



Creativity Support Tools: A Grand Challenge for HCI

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Crisis: Innovation & Creativity Skills



The workforce of the future requires people who have:

- strong communication skills
- ability to work collaboratively
- ability to manage ambiguity
- strong problem solving skills
- ability to rapidly learn new skills

<http://innovateamerica.org/>

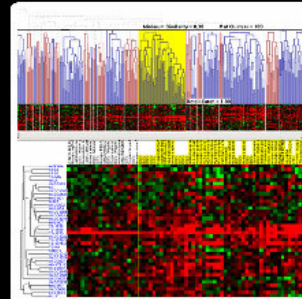
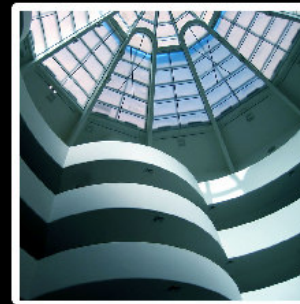
<http://www.compete.org/>





National Science Foundation Sponsored Workshop

June 13-14, 2005
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

Outcomes by quotes

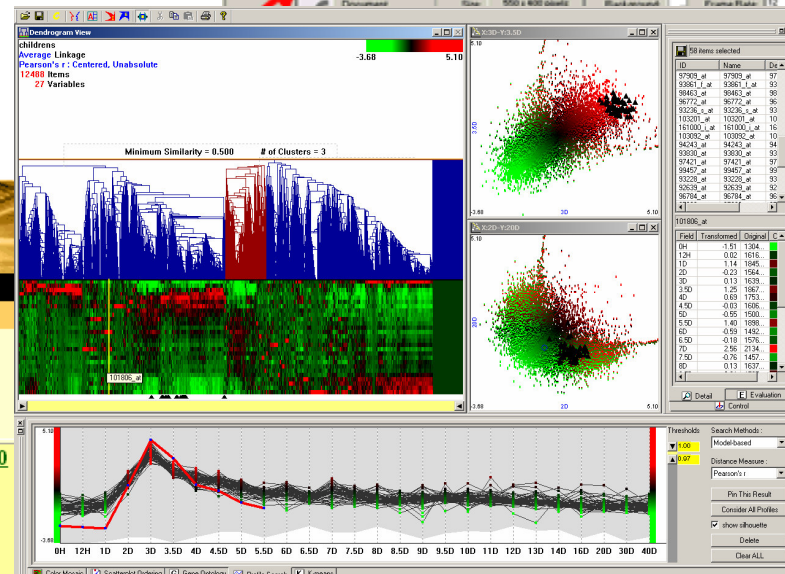
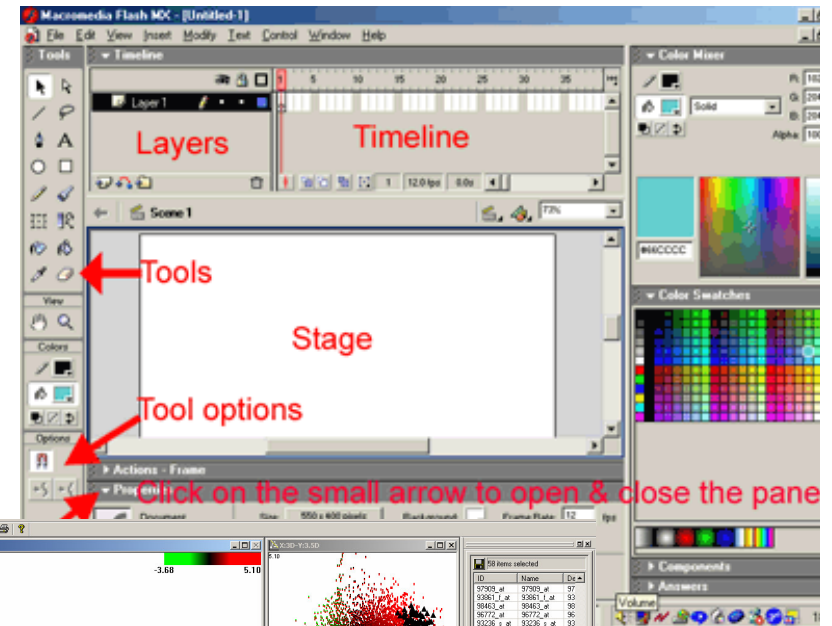


- “I have been studying collaboration for 20 years, but have only thought of creativity for 2 hours.”
- “Absolutely the most stimulating meeting I have been to in a long time.”
- “very stimulating and energizing ... I had trouble falling asleep... because my head was filled with new ideas...”

