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

Design, Learning, and Collaboration

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Spring Semester 2004

Introduction and Overview of Course, Jan 12, 2004
Intersection of Design, Learning and Collaboration and their Changing Nature through New Media
Design, Learning and Collaboration — the “Old” View

![Venn Diagram]

- Learning
- Collaboration
- Design
Design, Learning and Collaboration — the “New” View
The Tension between Human and Computational Power

The power of the unaided individual human mind remains constant over time.

Computing power increases at an exponential rate.
Distributed Cognition — Rethinking the Boundaries between Knowledge in the Head and Knowledge in the World

- Media as Extensions of Humans: “the story of the human race is one of ever-increasing intellectual capability. Since our early cave-dwelling ancestors, our brain have gotten no bigger, our hands no more nimble, but there has been a steady accretion of new tools for physical and intellectual work.”

- Jerome Bruner:
  - “Human’s use of mind is dependent upon her/his ability to develop and use tools or instruments or technologies that make it possible for him to express and amplify her/his powers”
  - “‘how the mind works’ is itself dependent on the tools at its disposal” ( → “‘how the hand works’ cannot be fully appreciated unless one also takes into account whether it is equipped with a screwdriver, a pair of scissors, ….”)
  - “if a theory of mind is to be interesting educationally, it should contain some specifications for (or at least implications bearing on) how its functioning can be improved or altered in some significant way”
Distributed Cognition — Creating Externalizations

- greatest milestone in the history of externalizations: **literacy** = putting thought and memory “out there” on clay tablets and paper

- claim: **digital media** provide new exciting and still largely unexplored opportunities
Fundamental Difference between Printed and Computational Media

- **print media:** a fixed context is decided at design time

- **computational media:** decision at use time can take advantage of contextual factors only known at use time → end-user programming and modification, customization, specification sheets, usage data, context-aware environments
Design

- **natural science: “how things are”**
  - knowledge about natural objects and phenomena
  - primary interest: analysis
  - examples: physics, chemistry

- **sciences of the artificial: “how things might be” (and ought to be in order to attain goals and to function)**
  - knowledge about artificial objects and phenomena
  - primary interest: synthesis
  - artificial things are as they are only because of a system's being molded, by goals and purposes, to the environment in which it lives
  - examples: engineering, medicine, business, architecture, painting, universities, cognitive artifacts, notations

- **design** = although there is a huge diversity among design disciplines, we can find common concerns and principles that are applicable to the design of any object, whether it is a (scientific, mathematical) notation, a household appliance, a housing development, a software system, .......
Design — Some Relevant Publications


Learning

- **lifelong learning** → “learning is inherent in human nature, on ongoing and integral part of our lives, not a special kind of activity separable from the rest of our lives”

- **learning on demand** → the way we learn is trying something, doing it and getting stuck. When we’re stuck we are ready for the critical piece of information. The same piece of information that made no impact at a lecture makes a dramatic impact when we’re ready for it.

- **learning and teaching:**
  - "A major illusion on which the school system rests is that most learning is the result of teaching" — Ivan Illich (in "Deschooling Society")
  - learning and teaching are not inherently linked → much learning takes place without teaching and **much teaching takes place without learning**

- **learning and working**
  - learning is a new form of labor
  - learning is often a collaborative effort among colleagues and peers
  - more and more knowledge, especially advanced knowledge, is acquired well past the age of formal schooling, and in many situations through educational processes that do not center on the traditional school
Learning — Some Relevant Publications


Collaboration

- **collaboration: a necessity, not a luxury** → the individual, unaided human mind is limited: there is only so much we can remember and there is only so much we can learn

- **collaboration — with whom:**
  - ourselves — e.g., capturing our thoughts of the past
  - all stakeholders — e.g., clients, designers, customers, users
  - colleagues — e.g., supporting long-term, indirect collaboration, software reuse tools — e.g., knowing which tools exist, how they can be used, how they can be tailored to our specific needs
  - critics and agents — e.g., shared knowledge of the task at hand, information volunteering

