Creativity Support Tools

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Systems Research
Interdisciplinary research community
- Computer Science & Psychology
- Information Studies & Education

(www.cs.umd.edu/hcil)
Scientific Approach (beyond user friendly)

- Specify users and tasks
- Predict and measure
  - time to learn
  - speed of performance
  - rate of human errors
  - human retention over time
- Assess subjective satisfaction
  (Questionnaire for User Interface Satisfaction)
- Accommodate individual differences
- Consider social, organizational & cultural context
Design Issues

- Input devices & strategies
  - Keyboards, pointing devices, voice
  - Direct manipulation
  - Menus, forms, commands
- Output devices & formats
  - Screens, windows, color, sound
  - Text, tables, graphics
  - Instructions, messages, help
- Collaboration & communities
- Manuals, tutorials, training
An Inspirational Muse: Leonardo da Vinci (1452-1519)

Renaissance Man

- Combined science & art
- Integrated engineering & esthetics
- Balanced technology advances & human values
- Merged visionary & practical

(MIT Press, Oct 2002)
National Science Foundation Sponsored Workshop

June 13-14, 2005
Washington, DC
Workshop Organizers

Ben Shneiderman  Univ. of Maryland (Co-Chair)
Gerhard Fischer  Univ. of Colorado (Co-Chair)
Mary Czerwinski  Microsoft Research
Brad Myers  Carnegie-Mellon Univ.
Mitch Resnick  MIT Media Lab

NSF:
Peter Freeman
Michael Pazzani
Maria Zemankova
Workshop Participants

Ernesto Arias          Univ. of Colorado  
Hal Eden               Univ. of Colorado  
Ernest Edmonds         Univ. of Technology, Sydney, Australia  
Pelle Ehn               Univ. of Malmö, Sweden  
Michael Eisenberg      Univ. of Colorado  
John Gero              Univ. of Sydney  
Elisa Giaccardi        Univ. of Plymouth, UK  
Francois Guimbretiere  Univ. of Maryland  
Tom Hewett             Drexel Univ.  
Pamela Jennings        Carnegie Mellon Univ.  
Andy Ko                Carnegie Mellon Univ.  
Bill Kules             Univ. of Maryland  
John Maeda             MIT Media Lab  
Kumiyo Nakakoji        Univ. of Tokyo, Japan  
Jay Nunamaker          Univ. of Arizona  
Gary Olson             Univ. of Michigan  
Randy Pausch           Carnegie Mellon Univ.  
Ted Selker             MIT Media Lab  
Elisabeth Sylvan       MIT Media Lab  
Michael Terry          Georgia Tech  

Outcomes by quotes

• “I have been studying collaboration for 20 years, but have only thought of creativity for two hours.”

• “Absolutely the most stimulating meeting I have been to in long time.”
Outcomes by quotes

• “A magnificent effort to bring together such a diverse range of people and then have them align their research so well along a single axis.”

• “very stimulating and energizing … I had trouble falling asleep… because my head was filled with new ideas… I left with dozens of pages of notes to follow up on in my own research.”
Creativity Support Tools: Goals

- More people, more creative, more of the time
- Software and other engineers, diverse scientists, product and graphic designers, architects, educators, students, new media artists, musicians. . .

  - Revolutionary breakthroughs, paradigm shifts, H-creativity

- Evolutionary, normal science, product design, engineering, music & art. . .

- Impromptu everyday creativity
Key Sources

- Csikszentmihalyi: *Creativity* (1996)
  

- Sternberg (Editor): *Handbook of Creativity* (1999)
Key Sources


• von Hippel: *Democratizing Innovation* (2005)
International Research Efforts (Sample)

**UK**: Creative Industries Mapping Document
**UK**: National Endowment for Science, Technology & the Arts
**UK**: EPSRC Culture and Creativity Networks

**Australia**: Synapse: Collaboration between Art & Science

**Hong Kong**: Baseline Study on HK's Creative Industries

**Japan**: Status of Creative Industries in Japan and Policy Recommendations for Their Promotion

**Brazil**: FORUM on Creative Industries: Shaping an International Centre

Canada, Austria, Germany, Netherlands, Hungary, . . .
Structuralists: A plan, method, process