Creativity Support Tools: Goals

More people, more creative, more of the time

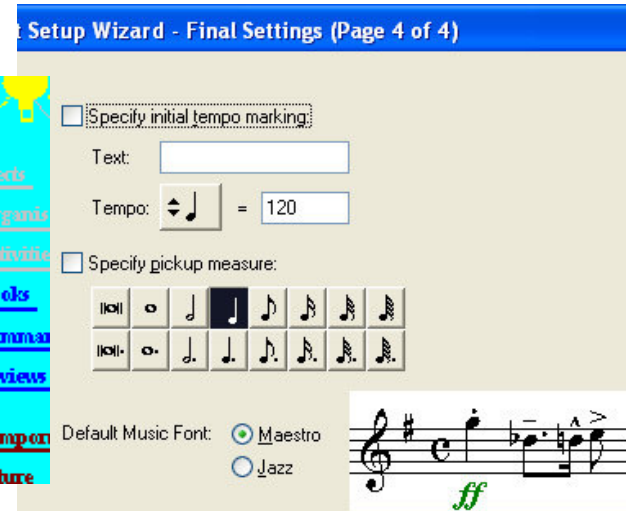
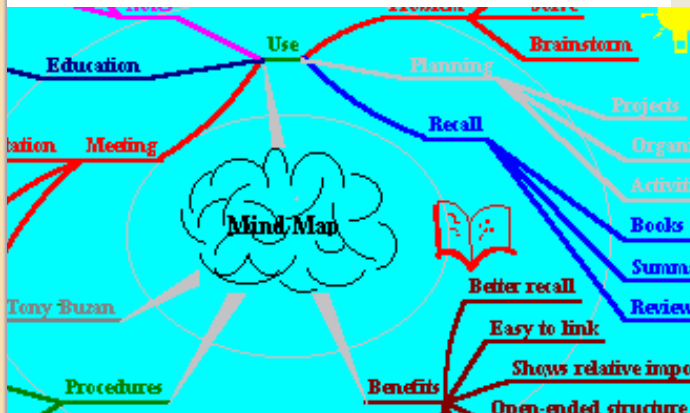
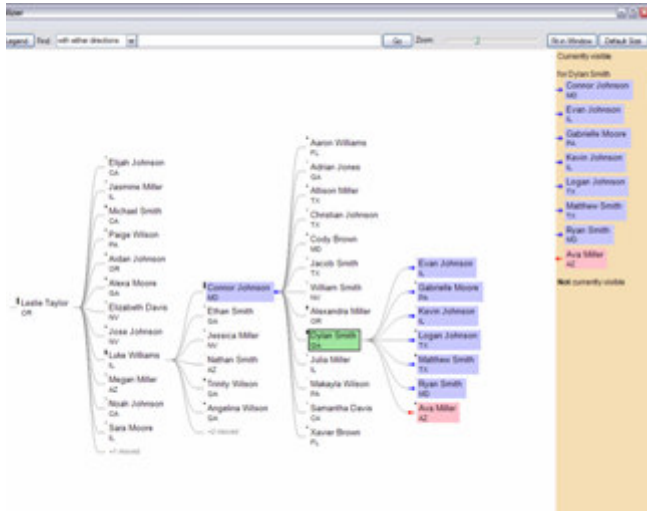
- Software & other engineers, scientists, architects, product & graphic designers, educators, students, new media artists, musicians, composers, writers, poets, screenwriters, . . .



The image shows the 'Dramatica Pro 4.0 vs. Writer's DreamKit 4.0' Feature Comparison Chart. The chart is a table comparing the features of the two software packages. The columns are 'Writer's DreamKit 4.0' and 'Dramatica Pro 4.0'. The rows list various features, including 'Theory', 'Community', 'Story Analysis', 'Support', 'Rave Reviews', 'Products', 'Archives', 'Sitemap', 'SSI Store', 'Comparison Chart', and '10 Reasons'. The chart is part of a website titled 'dramatica' by 'A Write Brothers Website'.