- **distributed cognition — between:**
  - socially (human beings)
  - technologically (humans and things/computational artifacts)
  - temporally (across time)
  - spatially (across space)
Collaboration — Some Relevant Publications


The Aided, Collective Human Mind — Exploiting the Social Power of Collective Human Minds, Aided by Technology

- 2500 BC: Reading & Writing
- 1500: Printing Press
- 1980: Computers
- 2000: Collaborative Systems
Innovative System Development Efforts In Support of Design, Learning and Collaboration

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

<table>
<thead>
<tr>
<th>Name of System</th>
<th>Objectives / Domain</th>
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<tbody>
<tr>
<td>Domain-Oriented Design Environments (DODEs)</td>
<td>kitchen design, computer network design, voice dialog design, .....</td>
</tr>
<tr>
<td>Dynasite / livingOrganizationalMemory</td>
<td>WWW support for collaborative design, Sources, Dynagloss, .....</td>
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<tr>
<td>Agentsheets, Visual AgenTalk, Behavior Exchange</td>
<td>substrates for DODEs, simulation, end-user programming, sharing the work</td>
</tr>
<tr>
<td>Envisionment and Discovery Laboratory (EDC)</td>
<td>integrated physical and computational environments</td>
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<tr>
<td>Swiki / Squeak</td>
<td>organizational memories created by collaborative knowledge construction</td>
</tr>
<tr>
<td><strong>PiTABoard</strong></td>
<td><strong>innovative interaction mechanisms in face-to-face-collaboration</strong></td>
</tr>
<tr>
<td><strong>CodeBroker</strong></td>
<td><strong>software reuse and information delivery</strong></td>
</tr>
<tr>
<td><strong>Clever: Cognitive Levers</strong></td>
<td><strong>rethinking distributed cognition for people with cognitive disabilities</strong></td>
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The Course

- This course will consist of lectures, guest lectures, independent research activities by students, demonstration of existing major prototype systems, experiments, and a major project by groups of students.

- Independent Research Activities by Students
  This part of the course will provide students with an opportunity to engage in self-directed learning in the context of independent research explorations (this work is more conceptual and complements the work in the course project). Students will present their research about these topics in class some ideas. A list of suggested topics will be provided by the instructor.

- Major Project (by groups of students)
  purpose: to gain an in-depth understanding of a theme relevant to the course. Projects need to be carried out through a learning-by-doing approach throughout the semester, preferably as a collaborative activity of team(s).

  Requirements for Projects include:
  - An Initial Description of your Course Project
  - Project Proposal
  - Progress Report
  - Final Report
Expectations about Involvement of Students

- active participation → presence in class
- readings and small assignments
- independent research
- projects
- create a community: (peer-to-peer learning, website)
Grading

Grades will be based on:

- **active and meaningful participation in class** — this will be measured primarily by the quality of the contributions, not by the quantity (obviously zero quantity does not indicate any quality), by interesting, unsolicited contributions of relevance to the class, and by answers to small assignments

- **independent research activities** — including written report and presentation in class

- the quality of the process and outcomes of the **semester project** (a handout about projects will be provided and discussed in an upcoming class meeting)

- a **self-assessment** of the students provided to the instructors at the end of the course.

Weight distribution

- assignments and contributions in class 25 percent
- independent research 20 percent
- semester project 40 percent
- self-assessment (which will be honored “as is”) 15 percent
Self-Application: A “New Culture” for this Course

- “symmetry of ignorance” — stakeholders are aware that while they each possess relevant knowledge, none of them has all the relevant knowledge

- teacher, learner = f{person} → teacher, learner = f{context}

- the knowledge for (re)solving complex, real-world problems does not exist a priori, but is generated through collaboration among stakeholders
Passion for Learning — Beyond Tests

"IF MOZART AND MICHELANGELO WERE STUDENTS IN TODAY'S AMERICAN SCHOOLS..."

"WOLFGANG! MIKE! STOP WASTING TIME! YOU SHOULD BE DOING PRACTICE DRILLS FOR THE STATE EXAMS!!"