



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

Exploring Fundamental Transformations of Learning and Discovery in Cultures of Participation

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Center for LifeLong Learning & Design (L³D)

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Overview

- CDI program at NSF
- Our Research Project
- Fundamental Transformations of Learning and Discovery
- Cultures of Participation
- Themes:
 - Human-Centered Computing
 - Socio-Technical Environments
 - Energy Sustainability, Smart Grid, Smart Meters

The CDI Program at NSF

- will support bold **multidisciplinary activities** that, through computational thinking, promise radical, paradigm-changing research findings
- grantees need to engage in productive **intellectual partnerships** involving investigators from academe, industry and/or other types of organizations, including international entities
- CDI investigators of different disciplinary perspectives should collaborate on the formulation, design, development, implementation, and continuous improvement of virtual organizations to test and verify **proposed theories and models of distributed learning and discovery with specific problems, populations and purposes**

The Overarching Research Question for our Proposal

Which **fundamental transformations of learning and discovery** can be achieved by supporting and fostering **cultures of participation**?

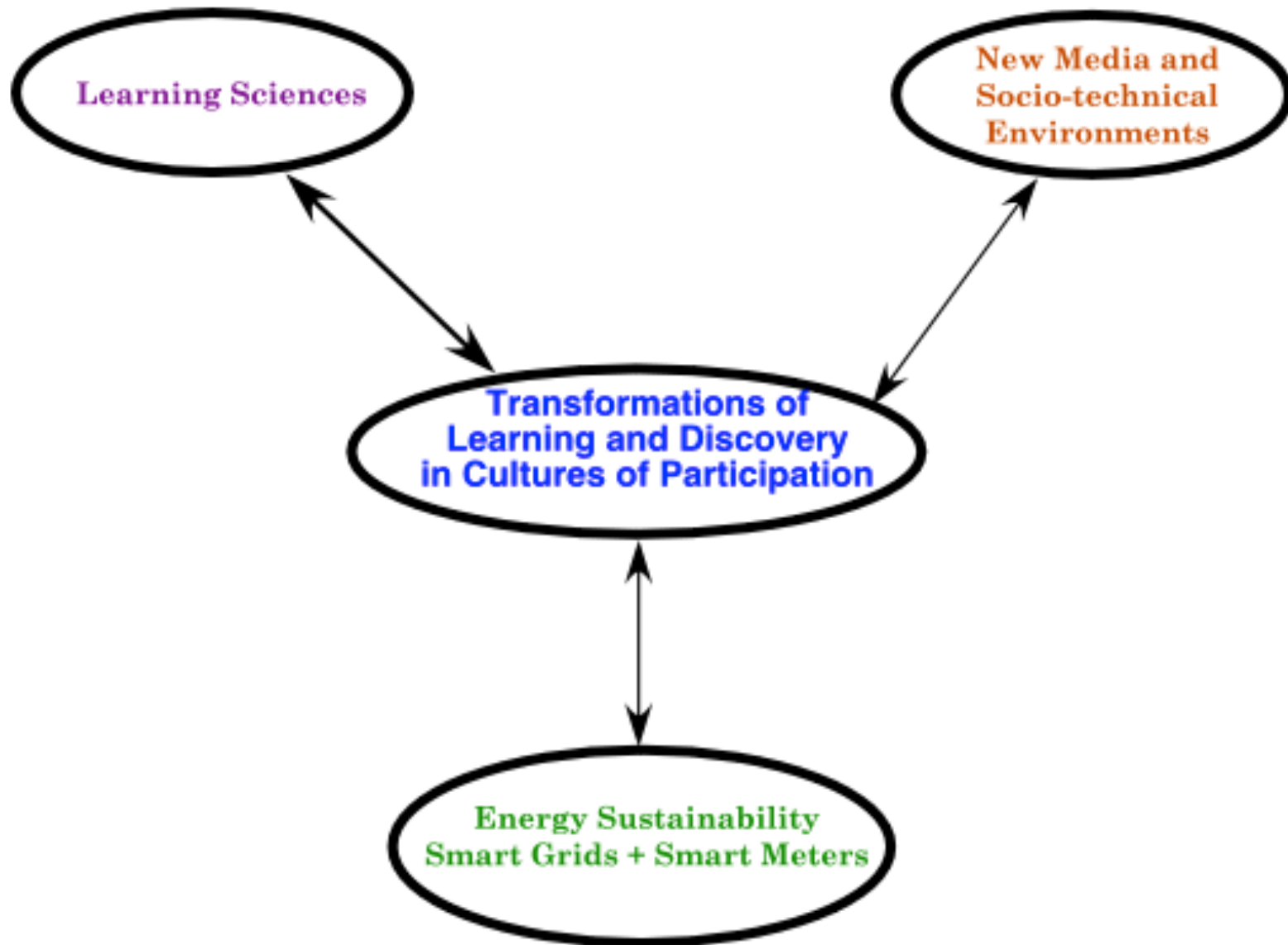
- **theoretical frameworks (TFs)**

- TF-1: creating transformative models for knowledge creation, accumulation, and sharing → Model-Authoritative and Model Democratic
- TF-2: developing meta-design as a foundation for cultures of participation → democratizing participation
- TF-3: articulating and supporting richer ecologies of participation → solving systemic problems transcending the individual human mind and requiring collaborative actions

- **two specific application contexts (ACs):**

- AC-1: Smart Grid environments / Energy Sustainability
- AC-2: the World-in-3D domain (collaboration with Google)

