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**

Beyond Binary Choices:
Integrating Individual and Social Creativity

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Fischer, G., Giaccardi, E., Eden, H., Sugimoto, M., & Ye, Y. (2005) "Beyond Binary Choices: Integrating Individual and Social Creativity," International Journal of Human-Computer Studies (IJHCS) Special Issue on Computer Support for Creativity (E.A. Edmonds & L. Candy, Eds.), 63(4-5), pp. 482-512

Creativity — a Brief Characterization

- ***historical creativity*** = ideas and discoveries that are fundamentally novel with respect to the whole of human history

- ***psychological creativity*** *= ideas and discoveries in everyday work practice that are novel with respect to an individual human mind or social community*
    - a capacity inherent to varying degrees in all people

    - needed in most problem-solving situations

    - knowledge workers and designers have to engage in creative activities to cope with the unforeseen complexities of real-world tasks

Creativity: Four Essential Attributes

- **originality** means people having unique ideas (mostly in the realm of *psychological creativity)* or applying existing ideas to new contexts

- **expression** — ideas or new applications are of little use if they are only internalized; they need to be *expressed and externalized*

- **social evaluation** — externalizations allow other people (with different backgrounds and perspectives) to understand, reflect upon, and improve them

- **social appreciation within a community** —rewards, credits, and acknowledgements by others that motivate further creative activities

Individual Creativity

- creative individuals can make a huge difference — for example: movie directors, champions of sports teams, and leading scientists and politicians

- **individual creativity**
    - grounded in the unique perspective that an individual brings to bear in a specific problem
    - results from the life experience, culture, education, and background knowledge of an individual

- individual creativity has **limits**
    - in today's society, the Leonardesque aspiration to have people who are competent in all of science fails because the individual human mind is limited ("symmetry of ignorance")
    - *"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"* (Csikszentmihályi)

Social Creativity

- the **Renaissance scholar** (who knows "everything") does **not** exist anymore
  - the individual, unaided human mind is limited
  - the great individual→ the great group/community

- **distinct domain of human knowledge exist** → of critical importance: mutual appreciation, efforts to understand each other, increase in socially shared cognition and practice

- exploit the **"symmetry of ignorance"** as an opportunity
  - none of the stakeholders solving a complex problem can guarantee that their knowledge is superior or more complete compared to other people's knowledge
  - to overcome the "symmetry of ignorance" → activate as much knowledge from as many stakeholders as possible with the goal of achieving mutual education and shared understanding

Creativity — The "Wrong" Image?
"The Thinker" by Auguste Rodin

Analyzing and Describing Creativity

- **Csikszentmihalyi, M. (1996) Creativity — Flow and the Psychology of Discovery and Invention, HarperCollins Publishers, New York, NY**

- **Bennis, W., & Biederman, P. W. (1997) Organizing Genius: The Secrets of Creative Collaboration, Perseus Books, Cambridge, MA.**
  - none of us is as smart as all of us → **social creativity**
  - great groups and great leaders create each other → **individual and social creativity**
  - people in great groups have blinders on → **group-think**
  - great groups are voluntary associations; people are in them, not for money, not even for glory, but because they love the work, they love the project → **motivation**
  - examples: Disney (animated movie), Xerox-Parc (personal computing), Manhattan project (atomic bomb), …..

- **John-Steiner, V. (2000) Creative Collaboration, Oxford University Press, Oxford.**

Creativity Support Tools

- **a recent workshop supported by the National Science Foundation**

- **for details see:**
    http://www.cs.umd.edu/hcil/CST/

- includes a web page with URLs to **"Resources for Creativity Support Tools":**
    http://www.cs.umd.edu/hcil/CST/resources.html

- see slides of **individual presentations:**
    http://www.cs.umd.edu/hcil/CST/schedule.html

Beyond Productivity: Innovation and Creativity

- **National-Research-Council (2003) Beyond Productivity: Information Technology, Innovation, and Creativity, National Academy Press, Washington, DC.**

  - challenge for the 21st century is to "work smarter, not harder"

  - explore collaborative efforts between persons in information technologies (IT) and creative practices (CP; fine arts, movie making) → artists and technologists should find common ground

  - **assumption:** exposing a culture (or a practice) to alien influences and experiencing marginality or even dissent are correlated with creativity → from "communities of practice" to "communities of interest"

  - **objective-1 (IT → CP):** how can information technology provide new tools and media for artists and designers that enable new types of work?

