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

Knowledge Creation, Integration, and Dissemination in Design Communities

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Overview

♩ The Basic Message

♩ Design and Design Communities

♩ Knowledge Management and Knowledge of the Past

♩ Conceptual Frameworks for KM
  - Informed Participation
  - Seeding, Evolutionary Growth, Reseeding Model
  - Meta-Design
  - Open Source and Open Systems

♩ Systems in Support of KM
  - Domain-Oriented Design Environments
  - Group Memory Systems / Living Organizational Memories
  - Envisionment and Discovery Collaboratory
  - Software Reuse as a KM Problem

♩ Myths, Realities, Challenges, and Conclusions
Major Processes in Knowledge Management (KM)

- Integration
- Knowledge
- Creation
- Dissemination
The Basic Message

 UserType: km is one of the most critical challenges in an information society — but so far it has been a limited success

UserType: limitation: remembering lessons from the past and archiving information is necessary, but not sufficient, because the information needs (specifically in design) of the future will not be the same as they were in the past

UserType: the challenge: knowledge is not a commodity to be consumed but is collaboratively designed and constructed emphasizing innovation, individual and social creativity, continuous learning, and collaborative knowledge construction
Design

- **design**
  - natural science: how things are
  - design: how things ought to be

- **design problems** are
  - complex requiring multidisciplinary approaches in which stakeholders from different disciplines have to collaborate
  - ill-defined requiring the integration of problem framing and problem solving
  - unique ("a universe of one") knowledge of the past is not enough
Design Communities: Communities of Practice and Communities of Interest

- **basic assumption:** (some form of) communities are the heart and soul of knowledge sharing

- **Communities of Practice (CoPs),** defined as groups of people who share a professional practice and a professional interest

- **Communities of Interest (Cols),** defined as groups of people (typically coming from different disciplines) who share a common interest (e.g., solve complex design problems, engage in complex decision making)

- **for details see:**
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, voice dialog systems designers ……

- **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

- **systems:** domain-oriented design environments (e.g.: kitchen design, computer network design, voice dialogue design, …..)
Learning in CoPs
**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
  - 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” (CoP) but “integrating diversity” and “making all voices heard”
Cols: Bringing Different CoPs Together

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 by building bridges between different ontologies

prototypes serve as boundary objects between developers and users in participatory system design
- stories convey the essence of an experience
Knowledge of the Past is Important

“do not reinvent the wheel” — do not stand on the toes, but on the hips or shoulders of the smart people who proceeded us (one form of social creativity)

George Santayana: “Those who cannot remember the past are condemned to repeat it.”

Herbert Simon: “Complex systems evolve fast if they can built on stable subsystems”
Why Knowledge of the Past is Not Enough

صارم design
- design problem are unique  ◇ the information needs of the future are not the same as they were in the past

صارم world-as-imagined  ↓◇ world-as-experienced:
- in a world that is not predictable, improvisation and innovation are more than desirable: they are essential
- planning ↓◇ situated action
## Contrasting two Different Views of KM

<table>
<thead>
<tr>
<th>Commodity Perspective</th>
<th>Community Perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>specialists (e.g., knowledge engineers)</td>
<td>everyone (e.g., people doing the work), collaborative activity</td>
</tr>
<tr>
<td><strong>integration</strong></td>
<td>at design time (prior to system deployment)</td>
</tr>
<tr>
<td><strong>dissemination</strong></td>
<td>lecture, broadcasting, classroom, decontextualized</td>
</tr>
<tr>
<td><strong>learning paradigm</strong></td>
<td>knowledge transfer</td>
</tr>
<tr>
<td><strong>tasks</strong></td>
<td>system driven (canonical)</td>
</tr>
<tr>
<td><strong>social structures</strong></td>
<td>individuals in hierarchical structures; communication primarily top-down</td>
</tr>
<tr>
<td><strong>work style</strong></td>
<td>standardize</td>
</tr>
<tr>
<td><strong>information spaces</strong></td>
<td>closed, static</td>
</tr>
<tr>
<td><strong>breakdowns</strong></td>
<td>errors to be avoided</td>
</tr>
</tbody>
</table>
## Comparison of Information Access (“Pull”) and Delivery Approaches (“Push”)