Creativity Support Tools: Goals

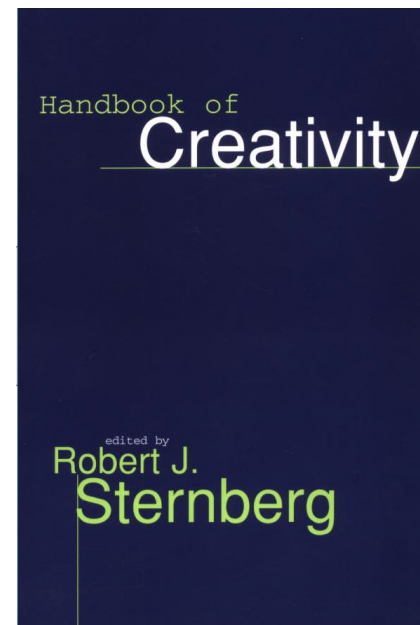
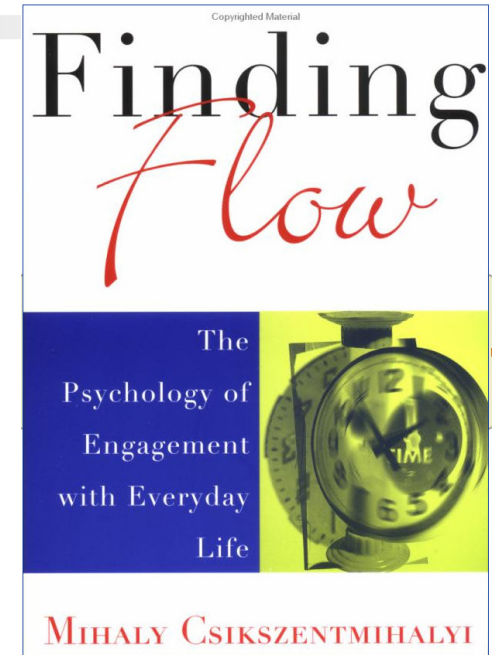
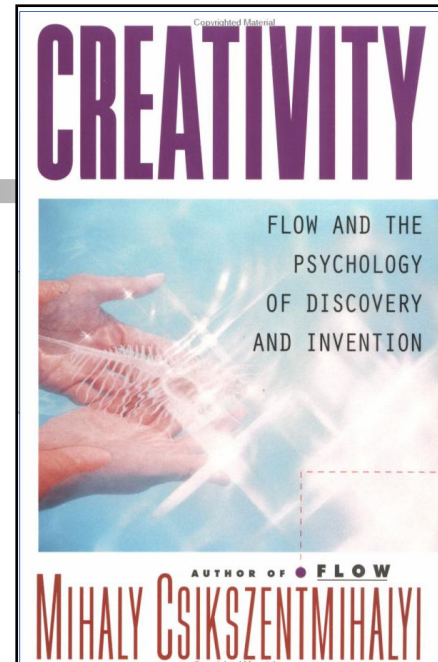
- Revolutionary breakthroughs, paradigm shifts
- Evolutionary, normal science, product design, engineering, music & art. . .
- Impromptu everyday creativity



Key Sources

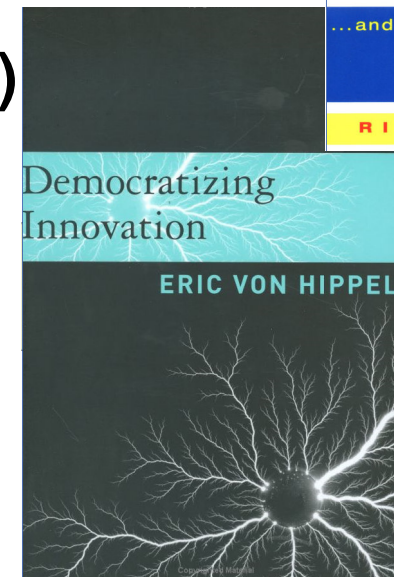
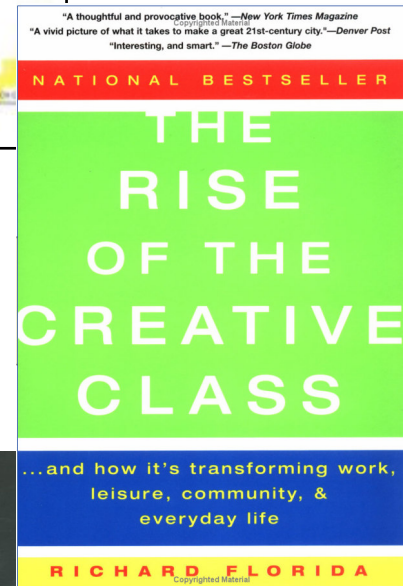
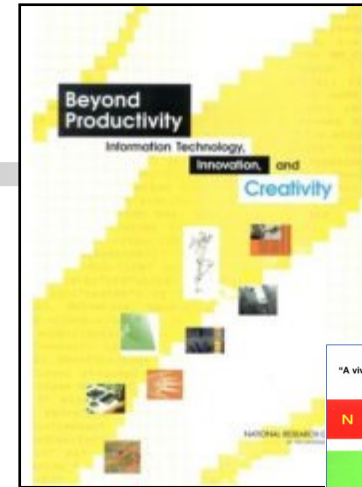
- Csikszentmihalyi:
Creativity (1996)