  - **objective-2 (CP → IT):** how can art and design raise important questions for information technology and help to push forward research and product development agendas in computer science and information technology?

  - **objective-3 (IT + CP):** how can successful collaboration of artist, designers, and information technologists be established?

The Creative Class

- **Florida, R. (2002) The Rise of the Creative Class and How It's Transforming Work, Leisure, Community and Everyday Life, Basic Books, New York, NY.**

  - the creative class derives its identity from its members' roles as being creative

  - creative class = people in science, engineering, architecture, design, education, arts, music, entertainment whose function is to create new ideas, new technology, and new creative content

  - creativity is now the *decisive* source of competitive advantage

  - creativity is multi-dimensional: technological, economic, artistic, cultural

  - creativity cannot be switched on and off at predetermined times; it is an odd mixture of work and play

  - creativity is largely driven by intrinsic awards → example: open source movement as a gift culture

  - tension between creativity and organization: the creative process is social, not just individual, and thus forms of organization are necessary; but elements of organization can and frequently do stifle creativity

  - **claim:** the deep and enduring changes of our age are not technological but social and cultural

Democratizing Creativity

- **Hippel, E. v. (2005) Democratizing Innovation, MIT Press, Cambridge, MA.**

  - creativity and innovation are being democratized — meaning: users of product and services are increasingly able to innovate for themselves

  - integrate and complement manufacturer-creativity and user--creativity

  - the needs of users for products are highly heterogeneous in many fields

  - users may value the process of innovating and being creative because of the enjoyment and learning that it brings them → in personally meaningful problems

  - **claim:** users' ability to innovate is improving radically and rapidly as a result of the steadily improving quality of computer software and hardware, improved access to easy-to-use tools and components for innovation, and access to a steadily richer innovation commons

  - meta-design → design that users can be creative and act as designers themselves

  - **examples:** open source, Wikipedia (www.wikipedia.org) = user-contributed online encyclopedia

Economic Implications

- **Friedman, T. L. (2005) The World is Flat: A brief history of the twenty-first century, Farrar, Straus and Giroux, New York**

  - the playing field is leveled → many countries compete for global knowledge work
  - **US tax returns in India** (tax returns: knowledge work, but rule-based)
    - 2003: 25,000
    - 2004: 100,000
    - 2005: 400,000
  - the changing world (in less than 50 years):
    - sold in China
    - made in China
    - designed in China
    - dreamed up in China
  - **basic assumption:** the more "creative work" will stay in the USA → combine technical knowledge (e.g., how to write computer programs) with business, scientific knowledge, and take advantage of local contexts
  - **question:** what are the educational implications of these changes? how do we educate students for finding a job in the world of tomorrow?

Individual versus / and Social Creativity

"The strength of the wolf is in the pack, and the strength of the pack is in the wolf."— Rudyard Kipling

- **social**
    - Rodin's sculpture "The Thinker" dominates our collective imagination as the purest form of human inquiry — the lone, stoic thinker
    - the reality is that scientific and artistic forms emerge from the joint thinking, passionate conversations, and shared struggles

- **individual:**
    - human collaboration is not only needed but central to social creativity
    - individuals participating in collaborative inquiry and creation, need the individual reflective time depicted by Rodin's sculpture
    - without such reflection it is difficult to think about contributions to social creativity

Design and Creativity
—
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**

- **unique** → **the answer is not known**

Trade-Offs

- trade-offs are the most basic characteristics in design: they are **universal**

- there are no best solutions ("sweet-spots") **independent** of goals and objectives

- trade-offs are often characterized and conceptualized as **binary choices** representing the endpoints of a spectrum

- **examples:**
    - **atoms (physical)** ←-------------X----------------X-------------→ **bits (digital)**
    - **adult-driven edu** ←-------------X----------------X-------------→ **child-driven edu**

Sweet Spots

HEAD » You can virtually draw a line from the center of Federer's head to a spot right in the middle of his feet. This produces an incredible center of gravity that allows him to move like a ballet dancer on the court.