Multidisciplinary Perspective of our CDI Grant



Fundamental Transformations of Learning and Discovery at a Global Level

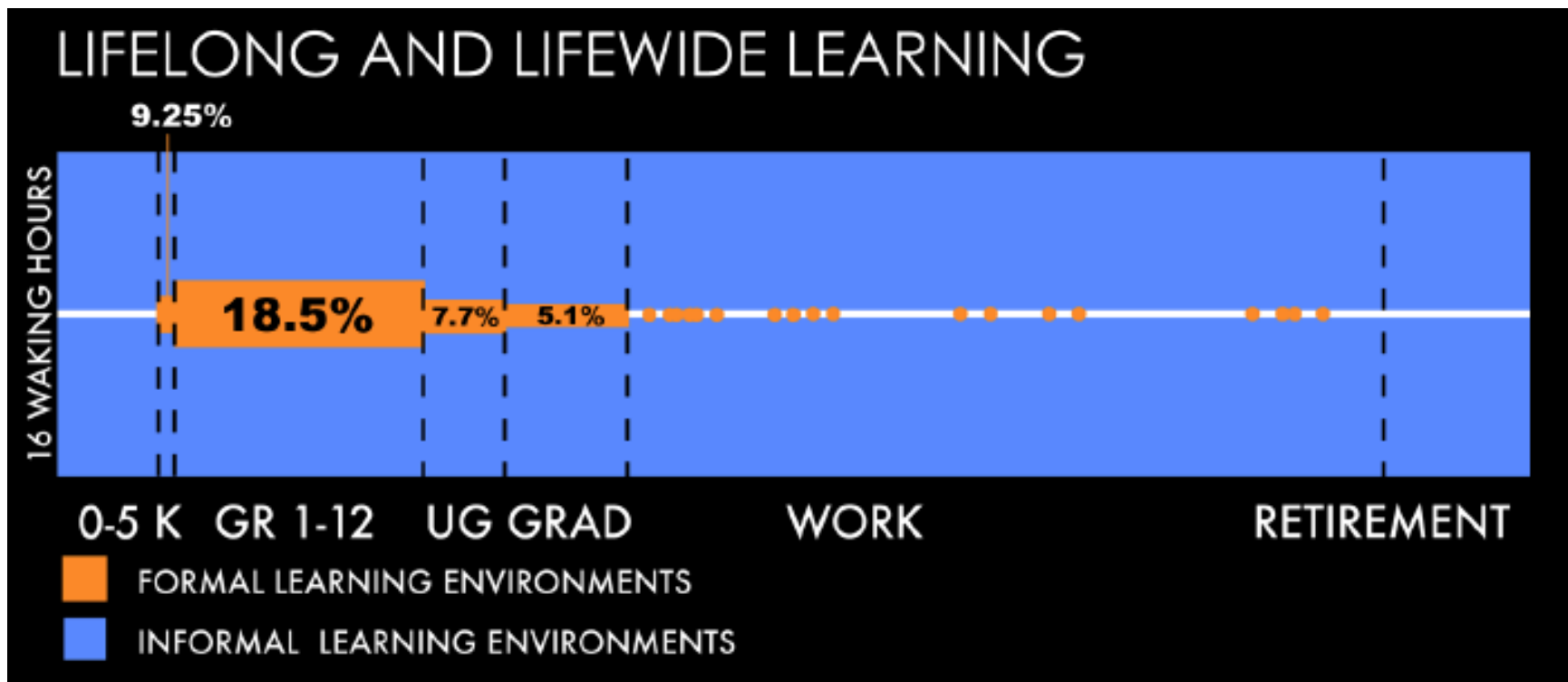
- 21st century skills
- lifelong learning
- self-directed, passion-based learning
- expansive learning
- synthesis between formal and informal learning
- transcending the unaided, individual human mind
- learning when the answer is not known

Science of Learning

- *“The inverse of school is possible: that we can depend on self-motivated learning instead of employing teachers to bribe or compel the student to find the time and the will to learn; that **we can provide the learner with new links to the world** instead of continuing to funnel all educational programs through the teacher.” — Ivan Illich “Deschooling Society” (1971)*
- *“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*

Formal and Informal Learning?

<source: LIFE Center, University of Washington + Stanford + SRI>



Learning In School and Out

<< Lauren Resnick: The **1987** Presidential Address >>

School Learning	Other Learning
individual cognition	shared cognition
pure mentation (tools for learning)	tool manipulation (tools for living)
symbol manipulation	contextualized reasoning
generalized learning	situation-specific competencies

▪ **questions**

- have these insights caused any **changes** in the 24 years?
- what do we **know in 2011** that we did not know in 1987?
- are we confronted with **different opportunities** (e.g., digital technologies) and **new challenges** (e.g., outsourcing of jobs)?

Background — Research Activities by our Invited Guests

- Collins, A., & Halverson, R. (2009) *“Rethinking Education in the Age of Technology: The Digital Revolution and the School”*
- Rogoff, B., et al (2007). *“Children’s development of cultural repertoires through participation in everyday routines and practices”*
- Shirley Brice Heath (2012): *“Words at work and play: Three decades in family and community life”*
- Derry, S. J., Schunn, C., & Gernsbacher, M. A. (Eds.) (2005) *“Interdisciplinary Collaboration: An Emerging Cognitive Science”*

Background – Selected Collaborative Efforts

- Lopez, A., Correa-Chavez, M., Rogoff, B., & Gutiérrez, K. (2010). “*Attention to instruction directed to another by U.S. Mexican-heritage children of varying cultural backgrounds. Developmental Psychology*”
- Gutiérrez, K. & Rogoff, B. (2003). “*Cultural ways of learning: Individual traits or repertoires of practice. Educational Researcher*”
- Derry, S. J., & Fischer, G. (2005) “*Toward a Model and Theory for Transdisciplinary Graduate Education*” (AERA'2005)
- Collins, A., Fischer, G., Barron, B., Liu, C., & Spada, H. (2009) “*Long-Tail Learning: A Unique Opportunity for CSCL?*” (CSCL'2009)
- Fischer, G., Derry, S., Eisenberg, M., A., R., & Collins, A. (2011) “*Design Research Exploring Transformative Frameworks for Learning and Education*” (AERA'2011)

