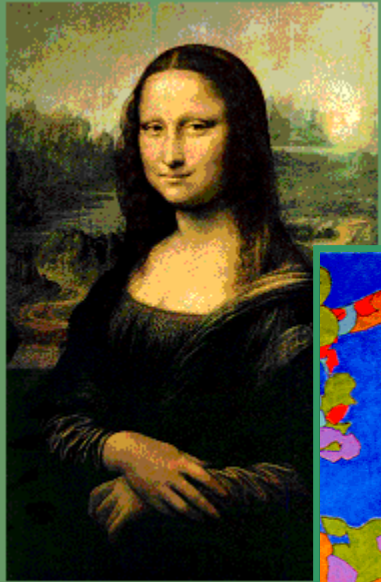# Artificial Creativity

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Overview

- Artificial Creativity – a critical approach
- Models for Creativity
- Models for Computational Creativity
- Our Model of Creativity
- Phoebe – a guitar playing creative engine.

Computers Do Not Think!

- Creativity cannot even be defined
- Computers don't have emotions or feelings
- Computers only follow code
- Creativity requires a special "magical" gift

Conceptual Space Theory

- Margaret Boden (1991)
- Creative thinkers explore "Conceptual Spaces"
- Conceptual Space is defined by a set of constraints (the dimension) guiding the generation of ideas
- Two types of creativity
    - Explorative
        - Systematically search the conceptual space
    - Transformative
        - Generalizing, specializing, dropping, negating, adding constraints

The Society of Mind

- Marvin Minsky (1985)
- The mind is a collection of mindless agents
- Not much difference between normal and "creative" thought
- Genius needs one thing more: learning unusually effective ways to learn
- Genius arises from "early accidents"

"I think the human mind is vastly complicated, but there is nothing fundamental about it that we couldn't capture in a computer program. It's a matter of complexity"

- Hofstadter
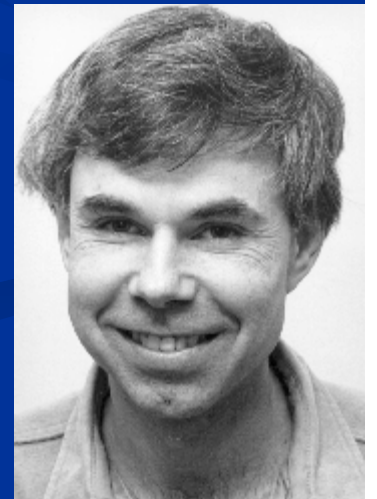
Views of Creativity

- Personal & Social views of creativity

- Boden's classification (1990): Historical & Psychological (H-Creativity & P-Creativity)

- Gero's extension: Situated creativity (S-Creativity)

Computational Models of Creativity

Grammar-Based Systems

- Capture the system by a rule base – produces "appropriate" work within a "style"

- Frank Wright's "Prairie Houses" – modeled using Shape Grammars

- Gero & Schnier: Identifying "building blocks" of style rather than hand crafting production rules

Discovery Systems

- Based on scientific & mathematical discovery models
- Lenat's Automated Mathematician (AM): fixed nature of heuristics
- EURISKO: Meta-heuristics to generate new heuristics as needed

"Finding the right problem, or asking the right questions, is more important than finding solutions"

-Einstein

Generate & Test Systems

- Most common approach to modeling creativity

- A two step approach:
  1. Generate novel products – a number of solutions
  2. Test products for "appropriateness" – some evaluation function
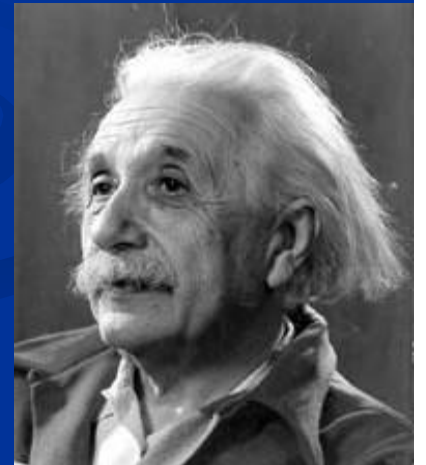
In Critique of Computational Models

- The agent is not creative, the creator is!