CHIN » Federer's chin is practically touching his right shoulder as he watches the ball into the sweet spot. Many players prematurely pull their heads away to watch the volley and end up shanking the shot.

LEFT ARM or skateboard his left arm ou Imagine walki you've got to h to maintain yo

WRIST » By keeping his racquet head above his wrist, Federer can volley with power and control. This kind of technique promotes a stable racquet face.

HIPS » F and hips ar to the net, him direct t his intende When the h you tend to ball and cre control insi

LEFT FOOT » Notice that Federer's left foot is off the court at impact. This means he's transferring his weight forward through the shot by pushing off his back leg.

Creativity — a Complex Phenomenon

- Csikszentmihalyi (in *"Creativity — Flow and the Psychology of Discovery and Invention "*, 1996) discusses personality characteristics of creative people who *"definitely know both extremes and experience both with equal intensity and without inner conflict."*

- **examples:**
    - being smart   ←→   naïve
    - playfulness   ←→   discipline
    - responsibility   ←→   irresponsibility
    - imagination   ←→   rooted sense of reality
    - rebellious/independent ←→   internalized a domain of culture

- **claim:** any socio-technical environment that supports and enhances creativity must be based on a **multi-dimensional** framework and architecture
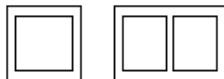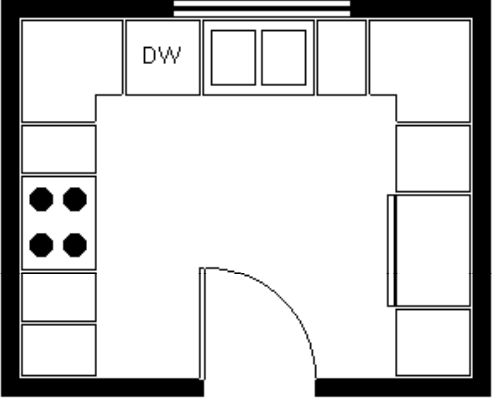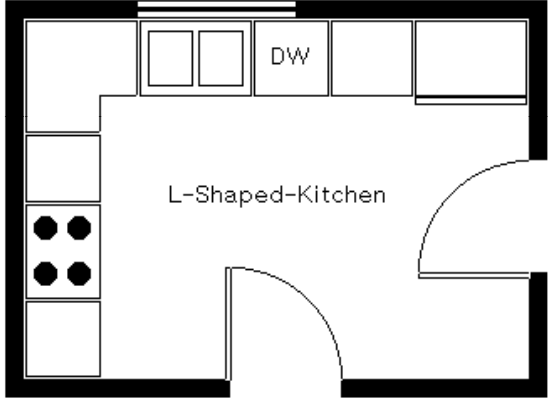
Socio-Technical Environments in Support of Creativity

- **Domain-Oriented Design Environments (DODEs)**

- **Envisionment and Discovery Collaboratory (EDC)**

Domain-Oriented Design Environments (DODEs)

- support reflective practitioners in specific domains by bringing tasks to the forefront

- support individual creativity by supporting
  - reflection-in-action
  - critiquing
  - simulation
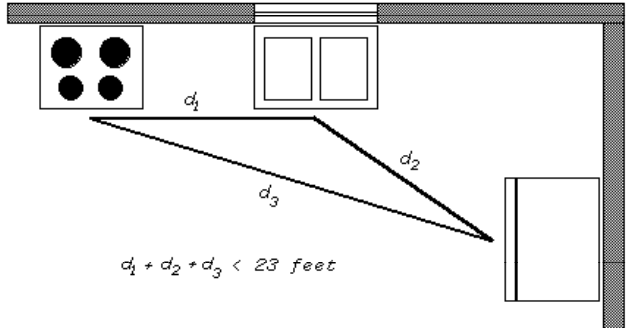
A DODE for Kitchen Design: Construction

Janus-Construction

Clear Work Area   Critique All   Edit Global Descriptions
Load Catalog   Save In Catalog   Select Context

Appliance Palette

walls

doors

windows

sinks

stoves

Catalog

L-Shaped-Kitchen

Work Area

DW

Messages

- The length of the work triangle (Double-Bowl-Sink-1, Four-Element-Stove-1, Single-Door-Refrigerator-1) is greater than 23 feet.
- Single-Door-Refrigerator-1 is not near Four-Element-Stove-1.