A Small Sample of Other Research

- Illich, I. (1971) *“Deschooling Society”*
- Gee, J. P., & Hayes, E. (2009) *“Public Pedagogy through Video Games: Design, Resources & Affinity Spaces”*
- Mizuko Ito et al (2009): *“Hanging Out, Messing Around, and Geeking Out: Kids Living and Learning with New Media”*
- Henry Jenkins et al: *“Confronting the Challenges of Participatory Culture: Media Education for the 21st Century”* (The John D. and Catherine T. MacArthur Foundation Reports on Digital Media and Learning)
- Engeström, Y., & Sannino, A. (2010) *“Studies of Expansive Learning: Foundations, Findings and Future Challenges”*
- Thomas, D., & Brown, J. S. (2011) *“A New Culture of Learning: Cultivating the Imagination for a World of Constant Change”*

L3D's 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

What's Wrong with the Universities of Today

- **lecture dominated** — emphasizing passive knowledge absorption instead of active knowledge construction
- **curriculum dominated** — little room for authentic, self-directed learning activities
- students solve **given problems** — they do not learn to frame problems
- problems in school have **right or wrong answers** — problem in the real world are wicked, ill-defined, ill-structured
- **closed book exams** — ignoring distributed cognition
- little emphasis on **collaborative learning and communication skills** — working together is regarded as “cheating”

A Long Tail Framework for Self-directed, Passion-Based Learning

<< Collins, A., Fischer, G., Barron, B., Liu, C., & Spada, H. (2009) "Long-Tail Learning: A Unique Opportunity for CSCL?" In *Proceedings of CSCL 2009* >>



Rethinking and Reinventing Learning and Education from a “Long-Tail” Perspective

▪ **basic beliefs / assumptions:**

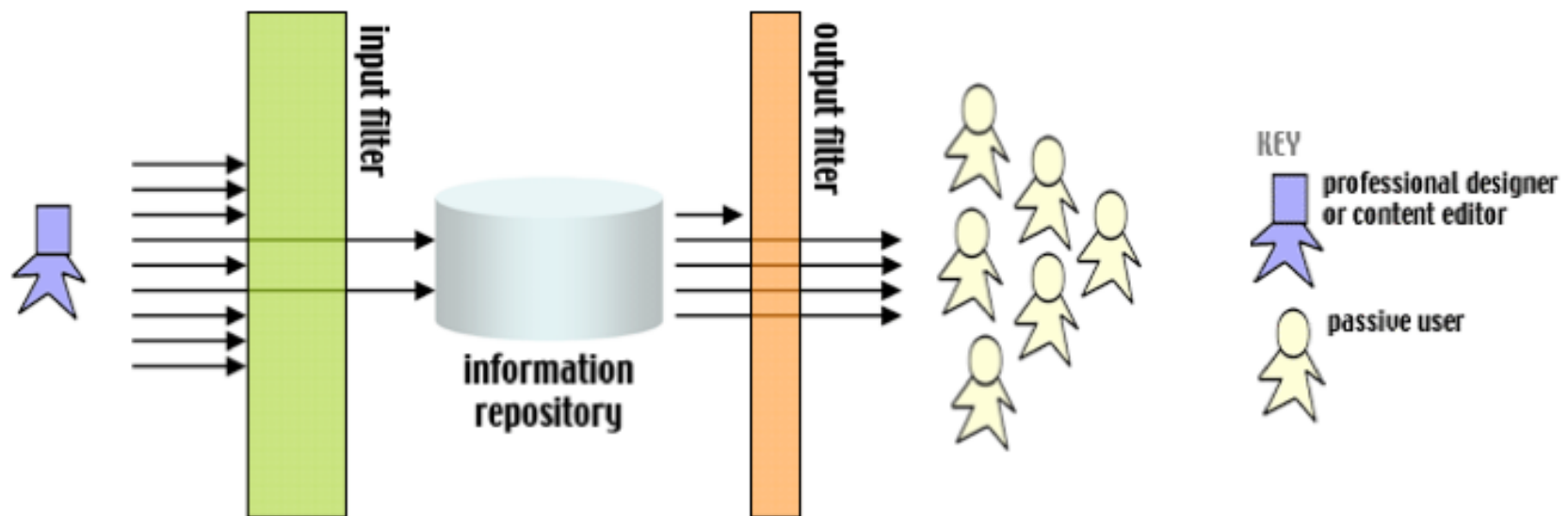
- individuals learn more and better when they learn in areas they choose and for which they are *motivated*
- *all people are interested in something* (Viking Ships, Dinosaurs, gambling, Nuremberg trials, White Rose, Castles in Northern Germany,)
- Whatever someone’s particular interest is, there is some *niche community* already formed on the net that the person can join

▪ **a new synergy and hybrid model:** integrate head and tail of the long-tail) → create richer learning environments

