Supporting Human Creativity

Understanding Creativity and Informing HCI Design
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Objectives

- Creative process and creativity research
- Inform HCI for creativity support
- Criteria for designing support tools
CREATIVITY -> DESIGN

Knowledge from Creativity Research

+ Experience from Pragmatic Approaches
Interpretations

- **Novelty + Value**
  - Innovation, Invention, New
  - Useful, Purposeful, Significant

- **Discipline**
  - Psychological, Social, Cultural ...

- **Domain**
  - Art, Design, Education, Engineering, Finance ...
Questions

- How does creativity take place?
- What do people do?
- How are resources used?
- What helps or hinders?

- Authentic versus Artificial Situations
Perspectives

• Selected characteristics
  – Psychological, perceptual, formative

• Special outcomes
  – Artefacts, concepts, methods

• Specific patterns
  – Thinking, behaviour, practice
Definitions

“Creativity is best described as the human capacity regularly to solve problems or to fashion products in a domain, in a way that is initially novel but ultimately acceptable in a culture.” (Gardner, 1989)

“Creative products, be they poems, scientific theories, paintings or technological advances, are both novel and acknowledged to be valuable or useful in some way.” (Gilhooly, 1982)

“Creativity is a process that can be observed only at the intersection where individuals, domains and fields intersect.” (Csikszentmihalyi, 1999)
People

• Individual
  – attributes

• Society
  – resources

• Culture
  – values
Evidence

• Individual
  – Attributes: confidence, motivation, risk taking (Amabile, 1983)
  – Biological bases of creativity (Martindale, 1999)
  – Mentors, supportive relationships (Cox, 1985; Gardner, 1983)

• Society
  – Resources, role models, (Simonton, 1984)

• Culture
  – Eastern and western values (Lubart, 1999)
Product

- Recognition
  - masterpiece
- Simulation
  - model
- Critique
  - rationale
Process

• Biography
  – histories

• Experiment
  – descriptions

• Observation
  – narratives
## Biography

<table>
<thead>
<tr>
<th>Date</th>
<th>Artefacts</th>
<th>Design Process</th>
<th>Knowledge Evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>FIRST BIKES</td>
<td>ADOPT ADAPT IMPROVE</td>
<td>LEARNING CONVENTIONS</td>
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<tr>
<td>1980</td>
<td>FUNNY BIKES</td>
<td>EXPLORATION</td>
<td>BREAK RULES</td>
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<td>ANALYSIS</td>
<td>FORMULATE PROBLEM</td>
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<td>1985</td>
<td>MONOCOQUE 1</td>
<td>EMERGENCE</td>
<td>EVOLVE NEW CONCEPT</td>
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<tr>
<td>1986</td>
<td>MONOCOQUE 2</td>
<td>ANALOGY</td>
<td>MODIFY CONCEPT</td>
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<td>1988</td>
<td>INTER BIKE</td>
<td>REFINEMENT</td>
<td>ADD FEATURES</td>
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<td>1990</td>
<td>MONOCOQUE 3</td>
<td>SYNTHESIS</td>
<td>COMBINE FEATURES</td>
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<td>1992</td>
<td>OLYMPIC BIKE</td>
<td>COMPLETION</td>
<td>APPLY MEASURES</td>
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</table>
Experiment

• Geneplorie a process model of creative cognition
  (Finke, Ward and Smith, 1992)
Observation

artist

researcher

technologist
## Features of Cognitive Style

<table>
<thead>
<tr>
<th>Cognitive Style</th>
<th>Descriptor 1</th>
<th>Descriptor 2</th>
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<tbody>
<tr>
<td>Approach</td>
<td>Exploratory</td>
<td>Goal Driven</td>
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<tr>
<td>Role</td>
<td>Different</td>
<td>Same</td>
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<tr>
<td>Ethic</td>
<td>Art-led</td>
<td>Technology-led</td>
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<tr>
<td>Control</td>
<td>Important</td>
<td>Necessary</td>
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<tr>
<td>Methods</td>
<td>Traditional</td>
<td>Digital</td>
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Can Creativity be Enhanced?