Commands

▶ Critique All
▶ ■

A DODE for Kitchen Design: Argumentation

Janus-Argumentation

Answer (Refrigerator, Sink, Stove)

The distance between sink, stove and refrigerator, the *work triangle*, should be less than 23 feet.
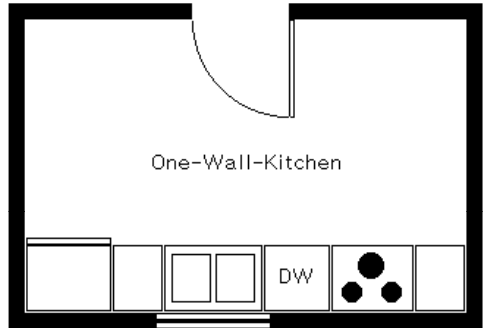
$$d_1 + d_2 + d_3 < 23 \ feet$$

Figure 10: the work triangle

Argument (Walking Distance)

The work triangle is an important concept in kitchen design. The work triangle denotes the center front distance between the three main appliances: *sink*, *stove* and *refrigerator*. This length should be less than 23 feet to avoid unnecessary walking and to ensure an efficient work flow in the kitchen!

Argument (Small Room)

In small kitchens where the work triangle is less than 16 feet,

Viewer: Default Viewer

Catalog Example

One-Wall-Kitchen

DW

The length of the work triangle (Stove, Refrigerator, Sink) is less than 23 feet.

Visited Nodes

⇒ Answer (Refrigerator, Sink, Stove) Section

Commands

▶

Show Example: "Answer (Refrigerator, Sink, Stove)"
Show Example Answer (Refrigerator, Sink, Stove)

▶■

Show Outline   Resume Construction
Search For Topics   Show Construction
Show Argumentation   Show Example
Show Context   Show Counter Example

A DODE for Computer Network Design

Creativity oriented Assessment / Evaluation Issues in DODEs

- do critics enhance or hinder creativity (e.g., Fosbury Flop)? — Stravinsky: *"without constraints, there can be no creativity"*

- differences in performance, quality, and creativeness as a function of critics, catalog, simulation component?

- trade-offs between critiquing (breakdowns occur) versus constraint (breakdowns are prevented)

- trade-offs between different intervention strategies (active versus passive)

- does "making information relevant to the task at hand" prevent serendipity?

- under which conditions will designers challenge or extend the knowledge represented in the system?

- should the "back-talk" be embedded directly in the artifact or in a separate discourse?

The Envisionment and Discovery Collaboratory (EDC)