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, ideation
 - 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)

Evaluation Methods : Controlled Experiments



- Specify users and tasks
- 2+ treatments of independent variable
- Predict and measure dependent variables
 - time to learn
 - speed of performance
 - rate of human errors
 - human retention over time
- Assess subjective satisfaction
(Questionnaire for User Interface Satisfaction)

Evaluation Methods: Usability test



- Specify users and tasks
- 5-12 users carry out tasks
- Researchers observe and record problems
- Report to developers ranking
 - Severity of problem
 - Difficulty of revision
- Iterative process for product development

Evaluation Methods: Ethnographic



- Specify users and tasks
- Observe, interview, survey, log usage
- Plan for longitudinal study of 3-10 users
- Novices and domain experts
- Consider impact:
 - Social
 - Organizational
 - Cultural context

Evaluation Methods: Ethnographic



- Multi-Dimensional
- In-depth
- Long-term
- Case studies

Evaluation Methods: Ethnographic



- **M**ulti-Dimensional
- **I**n-depth
- **L**ong-term
- **C**ase studies

MILCs

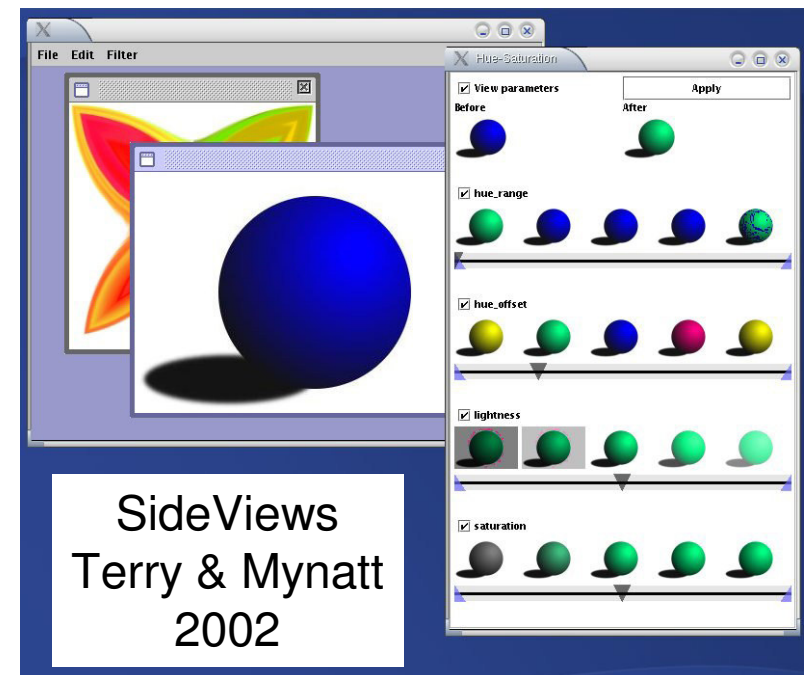
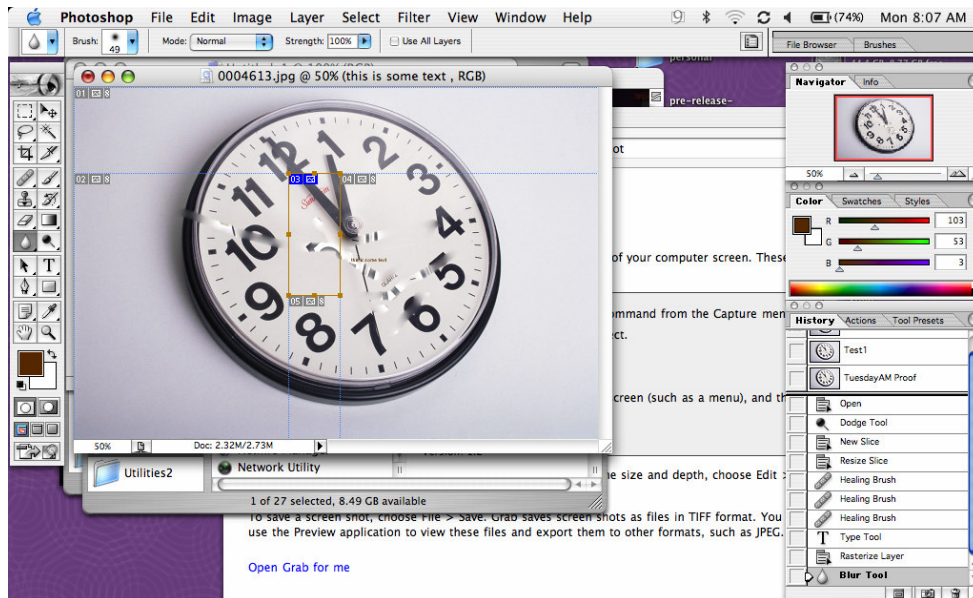
Guidelines for Creativity Support Tools

