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

Communities of Interest (Cols):
Learning through the Interaction of Multiple Knowledge Systems

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Overview

• Basic Message / Question

• Center for LifeLong Learning and Design (L³D)

• Communities of Practice (CoPs)

• Communities of Interest (Cols)

• Examples from our Work:
  - domain-oriented design environments (DODEs)
  - Envisionment and Discovery Collaboratory (EDC)
  - Participate-In-The-Action (PITA) Board
  - DynaSites

• Conclusions
The Basic Message / Question

How can we exploit the symmetry of ignorance in communities of interest as a source for social creativity?
Brief Introduction of the Major Concepts

- **knowledge systems** — relations and interfaces between the different actors and aspects of knowledge

- **CoPs** — practitioners who work as a community in a certain domain

- **Cols** — bring different CoPs together to solve a problem
  **Remark:** CoP ↔ Col: these are not either/or choices, but points on a continuum (relative to our definitions of “domains and practices”)

- **symmetry of ignorance** — in Cols there is nobody among all the carriers of knowledge (individual person or group) who has a guarantee that her/his knowledge is superior

- **social creativity** — new insights, new ideas, and new artifacts by bringing different points of view together and creating a shared understanding among all stakeholders

- **boundary objects** — perform a brokering role involving translation, coordination, and alignment between the perspectives of different CoPs
Knowledge Systems

• **knowledge systems include:**
  - computational systems
  - individual minds
  - knowledge building communities
  - knowledge management repositories
  - relations and interfaces between the above aspects of knowledge

• **human knowledge systems:** internal, tacit, conceptual
  - uniform, homogenous → CoPs
  - multiple, heterogenous → CoIs

• **computational knowledge systems:** externalizations
  - uniform, homogenous → DODEs
  - multiple, heterogenous → EDC, Participate-In-The-Action (PITA) Board, DynaSites

• Neil Postman: **“One cannot do philosophy with smoke signals”** (in “Amusing Ourselves to Death”) → knowledge systems can both enable and constrain our thinking and our ability to express ourselves, and knowledge systems for specific activities and objectives must provide appropriate support
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
  - knowledge in the head → creating shared understanding, distributed cognition
    * among humans: Cols, CoPs, boundary objects
    * among humans and tools/media (“virtual stakeholders”)
  - access → informed participation

• things that think → things that make us smart
  - what computers can do → what people and computers can do together
  - computational → computational and physical

• “gift-wrapping” with new media → tradition and transcendence
  - technology → co-evolution of media and new theories about thinking / working / learning / collaborating
Thinking, Learning and Working — The “Wrong” Image?
“The Thinker” by Auguste Rodin (1840-1917)
Individual and / versus Social

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

  “Rodin's sculpture "The Thinker" dominates our collective imagination as the purest form of human inquiry — the lone, stoic thinker.
  But while the Western belief in individualism romanticizes this perception of the solitary process, the reality is that scientific and artistic forms emerge from the joint thinking, passionate conversations, and shared struggles common in meaningful relationships!
  Many of the collaborators complemented each other, meshing different backgrounds and forms into fresh styles, while others completely transformed their fields.
  The mind — rather than driving on solitude — is clearly dependent upon the reflection, renewal, and trust inherent in sustained human relationships.”

- response from Ernesto Arias (a colleague of mine):
  “Human interaction is not only needed but central to social creativity, but I do believe that we as individuals, to participate in such 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.”
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, and software users
  - Worm Community System (1,400 scientists, 120 labs); to allow distributed scientists to work together on data

• **learning:**
  - masters and apprentices
  - legitimate peripheral participation (LPP)
  - develop a notion of belonging

• **problems:**
  - “Group-Think” → when people work together too closely in communities, they sometimes suffer illusions of righteousness and invincibility
  - human behavior is determined by the community's norms, rules and incentives which we have accepted when we decided to enter it

• **DODEs:** systems supporting CoPs
  (examples: kitchen design, computer network design)
Community of Practice

one accepted, well-established center (of expertise) and a clear path of learning towards this center
A DODE for Kitchen Design: Construction

