



Creativity Support Tools

Ben Shneiderman *ben@cs.umd.edu*

Founding Director (1983-2000), Human-Computer Interaction Lab
Professor, Department of Computer Science
Member, Institutes for Advanced Computer Studies &
Systems Research



UNIVERSITY OF
MARYLAND





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



www.awl.com/DTUI

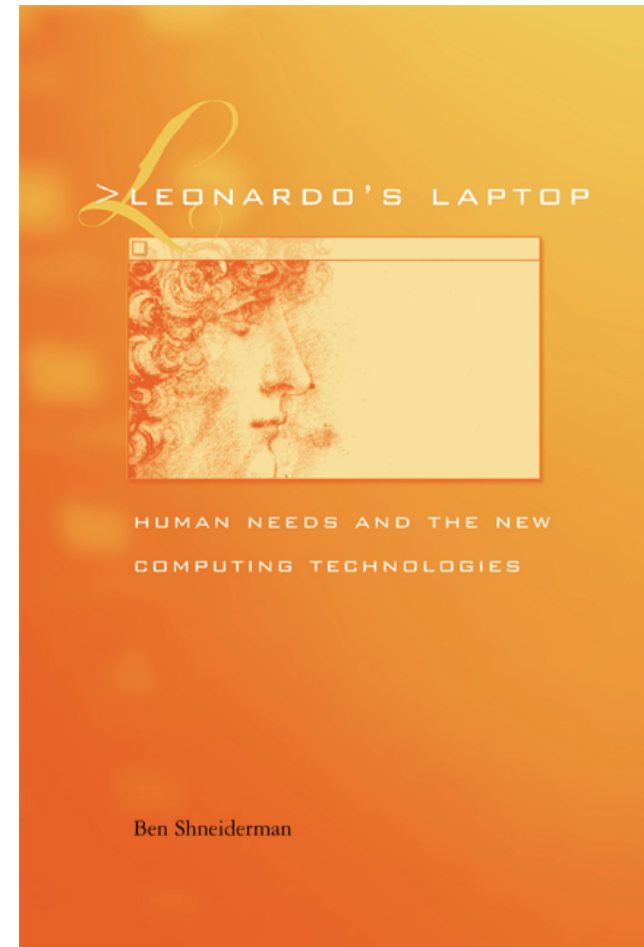
An Inspirational Muse: Leonardo da Vinci (1452-1519)



Renaissance Man

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

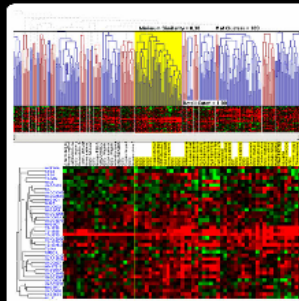
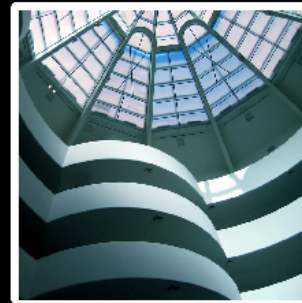
(MIT Press, Oct 2002)





National Science Foundation Sponsored Workshop

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Washington, DC




CREATIVITY SUPPORT TOOLS

*A workshop sponsored by
the National Science Foundation*

<http://www.cs.umd.edu/hcil/CST/>

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



Workshop Organizers



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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.”

