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

Doctoral Level Independent Study
CSCI 7900-903

Gerhard Fischer and Hal Eden
Fall Semester 2006

Introduction, August 30, 2006
Computer Science — A “Design” Discipline?

- **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
  - 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, .......
Beyond the Unaided, Individual Human Mind

Power of the collective human mind, aided by technology

- Reading and writing
- Printing press
- Personal computer
- Internet
- Wireless and mobile technologies

Time:
- 2500 BC
- 1500
- 1980
- 1993
- 2006
The Motto of the Integrated Teaching and Learning Laboratory (ITLL)

<from Confucius, 500 BC>

I hear and I forget
I see and I remember
I do and I understand
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
Passion for Learning — Beyond Tests
More is Less

- Blaise Pascal: “I have made this letter longer than usual, because I lack the time to make it shorter.” — Provincial Letters XVI

- Antoine deSaint-Exupéry (aviator, aircraft designer, author of classic children’s books): “Perfection (in design) is achieved not when there is nothing more to add, but rather when there is nothing more to take away.”
What is the Scarce Resource:  
Information or Human Attention

“What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate efficiently among the overabundance of information sources that might consume it.” — Herbert Simon

From “Anywhere, Anytime, Anyone” → “The Right Information at the Right Time, the Right Place, in the Right Way to the Right Person”
CS Formalisms — General or Specific

- question: why is one programming language not good enough?

- **Turing Tar Pit:** “Beware of the Turing Tar Pit, in which everything is possible, but nothing of interest is easy.”

- **The Inverse of the Turing Tar Pit:** “Beware of the over-specialized systems, where operations are easy, but little of interest is possible.”

- observation: “The smartest people in the world do not generally look very intelligent when you give them a problem that is outside the domain of their vast experience.”
The Role of Mathematics in Software Design

“I am skeptical that classical mathematics is an appropriate tool for our purposes: witness the fact that most formal specifications are as large, as buggy as, and usually more difficult to understand than the programs they purport to specify.

I don't think the problem is to make programming `more like mathematics'; it's quite the other way around.” — W. Wulf
Ease of Use — The Ultimate Goal?

▪ “If ease of use was the only valid criterion, people would stick to tricycles and never try bicycles.” — Doug Engelbart

▪ ease of use (usable) → useful, engaging

▪ ease of use → low threshold, high ceiling
Course Information Environment

- a Swiki at: http://l3dswiki.cs.colorado.edu:3232/phd-intro

- all course work (lecture notes, assignments, questionnaire) will be distributed, documented, and shared via the Swiki
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.
Preview of the Course

- locating relevant information
- writing papers
- giving a presentation
- defining a area of research
- writing a dissertation
- interviewing faculty members and experienced PhD students
- creating a community
- getting a job
- guest lectures
Some Relevant Websites

- the PhD program at CU Boulder
  [http://www.cs.colorado.edu/grad/phd/](http://www.cs.colorado.edu/grad/phd/)

- why computer science:
What does a Ph.D. require?

- intrinsic motivation
- dedication
- sometimes: hard work
- getting through days in which one thinks:
  - “I will never get done with this!”
  - “why do I waste years of my life doing this!”
What is a Ph.D. all about?

- it qualifies you for the rest of your life
- it opens you doors which may provide unique opportunities for you
- it should motivate you “to work hard not because you have to – but because you want to!”