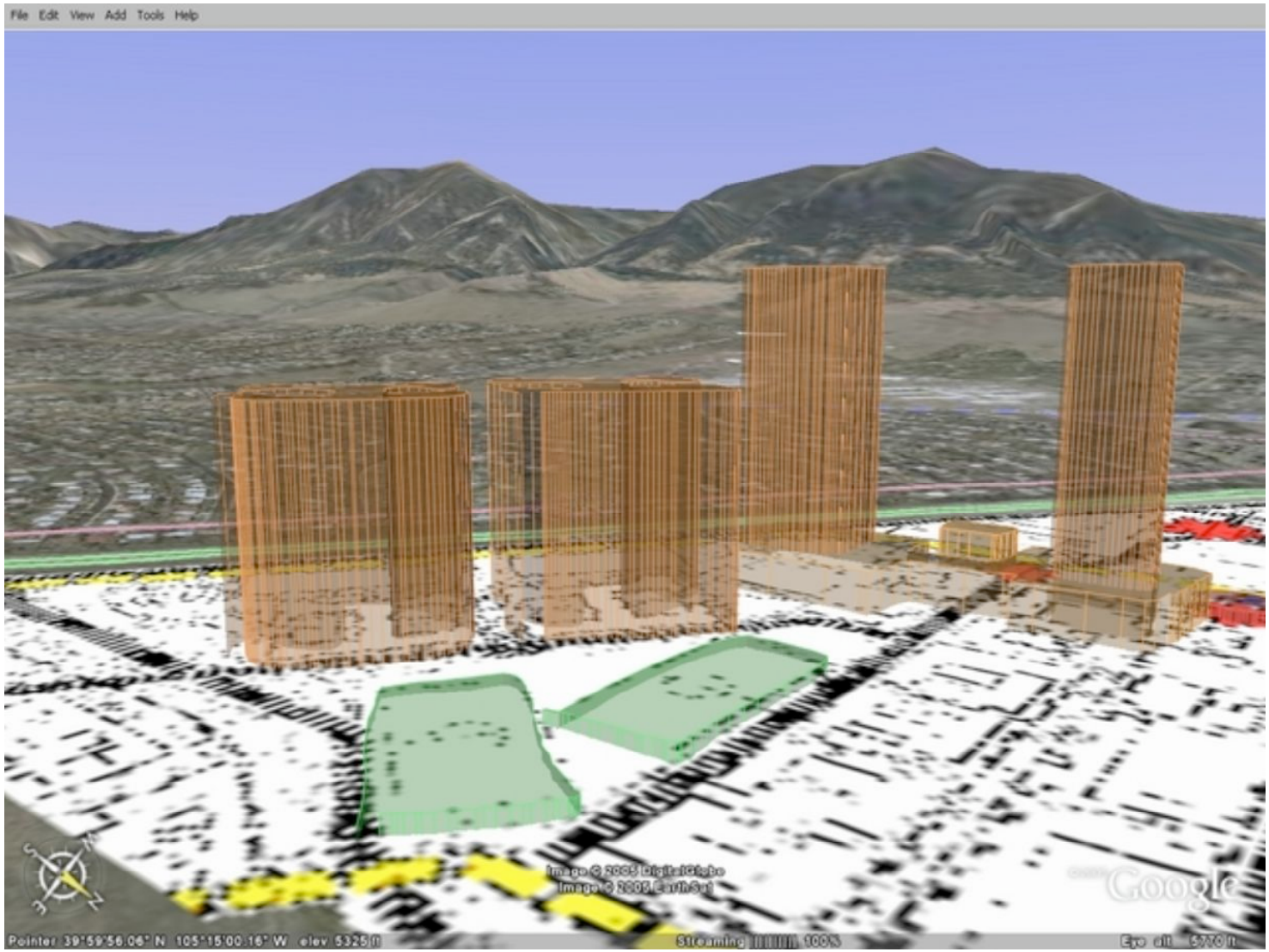
Face-to-Face Collaboration around the EDC Action Space