- **the big question:** does the EDC support
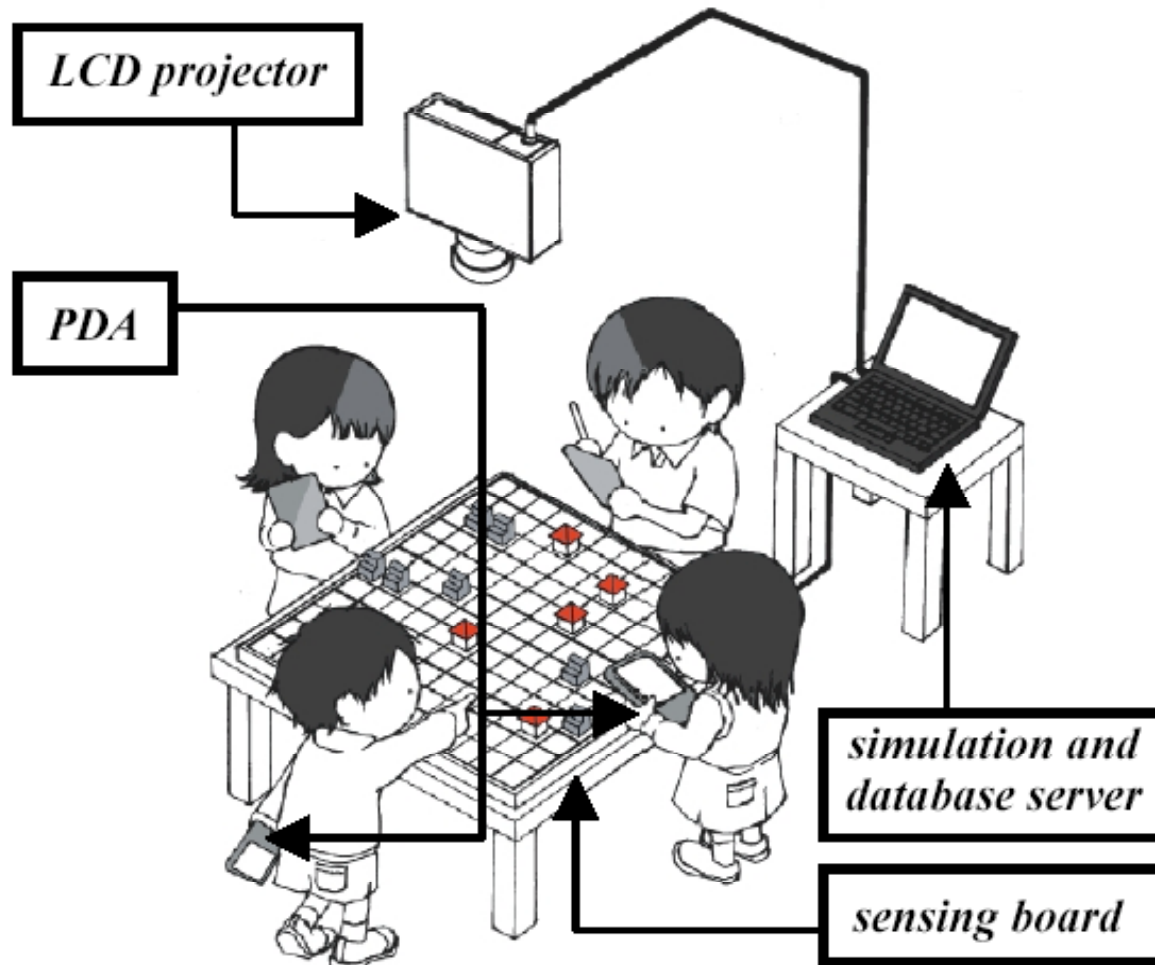
Creativity

- **if yes: how?**

Creativity Support with the EDC

- access → **informed participation**

- design → **meta-design**

- individual creativity→ **social creativity**

- communities of practice → **communities of interest**

- **computing beyond the desktop:** computationally enhanced physical objects, parallel interactions, context awareness, ….

Dimensions of Individual and Social Creativity explored in the EDC

- individual interaction with computational artifacts ⇔ shared interaction: supporting interaction with others through the computational artifacts as a shared medium

- individual agendas ⇔ creation of shared focus

- reliance on explicit knowledge ⇔ bringing out tacit knowledge

- expert tools ⇔ providing access to design for people with many perspectives, from many backgrounds

- dependence on model monopolies ⇔ creating boundary objects

- reliance on high-tech scribes ⇔ supporting meta-design

Caretta: A EDC Extension at the University of Tokyo

Caretta: Integrating Individual and Social Creativity

- **objective**: the smooth integration of individual and social creativity; individual creativity drives social creativity, and social creativity triggers further individual creativity

- technological support for **individual creativity**: Personal Digital Assistants (PDAs)

- technological support for **social creativity**: SensingBoard

Conclusions

- the complexity of problems transcends the individual human mind, requiring not only individual but also social creativity

- **socio-technical environments in support of individual and social creativity**:
  - unaided, individual human mind → media-augmented social creativity to make all voices heard and integrate diversity

  - exploit distances in communities as sources of creativity → spatial, temporal, conceptual, and technological distances

  - design → meta-design

  - communities of practice → communities of interest

  - reflective practitioners → reflective communities