Janus-Construction

Appliance Palette
- walls
- doors
- windows
- sinks
- stoves

Catalog
- L-Shaped-Kitchen

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

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.

\[ d_1 + d_2 + d_3 < 23 \text{ feet} \]

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

Commands
- Show Example: 'Answer (Refrigerator, Sink, Stove)'
- Show Example Answer (Refrigerator, Sink, Stove)
A DODE for Computer Network Design

Publications OT 8-6, College of Engineering, University of Colorado

(1) Group Memory
- Meeting Notes
- Priorities
- Machinery
- Miscellaneous
- All email

Design

Launch Construction Component

Worksheet: Publications -- OT 8-6

Priorities to be used for devices in this area
1st priority: Cost
   weight: 10
2nd priority: Expandability
   weight: 8
3rd priority: Reliability
   weight: 4

(2) (3) (4) (5)
Communities of Interest (Cols) — Heterogeneous Design Communities

“Innovations come from outside the city wall.”

- **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 around the world

- **fundamental challenges:**
  - establish a common ground
  - building a shared understanding of the task at hand
  - learning to communicate with and learn from others who have a different perspective and a different vocabulary for describing their ideas
Cols: Bringing Together Multiple CoPs
Cols: Multiple Centers of Expertise and Shifting Objectives

several centers of expertise which emerge, change and drift and
no single, clear path of learning
Social Creativity and “Symmetry of Ignorance” — Sources of Power for Cols

- the Renaissance scholar does not exist anymore — the individual human mind is limited (there is insufficient time to become a Renaissance scholar today — learners are forced to make choices, focus attention, and specialize)

- distinct domain of human knowledge exist (C. P. Snow) — of critical importance: mutual appreciation, efforts to understand each other, increase in socially shared cognition and practice

- a “group has no head” — externalizations are critically more important for groups and organizations than for individuals

- create boundary objects (shared objects to “talk about” and to “think with”) by exploiting the “symmetry of ignorance” as an opportunity for mutual learning
Cols: Social Creativity and Boundary Objects
Boundary Objects

“If a lion could speak would we understand him?” — Wittgenstein

- **boundary objects serve**
  - to communicate and coordinate the perspectives of CoPs brought together for some purpose leading to the formation of a CoI
  - the interaction between users and (computational) environments

- perform a **brokering role** involving translation, coordination and alignment between the perspectives of different CoPs

- **examples:**
  - boundary objects can bridge the gap between situation models and system models
The Gap between Situation and System Models

**Situation Model**
- ring
- doughnut
- tire
- wheel
- washer

**System Model**
- Symbolics:
  (graphics: draw-cricle
  x-center y-center radius inner-radius)

- Fortran package:
  CALL BLCIR (xcntr,ycntr,radius)
  CALL SHADE (xcrds, ycrds, npts,angle, gaps,ngaps,0,0)

**Application Units**

**Implementation Units**
Communication Problems Based on Missing Boundary Objects
The Envisionment and Discovery Collaboratory (EDC)

http://www.cs.colorado.edu/~l3d/systems/EDC

• creating shared understanding through collaborative design
  - symmetry of ignorance, mutual competence, and breakdowns as sources of opportunity

• integration of physical and computational environments
  - support and exploit face-to-face collaboration
  - hardware: touch-sensitive electronic whiteboards, crickets
  - software: AgentSheets, DynaSites
  - beyond the screen: immersive environments

• support for reflection-in-action
  - action space: AgentSheets, Visual AgenTalk
  - reflection space: DynaSites, WWW

• open system — seeding, evolutionary growth, reseeding process model
The Envisionment and Discovery Collaboratory (EDC)
The Envisionment and Discovery Collaboratory
Boundary Objects and the EDC

- **physical and computational languages to “think-with” and to “act-with”** — a common language meaningful to all stakeholders

- **simulations** — dynamic feedback meaningful to all stakeholders

- **reflection spaces** — explicit information helping stakeholders remember what they have learned and to consider other perspectives