Boulder City Council and University of Colorado Regents

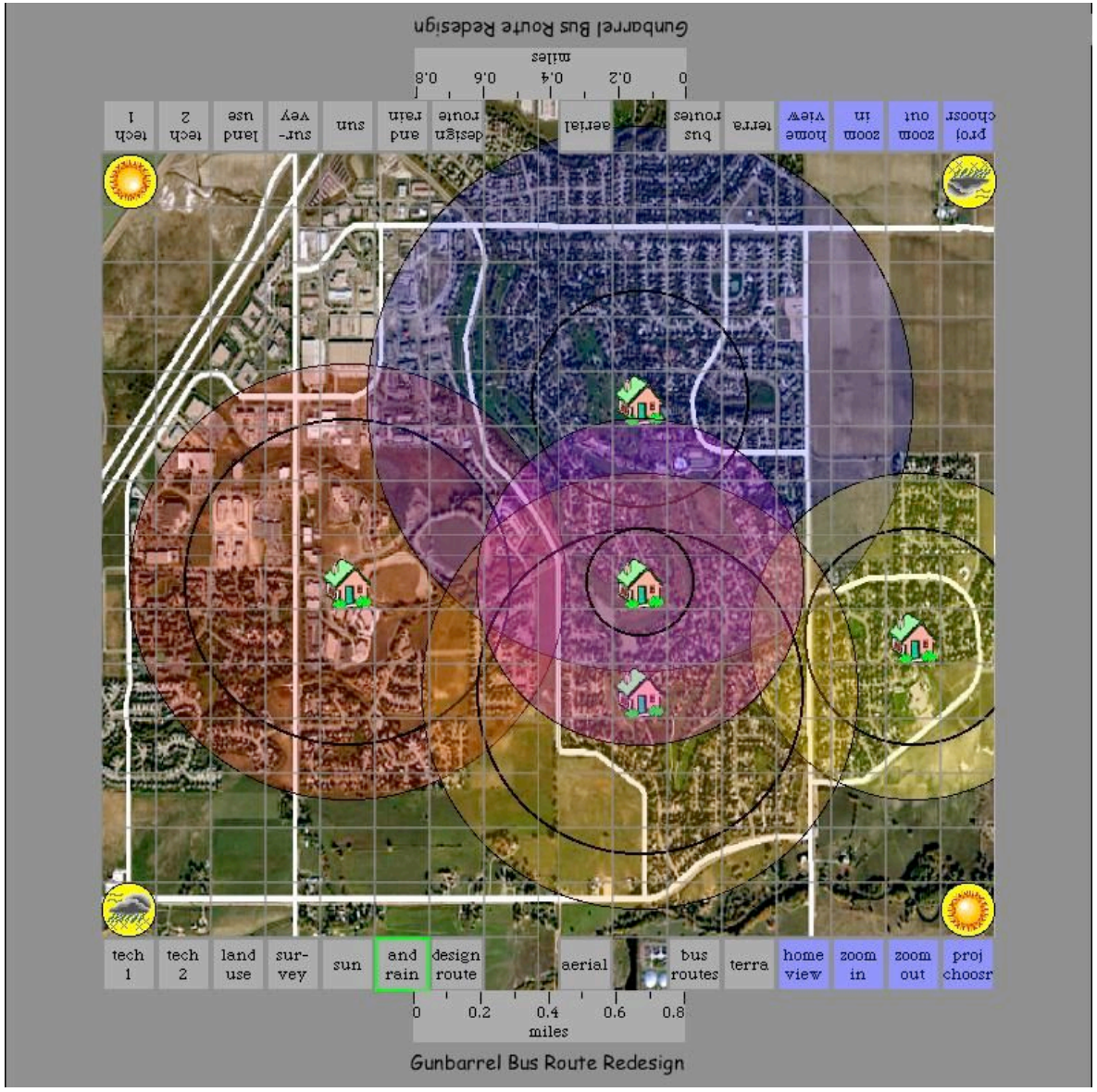
Sketching Support in the EDC



Buildings Sketched into a Google-Earth Client

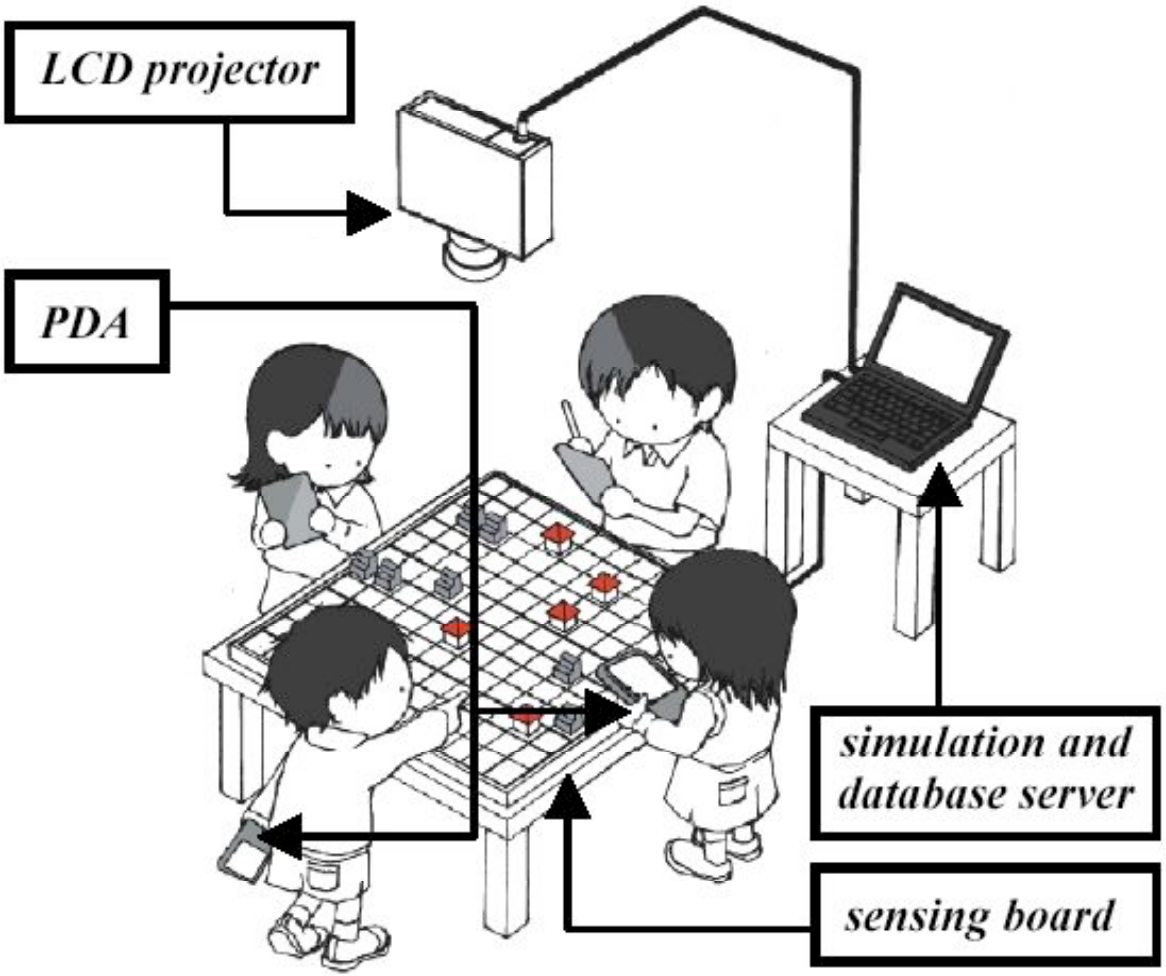


Emerging Insight: Illustrating Multiple Walking Distances



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/