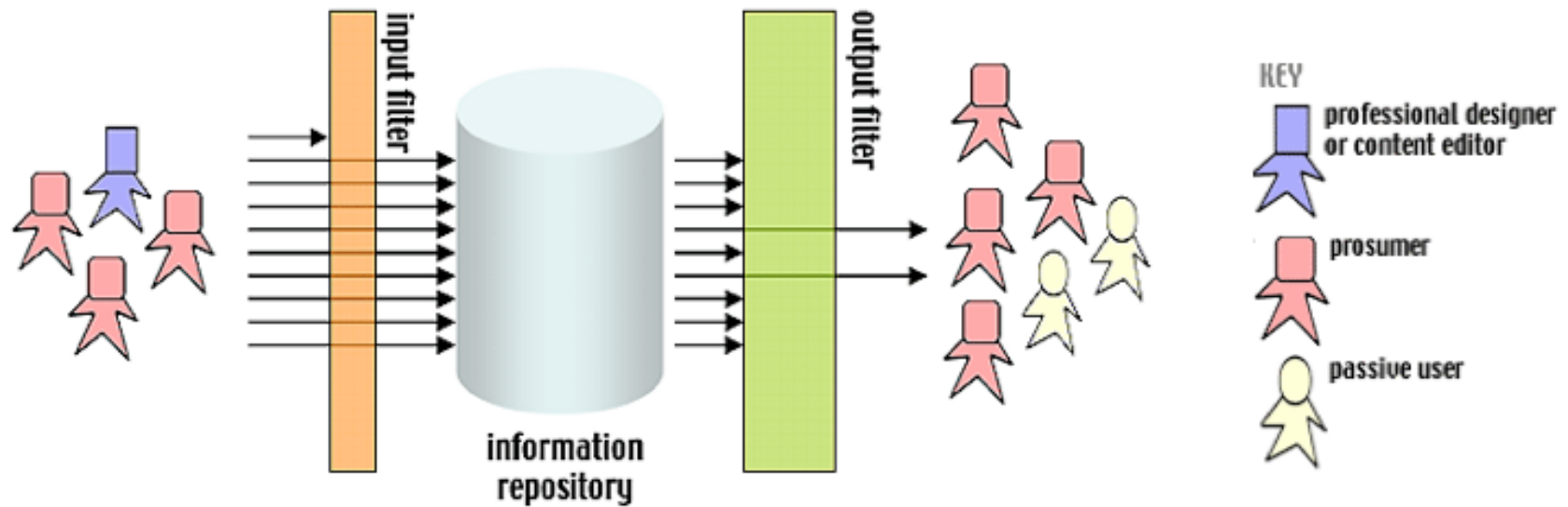
- **head** — basic knowledge and skills: learning to learn, learning on demand, preparation for future learning, soft skills, digital fluency,
- **tail** — personally meaningful problems: interest and passion, self-directed learning and intrinsic motivation, local knowledge in a globalized world

TF-1: creating transformative models for *knowledge creation, accumulation, and sharing*

MODEL-AUTHORITATIVE Underlying Consumer Cultures ("Filter-then-Publish")



MODEL-DEMOCRATIC Underlying Cultures of Participation ("Publish-then-Filter")



TF-2: Meta-design = “Design for Active Participation”

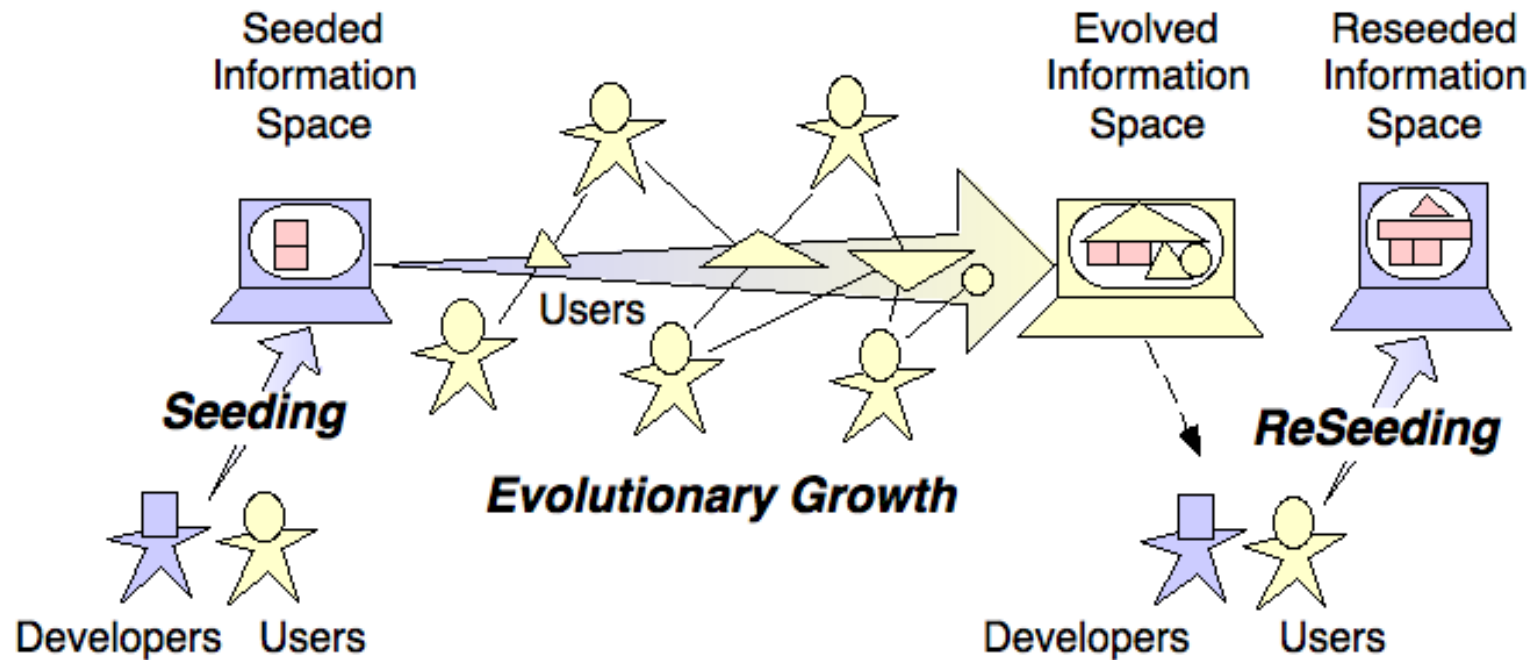
- **A fundamental objective of meta-design**

- to create living socio-technical environments in which users can participate actively as co-designers to shape those systems through collaboration in situations in which such participation is personally meaningful
- meta-designers (e.g.: teachers, software tool designers) use their own creativity to create context for other people (students, software users) more creative

- **related aspects:**

- teacher, learner = $f\{\text{person}\} \rightarrow f\{\text{context}\}$ — Barbara Rogoff’s “communities of learners” (instead of adult-run or children-run education)
- affinity spaces (Gee)