- **open, evolvable tools** — capturing important information not anticipated at system design time by encouraging a culture of participation, that addresses the open-ended nature of problems
The Participate-In-The-Action (PITA) Board

based on: DGT electronic chessboard, NL; http://www.dgtprojects.com/

• supporting alternative *processes* (in addition to the EDC) to create *content*
Differences between DODEs and the EDC

<table>
<thead>
<tr>
<th>User Communities</th>
<th>Problems and Artifacts</th>
<th>Knowledge Development</th>
<th>Interaction</th>
<th>Support</th>
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</thead>
<tbody>
<tr>
<td>CoPs</td>
<td>different tasks in the same domain and uniform representations</td>
<td>refinement of <em>one</em> knowledge system</td>
<td>indirect (through systems and artifacts)</td>
<td>DODEs</td>
</tr>
<tr>
<td>Cols</td>
<td>multiple domains and different representational schemes</td>
<td>synthesis and mutual learning through the integration of <em>multiple</em> knowledge system</td>
<td>face to face, mediation by physical and computational objects</td>
<td>EDC</td>
</tr>
</tbody>
</table>
• dynamic, extensible and integrated web-based information spaces

• supports the collaborative creation and evolution of artifacts through which communication can take place

• examples:
  - Dynagloss — a decentralized, dynamically evolved space of concepts
  - Living Book — an information space evolving as a side effect of interaction between readers
  - DynaClass — a DynaSites document type developed for class discussions and workshops
Organizational Memory

Current Definition

A shared information space that supports a group of people (an organization) to do work. The information space should be "living" in the sense that it is an evolving product of the work done by the members of the organization as opposed to simply being a static storage of information.

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Known Uses of Organizational Memory in Dynasites

- A question of terminology (in DynaClass)
- Group Decision Support Systems (in Source)
- Commercial product for Organizational Memory (in DynaClass)
- 1/26/98 Meeting Minutes (in FFUproject)
- Living Design Memory: Framework, Implementation, Lessons Learned (in Source)
- Work Promised (in OMOLProject)
- General Goals (in OMOLProject)
The LivingBook Model

- **LivingBook:**
  - aims to blur the traditional *distinction between readers and authors*
  - engages a **community of interest** who will enrich the seed with new ideas and new connections to related information

- **seed:** a starting point for conversations and debates of the ideas it contains

- **evolutionary growth:** use will result in a growth of the information space

- **reseeding:** periodically, the LivingBook will be **reseeded** to incorporate the new ideas and information constructed during the evolutionary growth phase
CoPs and Cols Models: Shaping our Organizations

- the **Alliance for Technology, Learning, and Society**
  [http://www.colorado.edu/ATLAS/](http://www.colorado.edu/ATLAS/)
  - new innovative collaborations and learning opportunities between the arts, humanities, science, and engineering
  - new media to support these collaborative efforts and express new ideas

- the **Institute of Cognitive Science**
  - a department (the CoP dimension; example: UC San Diego)
  - remaining an institute bringing representatives of different departments together (the Col dimension; example: CU-Boulder)

- the **Center for LifeLong Learning and Design (L³D)**
  - a CoP based on a shared history and the use of concepts and system developments as shared reference points
  - makes every conscious effort to exploit the strengths of Cols
  - creates a community without “boundaries” and with “no walls around it”
  - co-evolution of theories, systems, practice, and assessment
Conclusions

• CoPs and Cols are **two important forms of communities**

• the **knowledge systems** supporting CoPs and Cols are different

• Cols pose a number of **new challenges**
  - we need to find ways (e.g., boundary objects) to deal with cross-cutting identities, different value systems, and different notations
  - diversity causes difficulties, but it also provides unique opportunities
  - the dual goal of creating an object understandable by every participating stakeholder and at the same time making an important contribution to a specific CoP is not easily achieved
  - Cols support pluralistic societies which can cope with complexity, contradictions, and a willingness to allow for differences in opinions

• **in summary the basic message of my presentation:**

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some initial frameworks, systems, and reflections how “to exploit the symmetry of ignorance in COIs as a source for social creativity”
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Gerhard Fischer