- Polya's four steps in *How to Solve It* (1957):
  - Understanding the problem
  - Devising a plan
  - Carrying out the plan
  - Looking back
- Couger (1996) reviews 22 "creative problem solving methodologies"
  - Preparation
  - Incubation
  - Illumination
  - Verification
Structuralists: A plan, method, process

• Atman's design steps:
  • Problem definition – identify need
  • Gather information
  • Generate ideas – brainstorm & list alternatives
  • Modeling – describe how to build
  • Feasibility Analysis
  • Evaluation – compare alternatives
  • Decision – select one solution
  • Communication – write or present to others
  • Implementation

(Atman et al., Design Thinking Research Symposium 2003)
Inspirationalists: Aha, Aha, Aha!

- Free associations
  - Brainstorming
  - Thesauri, photo collages
  - Random stimuli, inkbolts

- Breaking set
  - Getting away to different locations
  - Working on other problems
  - Meditating, sleeping, walking

- Visualization
  - 2-d networks of ideas
  - Sketching
Situationalists: context, community, collaboration

- Personal history
  - Family history, parents, siblings
  - Challenging teachers, inspirational mentors
  - Supportive peers and partners

- Consultation
  - Peers and mentors
  - Early, middle and late stages
  - Information and empathic support

- Motivations
  - Fame, legacy, admiration
  - Competition
Csikszentmihalyi’s book *Creativity* (1993)

1) **Domain**: e.g. mathematics or biology
   "consists of a set of symbols, rules and procedures"

2) **Field**: "the individuals who act as gatekeepers to the domain...decide whether a new idea, performance, or product should be included"

3) **Individual**: creativity is "when a person... has a new idea or sees a new pattern, and when this novelty is selected by the appropriate field for inclusion in the relevant domain"
Eight Activities

- Searching & browsing digital libraries
- Consulting with peers & mentors
- Visualizing data & processes
- Thinking by free associations
- Exploring solutions - What if tools
- Composing artifacts & performances
- Reviewing & replaying session histories
- Disseminating results

(Creating creativity: User interfaces for supporting innovation
*ACM TOCHI, 3/2000*)
Creativity Research Methods

- Evaluation is difficult
  - Controlled studies are inappropriate
  - Brief case studies are not adequate

→ Multi-Dimensional Indepth Longitudinal Case Studies

- Observers & Participants
- Processes & Products
- Conversation, Email, Reports, Designs
- Impact on others
Guidelines for Creativity Support Tools

1. Support exploration
2. Low threshold, high ceiling & wide walls
3. Support many paths & many styles
4. Support collaboration
5. Support open interchange
6. Make it as simple as possible – and maybe even simpler
Guidelines for Creativity Support Tools

7. Choose black boxes carefully
8. Invent things that you would want to use yourself
9. Balance user suggestions, with observation & participatory processes
10. Iterate, iterate - then iterate again
11. Design for designers
12. Evaluate your tools
What now?

- **NSF**
  - Incorporate creativity in existing programs
  - Encourage new program on: *Software Tools & Socio-Technical Environments to Enhance Creativity*

- **Colleagues**
  - Refine research methods: multi-dimensional indepth longitudinal case studies ("Clinical trials" $100M for 3 years)
  - Develop dramatically improved software tools
Creativity Challenges

- Evolve new theories: incorporating social, technical, and organizational dimensions
- Identify the role of creativity in all disciplines (science, design, engineering, art, business, education..)
- Propose radically new creativity support tools that enhance creative thinking & expression
- Design socio-technical environments to support & enhance creativity
- Formulate systematic foundations for wide-spread distribution of creativity support tools
- Develop multi-dimensional assessment approaches
Take Away Messages

- New research direction is emerging
- Dramatically improved creativity support tools are possible

- Multi-dimensional indepth longitudinal case studies
- Guidelines for design are emerging