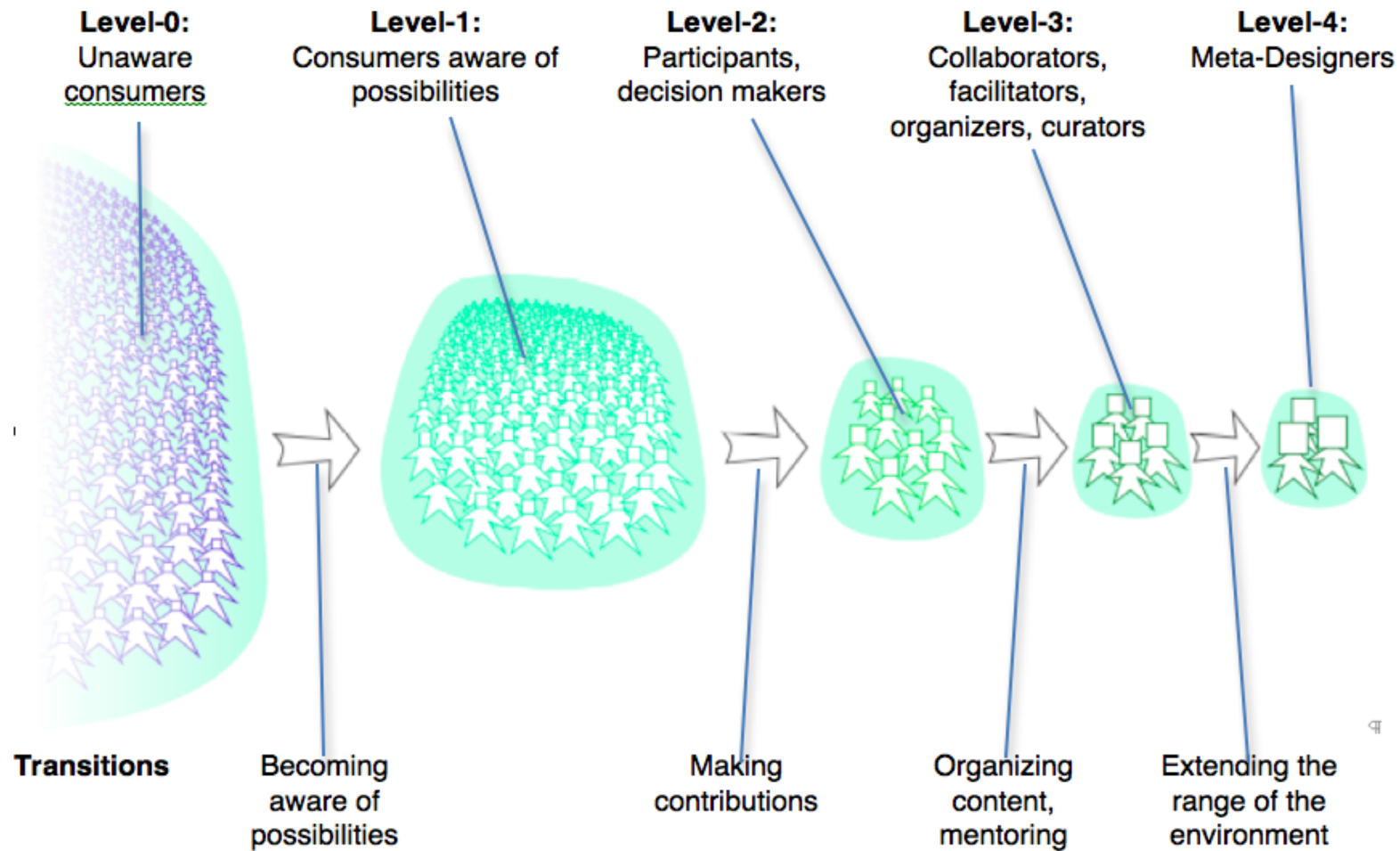
Meta-Design and the Seeding, Evolutionary Growth, Reseeding (SER) Model



- **self-application to our own teaching activities:**

- courses-as-seeds → changed our teaching for the last decade
- information repositories (“wikis”) seeded by instructor, extended by students

TF-3: Richer Ecologies of Participation



Application Domain: 3D Modeling (Manhattan in 3D)



Application Domain: **Energy Sustainability**

- energy sustainability = a theme of **national and worldwide importance**
- **technical innovations:**
 - the *Smart Grid* (overlying the electrical grid with a computational information system facilitating two-way communication)
 - *advanced metering infrastructures* measuring, collecting, and analyzing energy usage by interacting with *smart meter devices*
- **challenges of harvesting the benefits of technical innovations:**
 - most citizens are unaware of new technological developments;
 - information presentation is poorly designed
 - the social context of individual energy use is ignored, and few interaction and collaboration mechanisms exist
 - feedback alone is not persuasive enough to change human behavior.
- **claim:** all of these challenges are grounded in the intersection of **human behavior** (at individual and social levels) and **technology**

Energy Illiteracy

How Things Are: Current Understanding and Use of Energy

<<source: Reeves, B., Robinson, T., Banerjee, B., & Sweeney, J. (2009) *Large-Scale Energy Reductions through Sensors, Feedback, & Information Technology*>>

*“I use energy in my home but it’s **invisible**. I don’t consume it directly but only via things I want like light, heat and refrigeration. **I rarely think about the energy** I’m using, and most of my use is habitual and unconscious.*

*The amount of energy I use is registered on a **meter that’s out of sight, unintelligible, and read by someone else**. I only get feedback about my energy use in the form of monthly bills that present complex data that are a month old, and are boring and impersonal.*

*When information is provided to me about how and why I should **change my behavior**, it is also boring and impersonal and often not even applicable to my situation.*

