

COGSCI 300
Week 11: Creativity

Please turn off and put away all electronics.



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What is Creativity?



Instead of a definition, a concept can be clarified by 3-analysis:

Exemplars: standard examples

Typical features: prototype

Explanatory roles: what creativity explains, and what explains creativity

Blouw, Solodkin, Thagard, and Eliasmith, forthcoming, Cognitive Science.

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Creativity Features

A creative product is:

1. new (novel, original),
2. valuable (important, useful, appropriate, correct, accurate), and
3. surprising (unexpected, non-obvious).



Explanatory roles: Creativity explains individual and social success, but what explains creativity?

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Products of Creativity



1. Concepts: atom, atomic bomb, hospital, cubism

2. Hypotheses: evolution, fission, public education, atonal music

3. Things: moons of Jupiter, wheel, University of Bologna, Mona Lisa

4. Methods: experimentation, computer programming, universal health care, impressionism

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Human Creativity

1. **Combinatorial conjecture:** Creativity results from novel combinations of representations (Koestler, Boden, Dugald Stewart 1792, etc.).
2. In humans, mental representations are patterns of neural activity.
3. Neural representations are multimodal, encompassing information that can be visual, auditory, tactile, olfactory, gustatory, kinesthetic, and emotional, as well as verbal.

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Human Creativity

4. All creativity results from combinations of semantic pointers: imagery, concept combination, analogy, abduction, rule formation etc.
5. Emotions are both inputs and outputs of creativity.

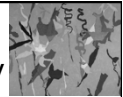
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Discussion Questions

1. What is missing in a cognitive explanation of creativity based on semantic pointers?
2. Does this explanation suggest how people might become more creative?

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Computer Creativity



1. Painting: AARON (Harold Cohen)
2. Music: David Cope
3. Heuristics: Lenat's Eurisko
4. Recipes: Chef Watson
5. Image processing and voice recognition:
e.g. Google brain and deep learning

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Increasing Computer Creativity



1. Multimodal representations
2. Recursive binding
3. Analogy: driven by semantics and pragmatics, not just syntax
4. Pragmatic evaluation by something like emotion
5. Procedural creativity: new methods

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How Chef Watson Works

Representations: Natural language databases of (1) recipes, (2) food chemistry, and (3) flavor psychophysics. Probabilities. Recipes, including ingredients, steps, chemical flavors

Procedures: (1) Generate new recipes by flavor pairing and olfactory pleasantness. (2) Evaluate new recipes probabilistically.

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Chef Watson Strengths

1. Large data base of recipes
2. Scientific information about food chemistry and flavor psychology
3. Fast processing to integrate many factors and generate many combinations

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Chef Watson Limitations

1. No sensory representations
2. No interaction with world
3. Linear evaluation of pleasantness of compounds – no synergies, emergence

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Discussion Question

Could Chef Watson replace human chefs?

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Chef Watson Versus Humans

1. Advantages of robots: breadth of information, speed of processing
2. Advantages of humans: embodied, emotional, empathic

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