<table>
<thead>
<tr>
<th></th>
<th>access (“pull”)</th>
<th>delivery (“push”)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>examples</strong></td>
<td>browsing, search engines, bookmarks, passive help systems</td>
<td>Microsoft’s “Tip of the Day”, broadcast systems, critiquing, active help systems</td>
</tr>
<tr>
<td><strong>strengths</strong></td>
<td>non-intrusive, user controlled</td>
<td>serendipity, creating awareness for relevant information, rule-enforcement</td>
</tr>
<tr>
<td><strong>weaknesses</strong></td>
<td>task relevant knowledge may remain hidden because users can not specify it in a query</td>
<td>intrusiveness, too much decontextualized information</td>
</tr>
<tr>
<td><strong>major system design challenges</strong></td>
<td>supporting users in expressing queries, better indexing and searching algorithms</td>
<td>context awareness (intent recognition, task models, user models, relevance to the task-at-hand)</td>
</tr>
</tbody>
</table>
Theories / Conceptual Frameworks Relevant to KM

- Informed Participation
- Seeding, Evolutionary Growth, Reseeding Model
- Meta-Design
- Open Source and Open Systems
Beyond Access: Informed Participation

\*informed participation*: focuses not on knowledge as information stored in repositories, but rather on a continual process in which knowledge is

- *created* as a by-product of work
- *integrated* in an open and evolving repository
- *disseminated* to others in the organization when it is relevant to their work

\*requires users who act as *active contributors and designers*, not passive consumers

- *art*: looking \(\Diamond\) interactive art
- *courses*: passive listening \(\Diamond\) collaborative knowledge construction

\*more information:*

Gerhard Fischer: “Beyond 'Couch Potatoes': From Consumers to Designers and Active Contributors”, First Monday, volume 7, number 12 (December 2002),
[http://firstmonday.org/issues/issue7_12/fischer/index.html]
The Seeding, Evolutionary Growth, and Reseeding (SER) Process Model
Meta-Design

- **Meta-design** = how to create new media at design time ("world-as-imagined") that allow users to act as designers and be creative at use time ("world-as-experienced")

- **why meta-design?**
  - deal with a changing world
  - address and overcome problems of closed systems
  - transcend "consumer mindsets"

- **impact of meta-design**
  - "if you give a fish to a human, you will feed him for a day — if you give someone a fishing rod, you will feed him for life" (Chinese Proverb)
  - can be extended to: "if we can provide someone with the knowledge, the know-how, and the tools for making a fishing rod, we can feed the whole community"
Design Time and Use Time

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

Design time:
- World-as-imagined
- Prediction
- Planning

Use time:
- World-as-experienced
- Reality
- Situated action
Open Source and Open Systems

* an intellectual paradigm requiring a new mindset
  - open source: collaborative development of software
  - objective: leverage is gained by engaging the whole world as a talent pool
  - from users/consumers to co-designers/active contributors

* some characteristics:
  - evolutionary design of complex systems
  - success stories so far: technically sophisticated developers not end-users
Social Capital and Gift Cultures

- the incentive to be a good colleague, to contribute and receive knowledge as a member of a community

- hacker milieu (and academia) as gift culture: human beings have an innate drive to compete for social status
  - in gift cultures, social status is determined not by what you control but by *what you give away*
  - prestige is a good way (and in a pure gift economy, the *only* way) to attract attention and cooperation from others
  - “utilization is the sincerest form of flattery”

more information:
Systems Exploring and Supporting the Different Conceptual Frameworks

- Domain-Oriented Design Environments
- Group Memory Systems / Living Organizational Memories
- Envisionment and Discovery Collaboratory
- Software Reuse as a KM Problem
A Domain-Oriented Design Environment for Computer Network Design