*Even when I understand it, **I rarely act.**”*

Socio-Technical Environments for Energy Sustainability

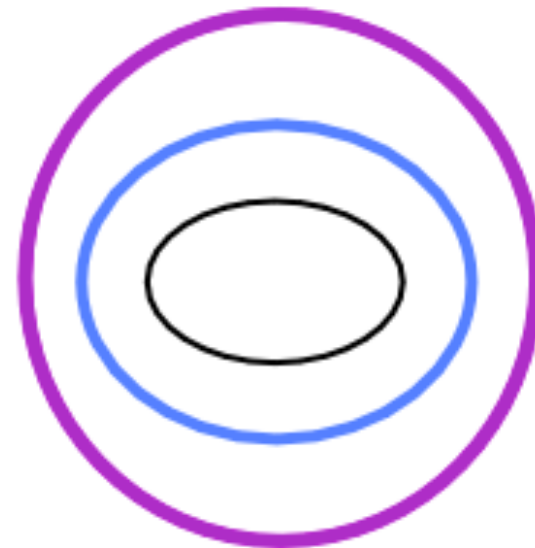
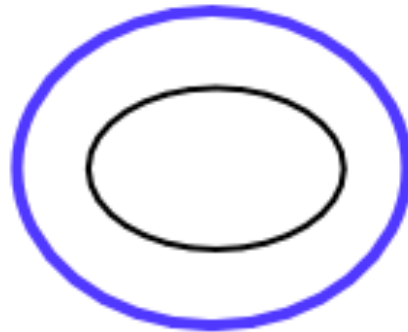
Electric Grid → Smart Grid

→ Human Grid

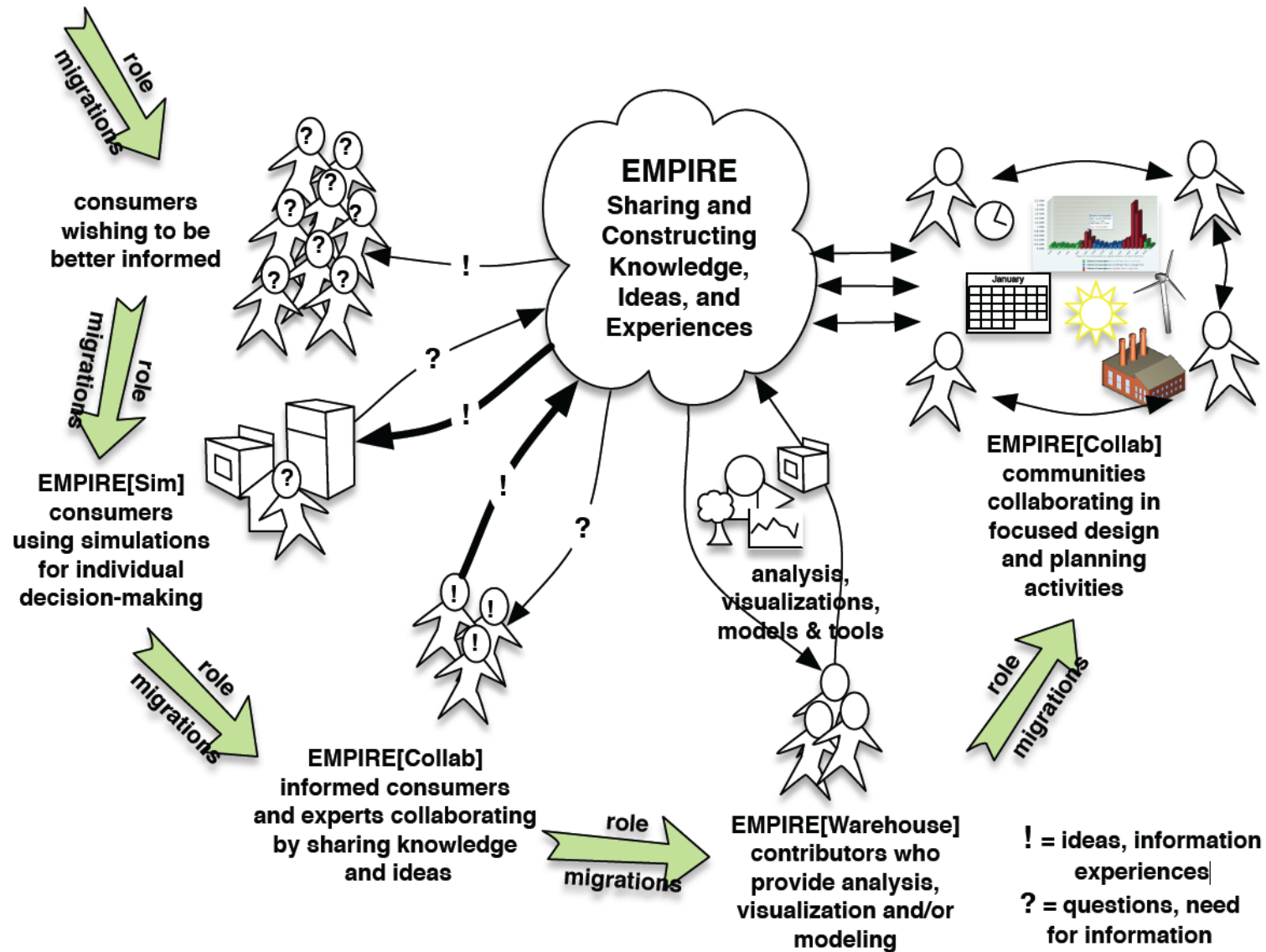
electrical grid

information and communication
technologies:
smart grid + smart meters +
advanced smart infrastructure

social environment:
energy illiteracy + control +
intrinsic motivation + social norms +
changing human behavior + eco-arts



Application Domain: Energy Sustainability



Cultures of Participation

Fundamental Challenge and Opportunity

consumer cultures

focus: produce finished goods to be consumed passively



cultures of participation

focus: provide all people are with the means to participate actively in **personally meaningful** problems

emphasis: the participatory web (“Web 2.0”) is not a technological but a **social revolution**