Support exploration & collaboration

Support many paths & many styles

Low threshold, high ceiling & wide walls

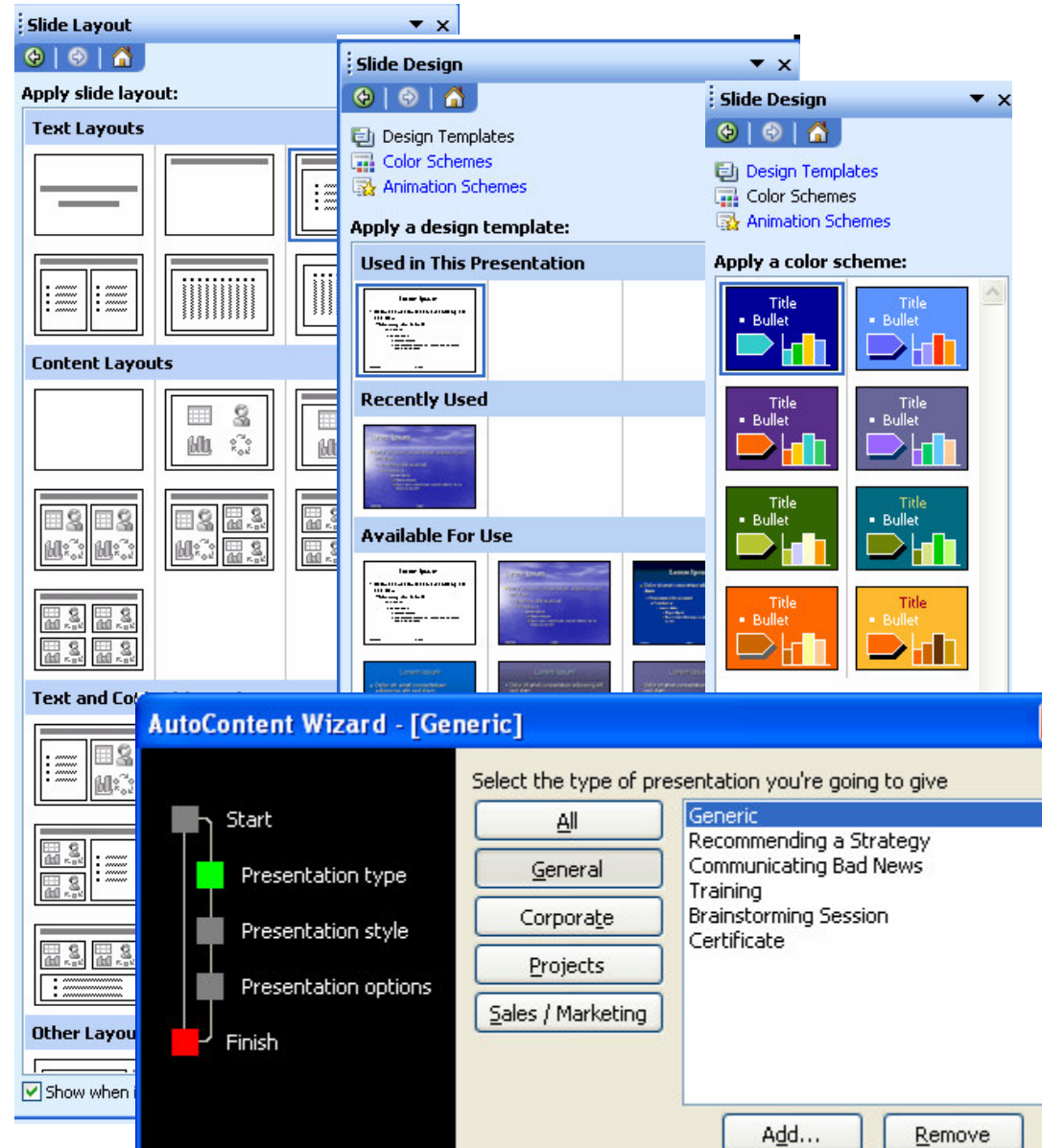
... and more



Guidelines for Creativity Support Tools

Initiate by:

- Exemplars
- Templates
- Processes



What now?

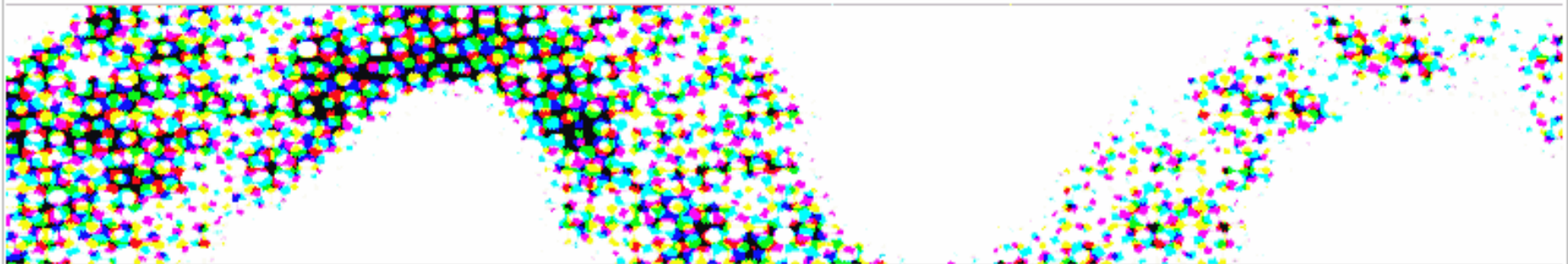
- NSF
 - Incorporate creativity in existing programs
 - Encourage new program on:
Software Tools & Socio-Technical Environments to Enhance Creativity
- Colleagues
 - Refine research methods: Multi-dimensional In-depth Long-term Case-studies (MILC)
("Clinical trials" \$100M for 3 years)
 - Develop dramatically improved software tools



6th Creativity & Cognition Conference

Seeding Creativity: Tools, Media, and Environments

June 13-15, 2007, Washington, DC USA



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Cognition Conference series began in 1993
to a lively multidisciplinary event
and practice. Rigorous research is
etic foundations are emerging and goals
efined. Successful practice manifests itself in
creativity support tools for discovery and

ware a
and gra
educator
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ools can

Important Dates

| | |
|------------------|-------------------|
| Papers Deadline: | December 15, 2006 |
| Notification: | February 19, 2007 |
| Revised papers: | March 19, 2007 |
| Conference: | June 13-15, 2007 |

<http://www.cs.umd.edu/hcil/CC2007/>

feature two elegant evening receptions at
prominent Washington, DC locations:
the National Academy of Sciences (June 13) and Corcoran Gallery of Art (June 14)

Creativity Challenges



- Evolve new theories: incorporating social, technical, and organizational dimensions
- Identify the role of creativity in *all* disciplines
- Propose radically new individual *creativity support tools*
- Design *socio-technical environments* to enhance group creativity

Take Away Messages



- New research direction is emerging
- Dramatically improved creativity support tools are possible
- Multi-dimensional in-depth long-term case-studies (MILCs)
- Guidelines for design are emerging



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