  - more in my paper in the proceedings

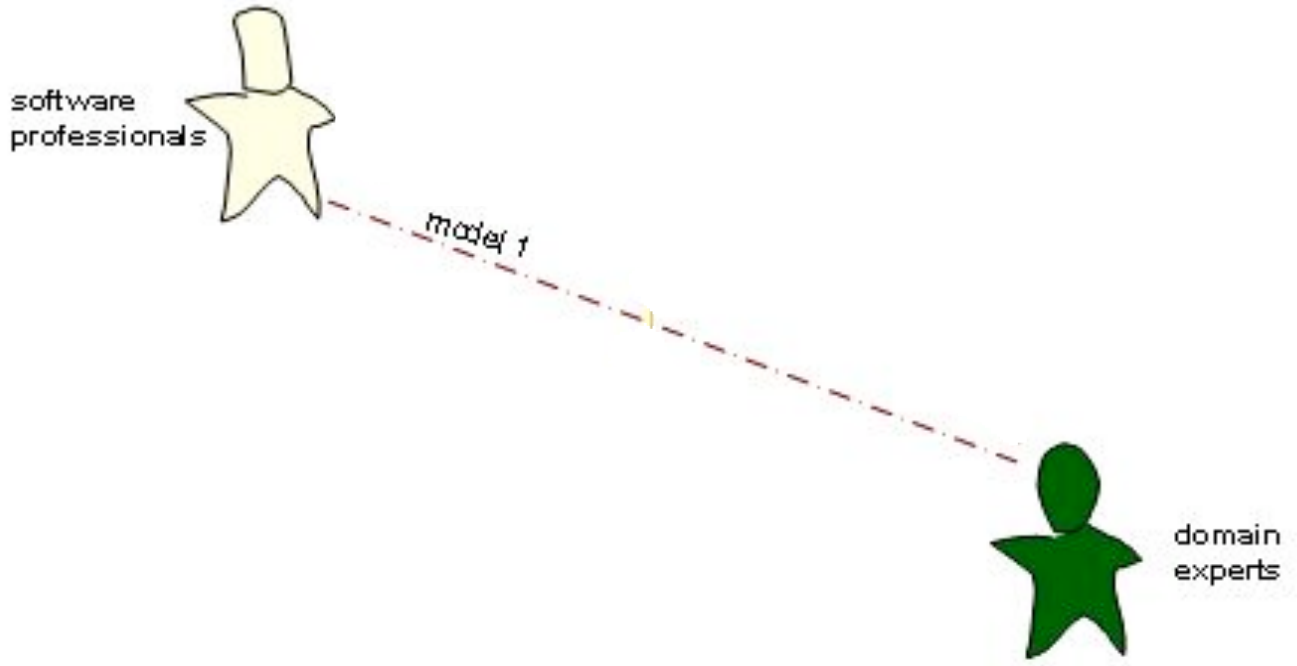
- **Transdisciplinary Collaboration** (collaboration with **Sharon Derry**)
  - successful collaboration **creates new forms of knowledge** outside or in between disciplines and in the process **transforms the disciplinary identities** of the collaborating researchers