Cultures of Participation Addressing Important Societal Problems

- problems of a **magnitude** which individuals and even large teams cannot solve (example: to model all buildings in the world in 3D as addressed by “Goggle SketchUp and 3D Warehouse”)
- problems of a **systemic nature** requiring the collaboration of many different minds from a variety of background (example: cultures of participation)
- problems being **poorly understood and ill-defined** and therefore requiring the involvement of the owners of problems because they cannot be delegated to others (example: digital literacy to become independent of high-tech scribes)
- problems **modeling changing and unique worlds** being dependent on open, living information repositories and tools (example: meta-design, SER model)

Environments Created by Cultures of Participation

Site	Objectives and Unique Aspects
Wikipedia	web-based collaborative multilingual encyclopedia with a single, collaborative, and verifiable article; authority is distributed (http://www.wikipedia.org/)
KNOL	a library of articles by recognized experts in specific domains; authors take credit and elicit peer reviews; readers can provide feedback and comments; authority rests primarily with the author (http://knol.google.com/)
iTunes U	courses by faculty members from “certified institutions”; control via input filters; material can not be remixed and altered by consumers (http://www.apple.com/education/itunes-u/)
YouTube	video sharing website with weak input filters and extensive support for rating (http://www.youtube.com/)
Encyclopedia of Life (EoL)	documentation of the 1.8 million known living species; development of an extensive curator network; partnership between the scientific community and the general public (http://www.eol.org/)
SketchUp and 3D Warehouse	repository of 3D models created by volunteers organized in collections by curators and used in Google Earth (http://sketchup.google.com/3dwarehouse/)

Environments Created by Cultures of Participation

Scratch	Learning environment for creating, remixing, and sharing programs to build creative communities in education (http://scratch.mit.edu)
Instructables	socio-technical environment focused on user-created and shared do-it-yourself projects involving others users as raters and critics (http://www.instructables.com/)
PatientsLikeMe	collection of real-world experiences enabling patients who suffer from life-changing diseases to connect and converse (http://www.patientslikeme.com/)
Ushahidi	tools for democratizing information, increasing transparency and lowering the barriers for individuals to share their stories; originated in the collaboration of Kenyan citizen journalists during crises (http://www.usahidi.com/)
Stepgreen	library of energy saving actions, tips, and recommendations by citizen contributors for saving money and being environmentally responsible (http://www.stepgreen.org/)

Consumer and Designers – Beyond Binary Choices

■ **claims:**

- there is nothing wrong about being a consumer (watching a tennis match, listening to a concert, ...)
- the same person wants to be a consumer in some situations and in others a designer → consumer / designer is not an attribute of a person, but of a context
consumer / designer ≠ f{person} → f{context}

■ **problems:**

- someone wants to be a designer but is forced to be a consumer → **personally meaningful activities**
- someone wants to be a consumer but is forced to be a designer → **personally irrelevant activities**

Design Trade-Offs for Cultures of Participation

- **advantages of cultures of participation**

- extensive coverage of information
- creation of large numbers of artifacts
- creative chaos by making all voices heard
- reduced authority of expert opinions

- **disadvantages**

- participation overload
- accumulation of irrelevant information
- lack of coherent voices
- fragmented culture based on too many idiosyncratic voices (a modern version of the “Tower of Babel”)

Drawbacks of Cultures of Participation: Engaging People in Personally Irrelevant Activities

- **we have all become**
 - telephone operators and travel agents
 - check-in clerks (at airports) and check-out clerks (in supermarkets)
 - file expense reports and typeset our papers
 - <<.....many more things>

- **drawbacks:**
 - we (e.g., as faculty members) are paid more money per hour than staff members being experts in these activities
 - we are not particularly skillful doing these activities (doing them only very rarely)

- **questions:**
 - who are the winners (e.g.: companies off-loading work to us)?
 - are these additional burdens only felt by the “non-digital natives”)?
 - are our systems supporting us in these activities still too inefficient?

New Discourses: Motivation, Control, Ownership, Quality, and Changing Human Behavior

- **Motivation:** material gain + psychological well-being, social integration and connectedness, social capital, recognition, reputation, gift cultures
- **Control:** cultures of participation erode monopoly positions held by professions, educational institutions, experts, and high-tech scribes
- **Ownership:** cultures of participation are less successful
 - when users are brought into the process late (thereby denying them ownership)
 - when they are “misused” to fix problems and to address weaknesses of systems that the developers did not fix themselves

New Discourses — Continued

- **Quality — Example:** *Encyclopedia Britannica* \leftrightarrow Wikipedia
 - errors will always exist, resulting in learners acquiring the important skill of being critical of information rather than blindly believing in what others (specifically experts or teachers) are saying
 - ownership as a critical dimension: the community at large has a greater sense of ownership and thereby is more willing to put an effort into fixing errors
 - importance of public scrutiny (data on how quickly information is corrected in Wikipedia)
 - **claim:** there are only limited ways to filter for quality in advance — which are sometimes counter-productive

- **changing human behavior**
 - technology alone does not determine social structure nor does it change human behavior: it creates ***feasibility spaces*** for new social practices and it can persuade and motivate changes at the individual, group, and community level.
 - human-centered technologies can change people's lives (1) by making it easier for people to do things, and (2) by providing value that cannot be accounted for in monetary terms

Some Claims about (Intrinsic) Motivation and Interests

- the chief impediments to learning are not cognitive but **motivational**

- people can learn many things if **they want to**

- motivation is a tricky problem in learning because while it plays a major role, it is **not well understood**

- examples:
 - “A Fine is a Price” Story → Coming Late to the Child Care Center;
<http://rady.ucsd.edu/faculty/directory/gneezy/docs/fine.pdf>

 - the Piano Stairs; http://www.youtube.com/watch?v=2lXh2n0aPyw&feature=player_embedded#

Assessment

- **conventional assessment techniques are of little value**
 - standardized tests
 - curricular coverage

- **aspects that can be “easily” measured**
 - how people located a site, how often they visit it, how many contributions they have made (using tools such as Google Analytics)
 - how well a site lives up to certain usability and sociability factors