"Develop computational systems that have enough cultural knowledge that they can evaluate the novelty of their own work to determine whether it counts as being creative"
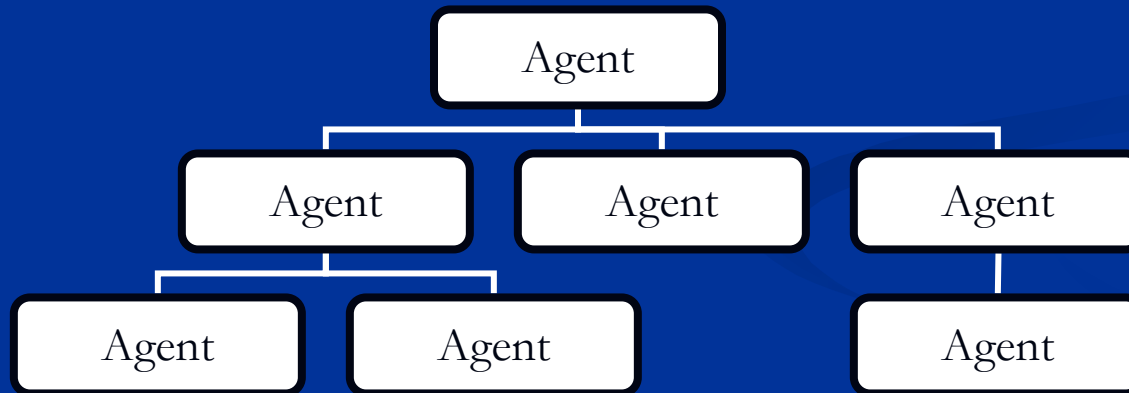
-Elton

"The hardest thing to understand is why we can understand anything at all"

- Albert Einstein

Society of Mind

- Mind as a collection of simple "mindless" components
- Agent and Agencies

- Complexity from Simplicity

Our Model

- Features
  - Agencies associated with each feature
  - Dimensions of conceptual space
- Importance of features
  - Modeled using weighted links
- Degree of dissatisfaction
  - Individual and entire system
  - Probabilistic firing

System Evolution

- Provide examples
  - Find new features
  - Adjust importance of existing features
- Maximize satisfaction of system
  - Adjust link weights
- Learn from its own output – Reinforcement

Implementation Issues

- Domain Representation

- Feature identification

- Discovering new features

"And I forget just why I taste,
    Oh yeah, I guess it makes me smile,
    I found it hard, it was hard to find,
    Oh well, whatever, nevermind"
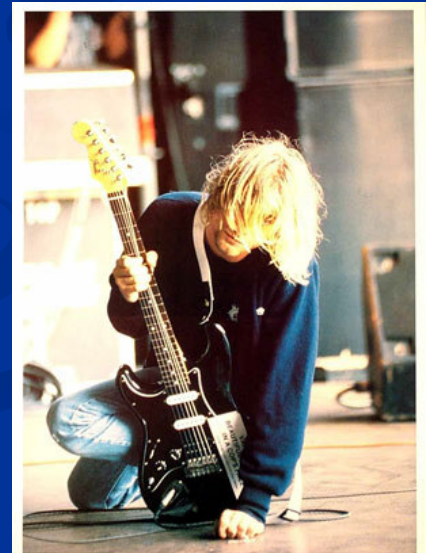
                        - Kurt Cobain

Phoebe – The Guitarist

- Application of our model to music
- Simplistic view of music
  - Feature Finders
  - Measure Takers
  - Difference Finders
  - Structure Builders

Features of Music

- Basic Features
  - Notes
  - Duration of individual notes
  - Time interval between notes
- Higher level features
  - Chords (multiple notes)
  - Chord Progressions (repeating patterns)
  - Tempo (fast or slow)
  - Song Structure (verse, chorus, bridge)

Architecture

- Song representation

    The song is represented in the form sequence of notes, along with their duration and the time intervals between them

- Knowledge Representation

    A feature is encoded in an agent and its agency

Architecture

- Discovering new features
  - Recognizing Patterns
  - Data Mining
  - Propose new features
  - Create agents

Conclusion

- Phenomena are "magical" until we understand them
- We propose a different view of creativity
- Limitations of our model
  - Role of society
  - Radical transformation of conceptual spaces through analogies from different spaces

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- Margaret Boden. Agents & Creativity. *Communications of the ACM, 1994.*