Challenges

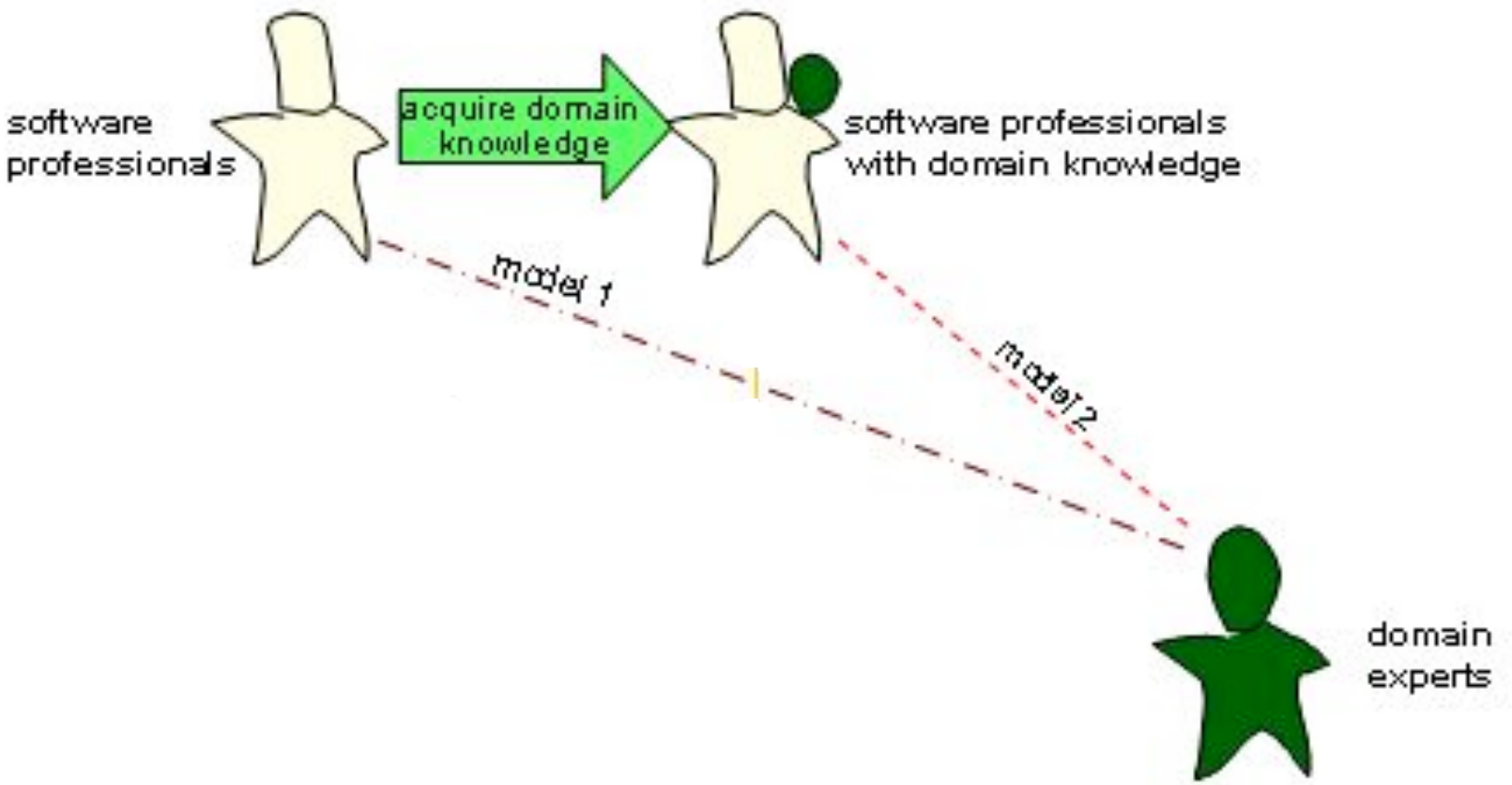
- **reflective communities**
- **“long tail” opportunities**
- **learning from each other**

Reflective Practitioners → Reflective Communities

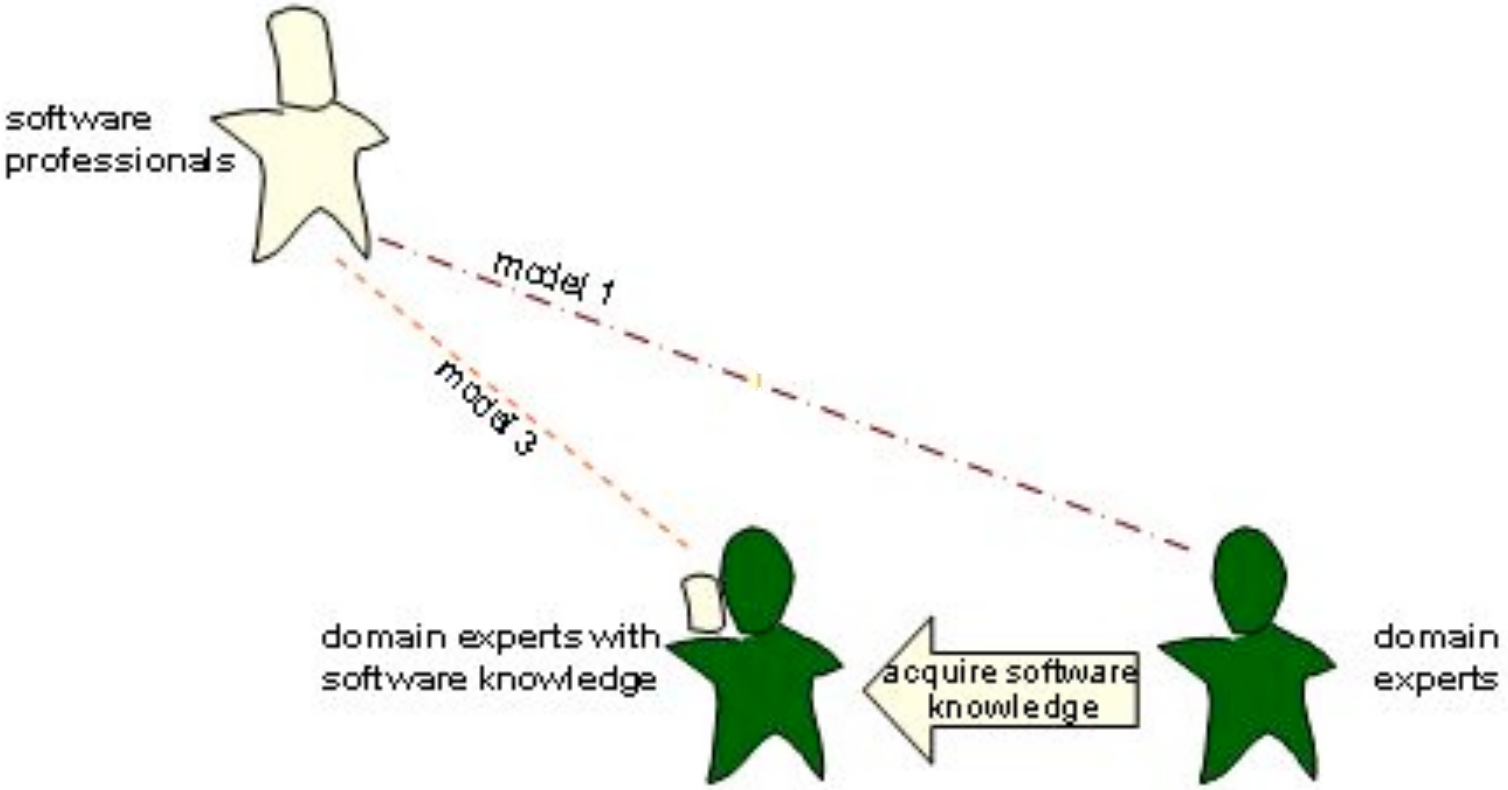
Large Conceptual Distance — Limited Common Ground