NetDE

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

Worksheet: Publications -- OT 8-6

Launch Construction Component

Priorities to be used for devices in this area

1st priority: Cost
weight: 10

2nd priority: Expandability
weight: 8

3rd priority: Reliability
weight: 4

(1)

(2)

(3)

(4)

(5)
Group Memory Systems / Living Organizational Memories

полнение Group Memory Systems
- supports awareness of the activities of group members
- finds answers to repeatedly posed questions
- focuses on reusing knowledge which is already there and applied knowledge mining and intelligent classification
- uncovered the concept of *media-competition*

Dynasite / LivingOM
- explores alternatives to “put all the knowledge in at the beginning versus provide an empty framework”  ◇ SER model
- supports informed participation
- creates linkages between different information repositories (e.g.: glossaries and publication analysis and documentation environments)
- provides a small-scale model for the “*Semantic Web*”
The Envisionment and Discovery Collaboratory

http://www.cs.colorado.edu/~l3d/systems/EDC (including demo)

- creating shared understanding in the context of collaborative design
- integration of physical and computational environments
- support for:
  - CoPs and CoIs
  - reflection-in-action
- specific major application: urban planning build an end-user modifiable version of Simcity (meta-design approach)
The Envisionment and Discovery Collaboratory
CodeBroker — Personalizing Delivered Information in a Software Reuse Environment

Yunwen Ye (more info at: http://www.cs.colorado.edu/~yunwen)

- **thousands of components**, no programmer knows all of them, constantly evolving

- information access does **not support programmers** who do not actively search for reusable components

- **delivers personalized components** based on task and user modeling techniques

- programmers are **consumers and contributors**
KM Challenges in Large Software Reuse Repositories

(L4 – L3): Unanticipated Information

L4: Entire Information Space

L1: Well Known
L2: Vaguely Known
L3: Belief

Task-relevant information
Some Knowledge Management Myths

✶ **myth-1: knowledge is a commodity** ♦ “we can simply ‘capture’ the knowledge of a thirty-year expert in explicit form so we can fire the expert and hire someone with no relevant skills off the street who can now use the ‘knowledge base’ to perform like an expert” ♦ collaborative knowledge construction

✶ **myth-2: self-organizing evolution** ♦ “informed participation leads to evolutionary growth and large information repositories which will be self-organizing” ♦ reseeding

✶ **myth-3: information is a scarce resource** ♦ “access to information anytime and anywhere will solve a key KM problem” ♦ say the ‘right’ thing at the ‘right’ time in the ‘right’ way
Realities based on Assessment Studies

*KM: new technology is necessary, but not sufficient* ◆ change of work practices, mindsets and reward structures is necessary
- design rationale research
- reuse versus “not invented here”
- media competition

◆ motivation for a group is different than for an individual
- “who is the beneficiary and who has to do the work?”
- utility = value / effort

◆ engage skilled professionals in realistic work situations
- requires useful and usable systems (not just demo systems)
- prerequisite for evolutionary growth
Experiences from Industry


- **DaimlerChrysler Research, Ulm** — Experience Factory

- **Nynex, White Plains** — Gimme, Knowledge Depot (group memories)

- **IBM, Global Services, Boulder** — 1200 Help Desk People
Producer/Consumer Models in a Consumer Culture ("Access"): Strong Input Filters, Small Information Repositories, Weak Output Filters

Limitation: Making All Voices Heard
Design Culture ("Informed Participation"):
Weak Input Filters, Large Information Repositories, Strong Output Filters

Limitation: Trust and Reliability of Information
Conclusion: Fundamental Challenges for KM

![the basic message: remembering lessons from the past and archiving information is necessary, but not sufficient, because the information needs (specifically in design) of the future will not be the same as they were in the past]

![the challenge for the future: understanding KM as a socio-technical problem requiring the co-evolution of]
- new technologies
- new mindsets
- new organizations
- new cultures
Some Publications Relevant to Knowledge Management

for a complete list including pdf files to be downloaded:

http://l3d.cs.colorado.edu/~gerhard/papers.html


Some Publications Relevant to Knowledge Management