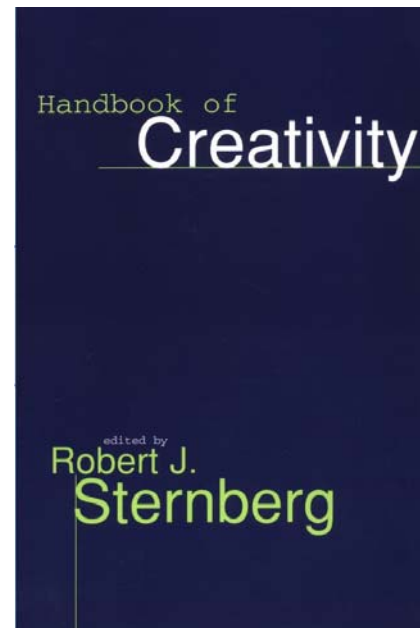
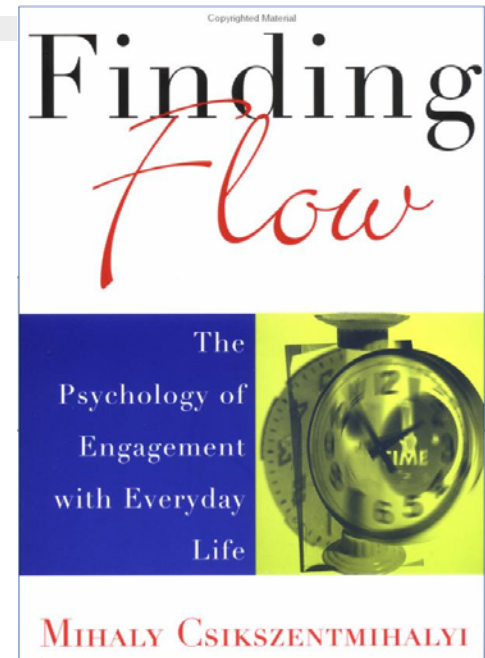
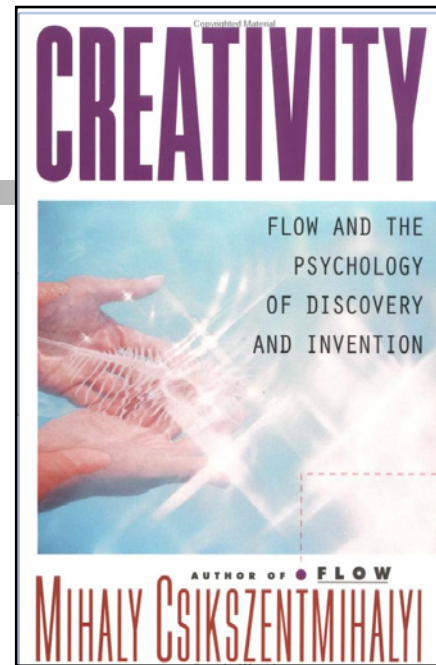
Creativity Support Tools: Goals

- **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

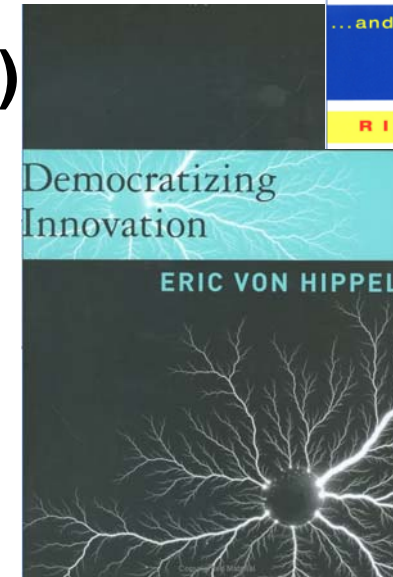
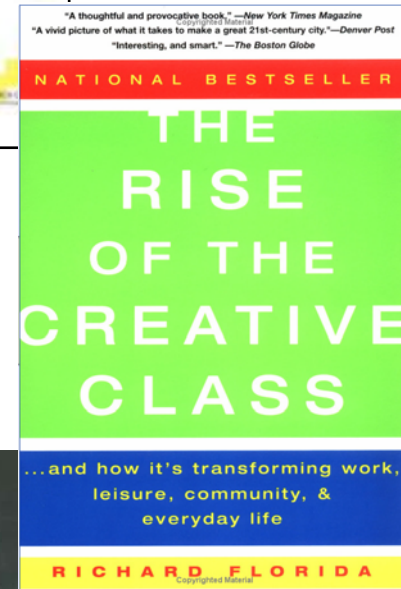
- Csikszentmihalyi:
Creativity (1996)

Finding Flow (1997)
- Sternberg (Editor):
Handbook of Creativity
(1999)



Key Sources

- National Academy of Sciences:
*Beyond Productivity:
Information Technology,
Innovation and Creativity* (2003)
- Florida:
Rise of the Creative Class (2002)
Flight of the Creative Class (2005)
- 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, inkblots
- 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

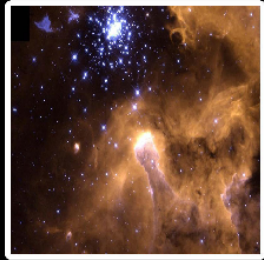
Creativity Challenges

- 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*

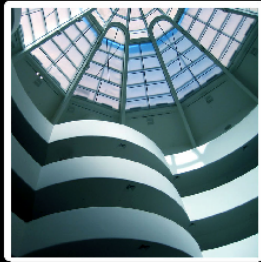
Take Away Messages



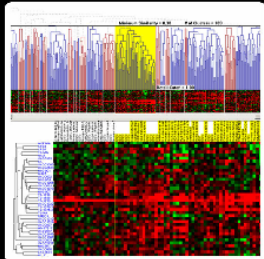
- New research direction is emerging
- Dramatically improved creativity support tools are possible
- Multi-dimensional indepth longitudinal case studies
- Guidelines for design are emerging



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