Software Professionals Acquiring Domain Knowledge

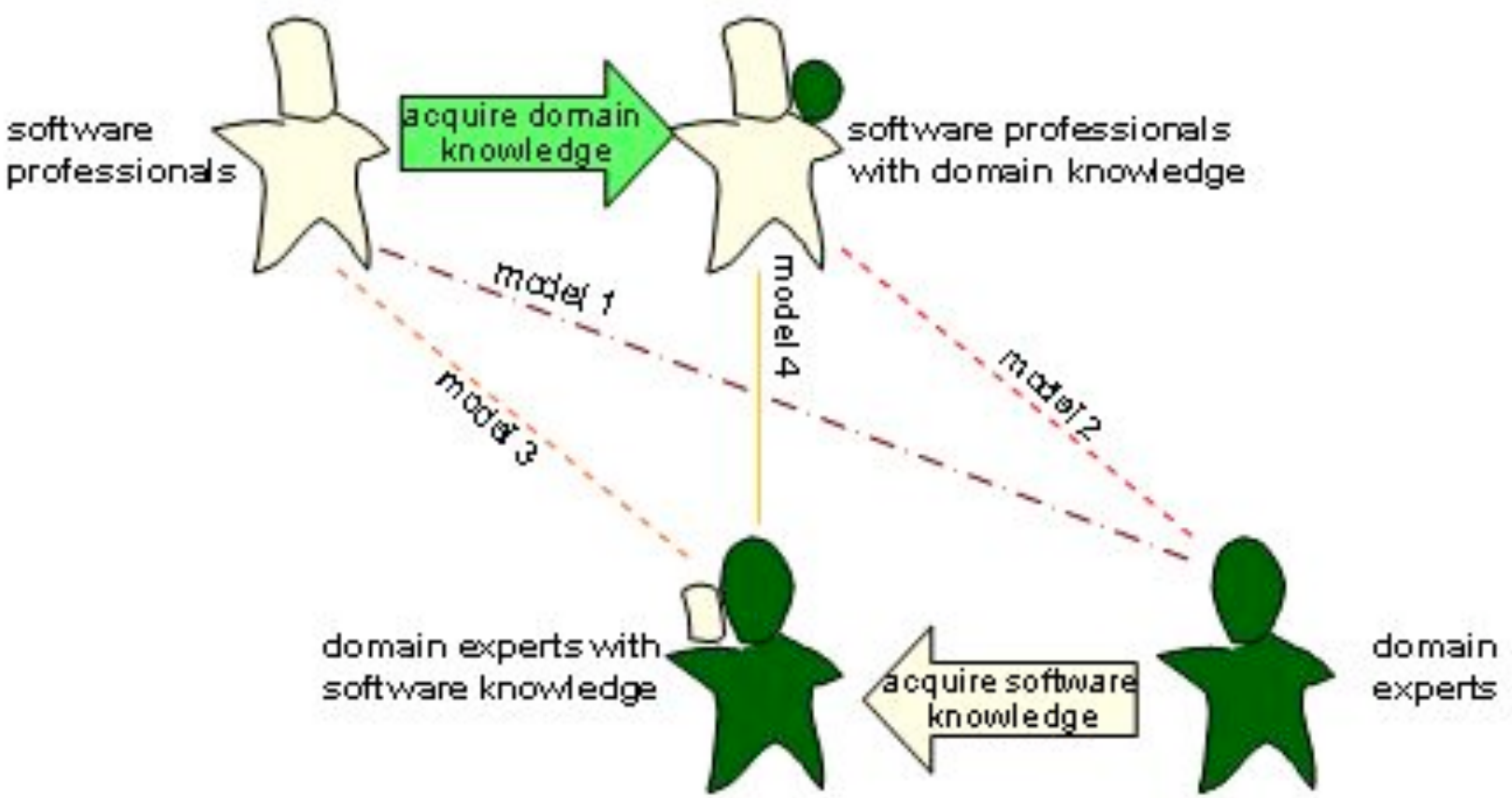


Domain Experts Acquiring Media Knowledge



From Reflective Practitioners to Reflective Communities

(supported by transdisciplinary collaboration)