- Pragmatic Approaches
  - Brainstorming (Osborn, 1953, Finke et al, 1992))
  - Creative Problem Solving
  - Productive Thinking Program
  - CoRT Program (De Bono, 1973)
  - Synectics
- Success measures inconclusive
- Results open to interpretation
- BUT Support is widespread
CREATIVITY -> DESIGN

Knowledge from Creativity Research

+ 

Experience from Pragmatic Approaches
Recommendations

- Establish Purpose and Intention
- Build Basic Skills
- Build Motivation especially Intrinsic Kind
- Encourage Acquisition of Domain Knowledge
- Stimulate and Reward Curiosity and Exploration
- Encourage Confidence and Risk Taking
- Focus on Mastery and Self Competition
- Provide Opportunities for Choice and Discovery
- Teach Techniques for Facilitating Creative Performance
- Develop Self-Management (Meta Cognitive Skills)

- (Nickerson, 1999 p408-418)
ENHANCE PERSONAL EXPERIENCE

IMPROVE OUTCOMES AND ARTEFACTS

SUPPORT PROCESS IMPROVEMENT

HCI OBJECTIVES
HCI design issues

- Affordances
- Causality
- Visible constraints
- Mapping
- Transfer effects
- Population stereotypes
- Conceptual models
- Individual differences
HCI design issues

• Affordances
• Causality
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HCI design issues

• Affordances
• Causality
• Visible constraints
• Mapping
• Transfer effects
  • Population stereotypes  COMMITTED
  • Conceptual models  CREATED
  • Individual differences  CONSIDERABLE
HCI objectives

- Enhance personal experience
- Improve outcomes and artefacts
- Support process improvement by providing tools and systems that
- Address the HCI design issues
CONSULT WITH OTHERS

LEARN FROM HISTORY

EXPLORE AND SHAPE

TOOLS & SYSTEMS
TOOLS & SYSTEMS

- Learn from history – collect
- Consult with others – relate
- Explore and shape – create
- Disseminate results – donate

Ben Shneiderman - Leonardo’s Laptop
‘GENEX’ Framework

• Collect
• Relate
• Create
• Donate
GENEX: down sides?

• Collect
  – Will knowledge limit imagination?

• Relate
  – Will mentors discourage the exotic?

• Create
  – Will standard tools limit creativity?

• Donate
  – Will intellectual property issues limit dissemination?
GENEX: tools

• Collect
  – Browsers
• Relate
  – Email, groupware
• Create
  – Visualization
• Donate
  – www
CONFIGURATION

QUALITY

DESIGN CRITERIA

STYLE
CRITERIA CATEGORIES

- Behavioural
- Compositional
- Symbolic
- Preferential
- Pragmatic
- Performance
- Contextual
CRITERIA CATEGORIES

- Behavioural: user action
- Compositional: aesthetics
- Symbolic: image
- Preferential: market trend
- Pragmatic: cost
- Performance: response time
- Contextual: organization
INTERACTION DESIGN

• Configuration
• Style
• Quality
INTERACTION DESIGN

- Configuration: system
- Style: dialogue
- Quality: user support
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CRITERIA FOR INTERACTION

- Graphical interaction methods
- Domain specific representations
- Support for exploration
Systems should allow the user to:-

- take an holistic view of the source data
- suspend judgement on any matter
- be able to make unplanned deviations
- return to old ideas and goals
- formulate, as well as solve, problems
- re-formulate the problem space
Creative Knowledge Work

ACTIVITIES

- EXPLORATION
  - examine
  - analyse
  - interpret
  - select

- GENERATION
  - formulate
  - apply
  - refine
  - transform

- EVALUATION
  - analyse
  - test
  - refine
  - reformulate

CONTRIBUTORS

- Design Brief
- Visual Images
- Statistical Regulations
- Manufacturing Constraints
- Human Expertise

- Candidate Solutions
- Client Feedback
- Organisational Changes
- Plan of action

- Test results
- Modifications
- New requirements
- Further plans

KNOWLEDGE

- Domain
- Context
- Strategic
Creativity Support Systems

Demonstrations

- Concept Map
  http://cmap.coginst.uwf.edu
- Side Views
  http://www.cc.gatech.edu/~mterry/
- Smart Money
  http://www.smartmoney.com/marketmap/
- Max/MSP
  http://www.cycling74.com/index.html
Design Criteria

Systems should allow the user to:-

1. take an holistic view of the source data
2. suspend judgement on any matter
3. be able to make unplanned deviations
4. return to old ideas and goals
5. formulate, as well as solve, problems
6. re-formulate the problem space
Recommendations

• Establish Purpose and Intention
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• Teach Techniques for Facilitating Creative Performance
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Tasks

• Judge whether the recommendations are satisfied by the systems.
  – e.g. assess user progress and satisfaction
  – or test for efficiency and effectiveness.

• To make the list of recommendations useful, can you derive criteria for judging whether they have been achieved?
  – e.g. has mastery, curiosity, discovery taken place?