- **aspects difficult to assess and measure:**
 - intrinsic motivation underlying self-directed and collaborative learning
 - which guidance, scaffolding, critiquing, feedback is effective?
 - change in (persistent) human behavior

- **an interesting suggestion** (by Allan Collins): national credentials demonstrating expertise in a set of skills

Community Building of our CDI Grant

in response to CDI objective: establish productive intellectual partnerships

- **companies:**

- *Tendril* — “Helping energy service providers and their customers solve energy challenges together”
- *Google, Boulder* — OpenStudio Plug-in for Google SketchUp

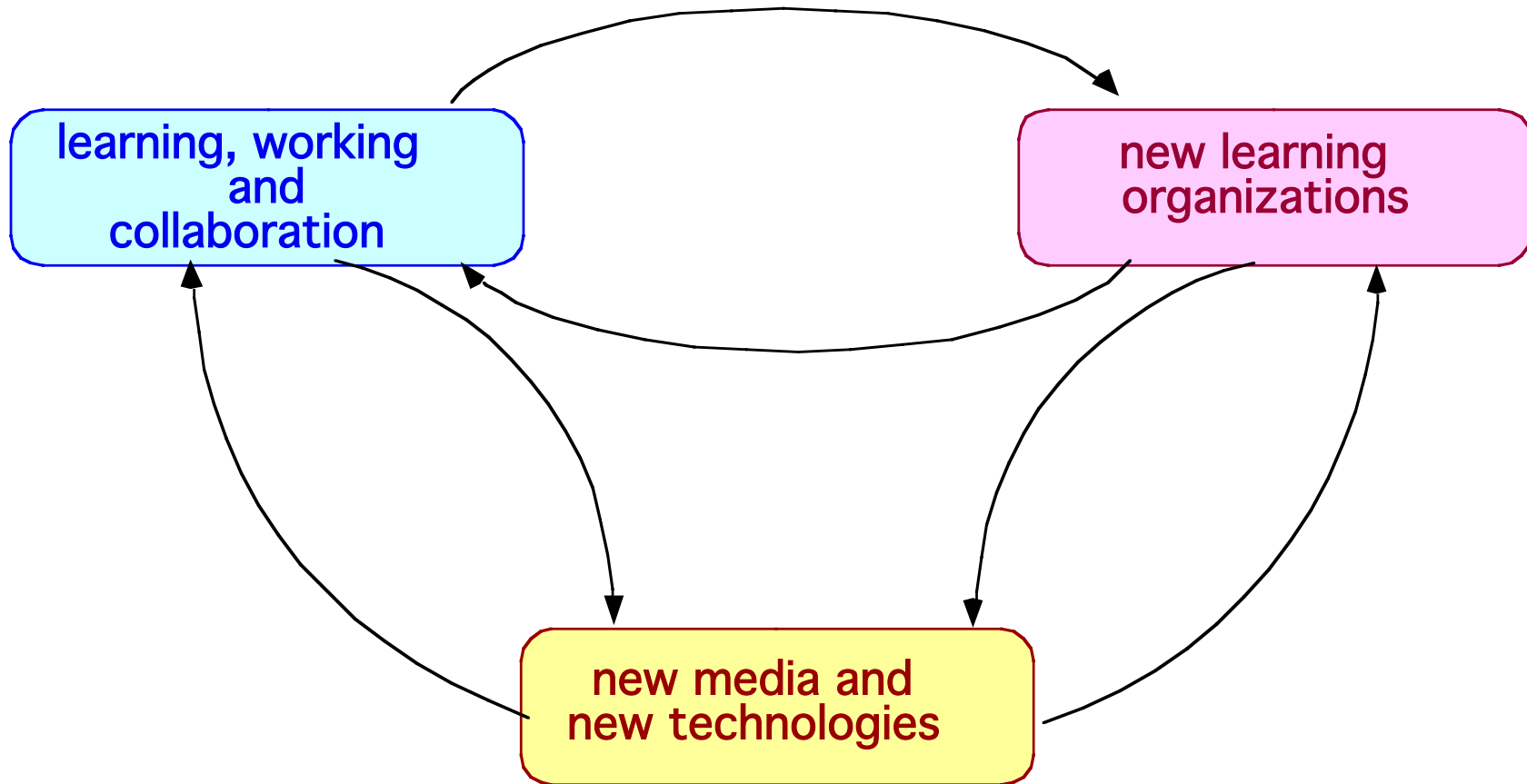
- **Research Labs:**

- *National Renewable Energy Laboratory* (NREL; Golden) — OpenEI (= Open Energy Information Repository)
- Renewable and Sustainable Energy Institute (RASEI), CU Boulder — **empirical studies** → Karen Ehrhardt-Martin et al (2010:) “Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities”

- **learning communities**

- **schools: After-School Program “El Pueblo Magico” (Kris Gutiérrez)**
- *universities:* sustainability action team and environmental board of CU Boulder
- *international:* Fraunhofer Institute, Bonn, Germany

Co-Evolution: Beyond “Technology-Driven Developments” and “Gift-Wrapping”



Summary Statements and Objectives

- the major objectives of the Center for Lifelong Learning & Design (L3D):
 - **lifelong learning**: *“Doing basic research on real problems”*
 - **design**: *“Philosophers interpret the world in various ways; what matters is to change it!”* (Karl Marx)

- my own personal life objective: ***“envision and create socio-technical environments in which people want to learn rather than have to learn”***
 - an **early reflection** on this objective: Burton, R. R., Brown, J. S., & Fischer, G. (1984) *“Analysis of Skiing as a Success Model of Instruction: Manipulating the Learning Environment to Enhance Skill Acquisition.”* In B. Rogoff, & J. Lave (Eds.), *Everyday Cognition: Its Development in Social Context*
 - **analogy**: “Exxon sells a product which **people need** — Apple sells a product which **people want**”

- **objectives for the symposium**:
 - explore “symmetry of ignorance”
 - exploit productive controversies