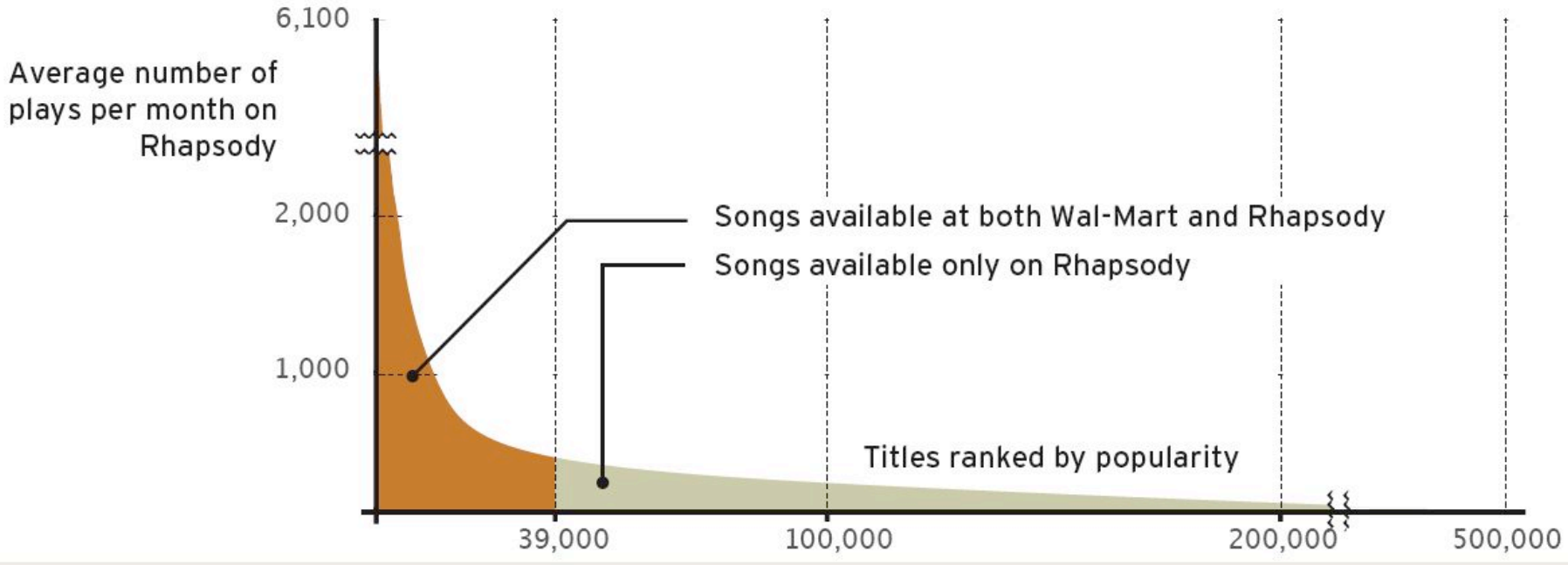


Exploiting "Long Tail" Opportunities

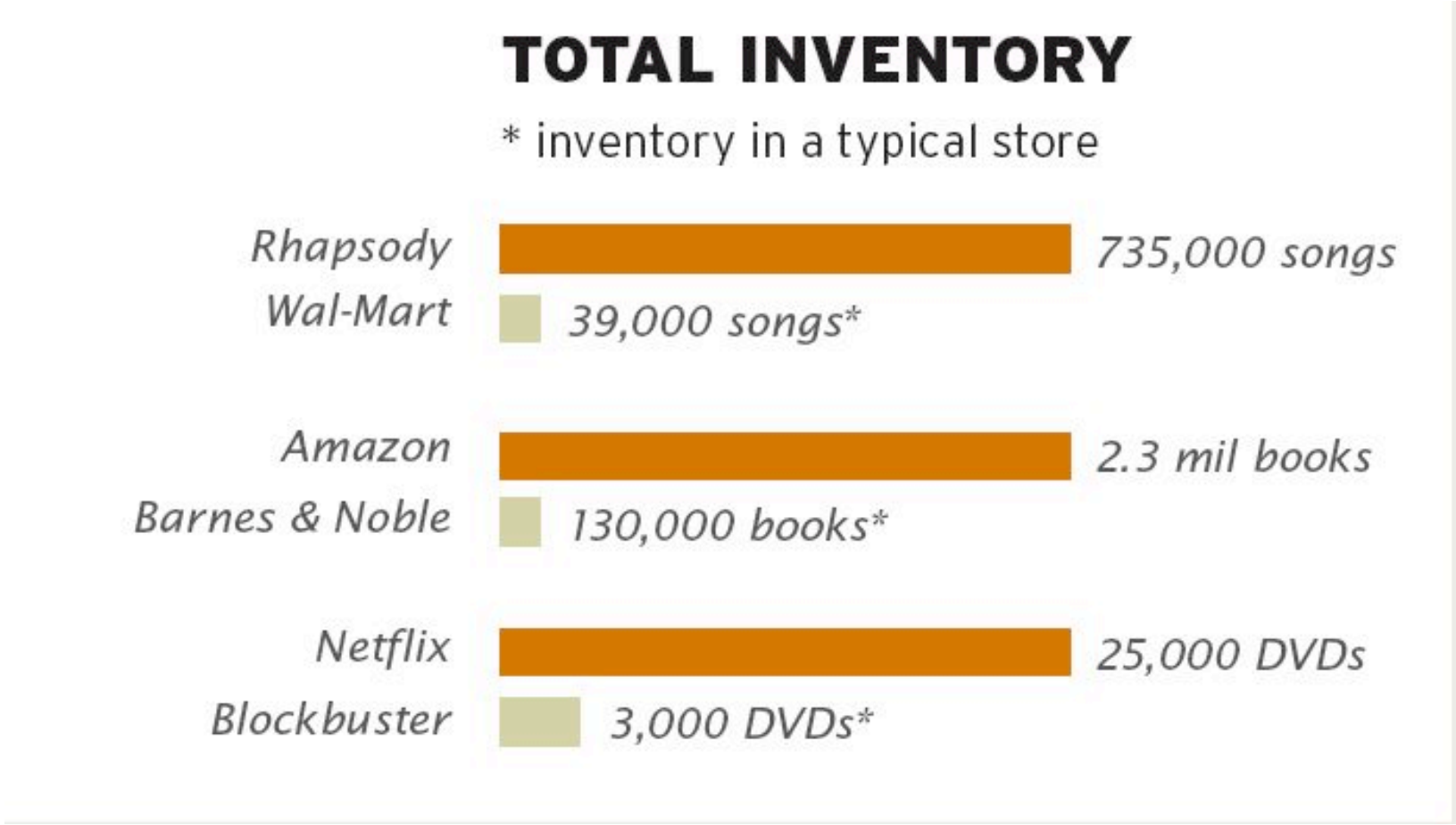
—

The Long Tail

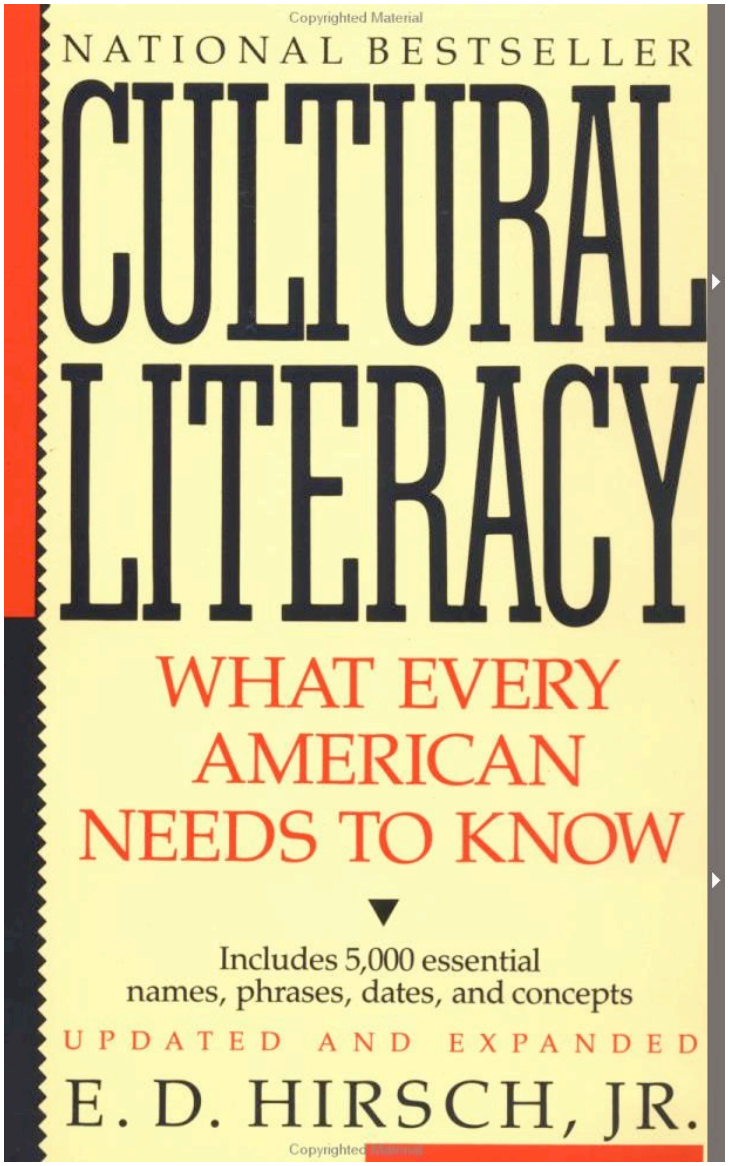
(**sources:** Chris Anderson "The Long Tail" and
John Seely Brown: "New Learning Environments for the 21st Century")



The Long Tail



The Other End: Cultural Literacy



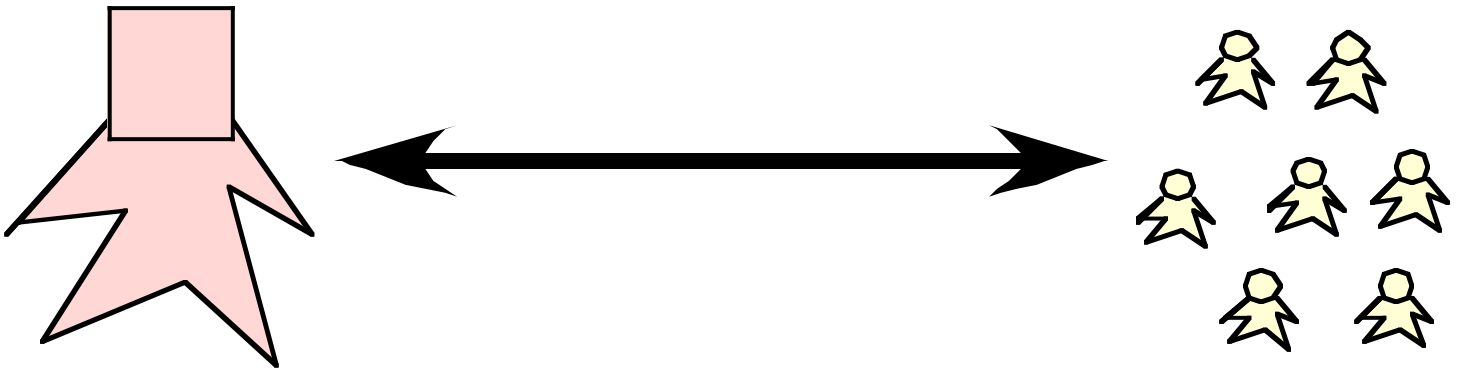
A New Synergy: Basic Knowledge/Skills and Long-Tail

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

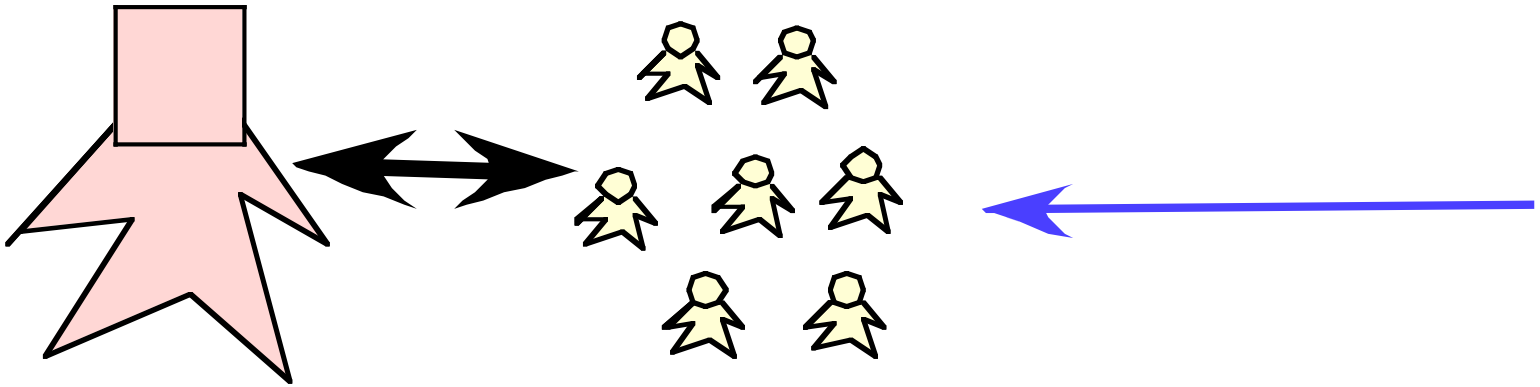
- **long-tail:**
  - interest
  - passion
  - self-directed learning
  - intrinsic motivation
  - personally meaningful problems
  - interesting example → movie: "October Sky"

- **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

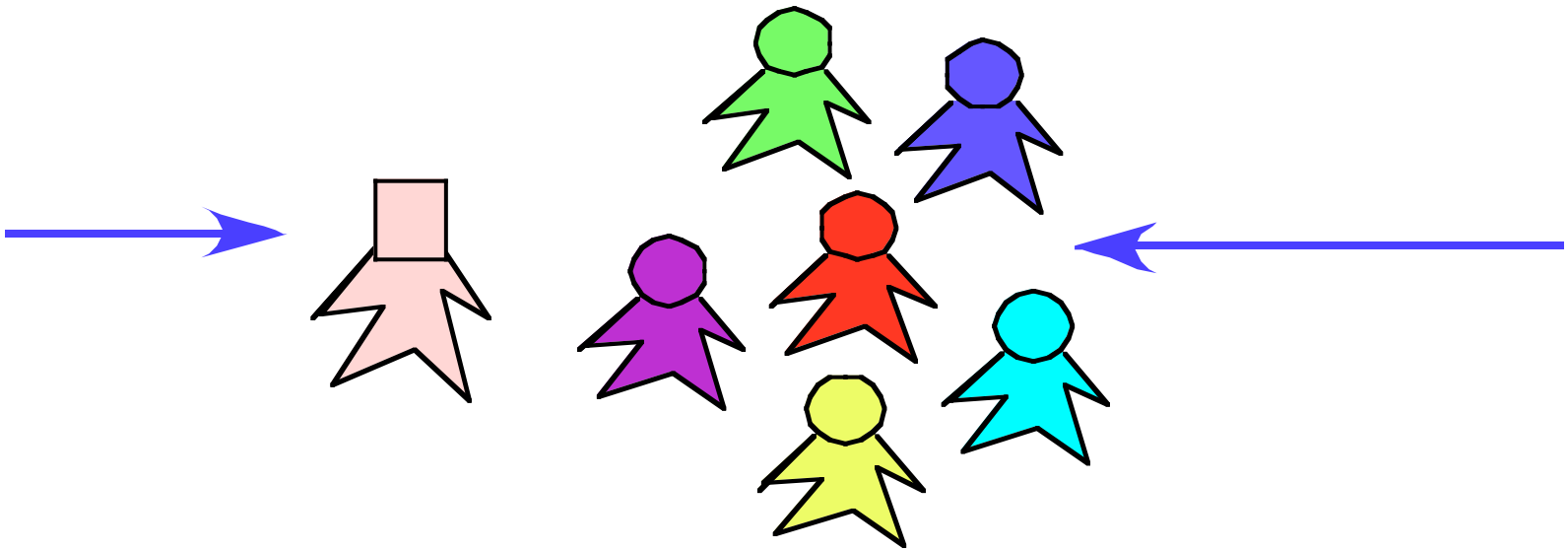


School and Cultural Literacy



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.”*