Improvisation and Technical Innovation

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What is Innovation?

- Doing something different, but better.

- Out-of-the-blue "aha!" moments.

- Individual creativity.

- A new set of eyes.

- New insight gained after giving up on applying heat, and instead applying light.
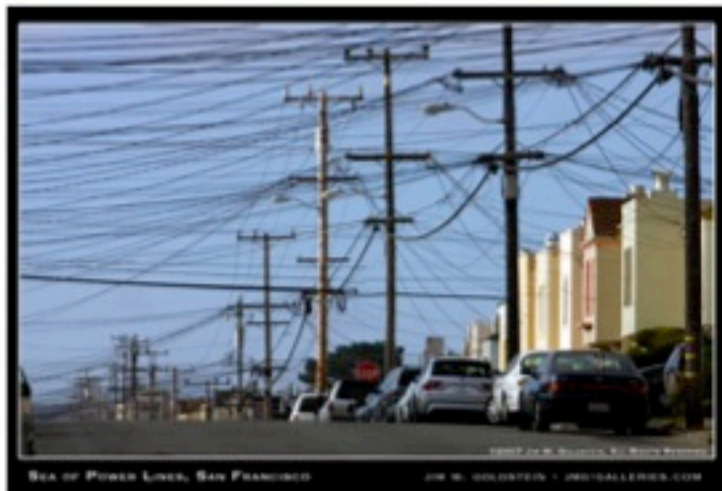
Innovation - The Buzzword

Global Innovation Index

Measures the level of innovation of a country based on business executive interviews, and government's encouragement and support of innovation through public policy.

1. South Korea
2. United States
3. Japan
4. Sweden
5. Netherlands
6. Canada
7. United Kingdom
8. Germany
9. France
10. Australia

Technical Innovation

Innovation:
A critical stage of design

- Drug Design
- Engineering Design
- Graphic Design
- UI Design

Classical
Brainstorming
Exercises

Importance of Innovation

The National Science board met in August of 2009 to recommend ways to produce

"talented math and science students that also posses the hard-to-define skill: *the ability to innovate.*"

Improvisation and Comedy

Improv Characteristics

- Listening
  (focus outside yourself)
- Yes, and....
  (agreement, acceptance)
- Spontaneity
  (ding a weak offer)
- Trust
  (everyone has valuable
    ideas to contribute)
- Having fun
  (relaxing)
- Focus on the here and now

(We'll do it live!)

Humor and Innovation

John Sweeny's
Brave New Workshop
*Innovation at the Speed of
Laughter*

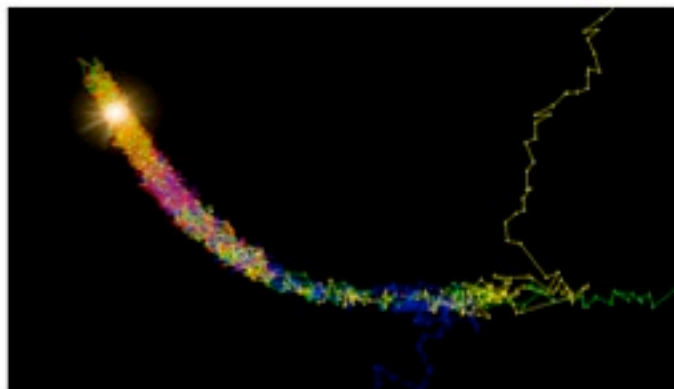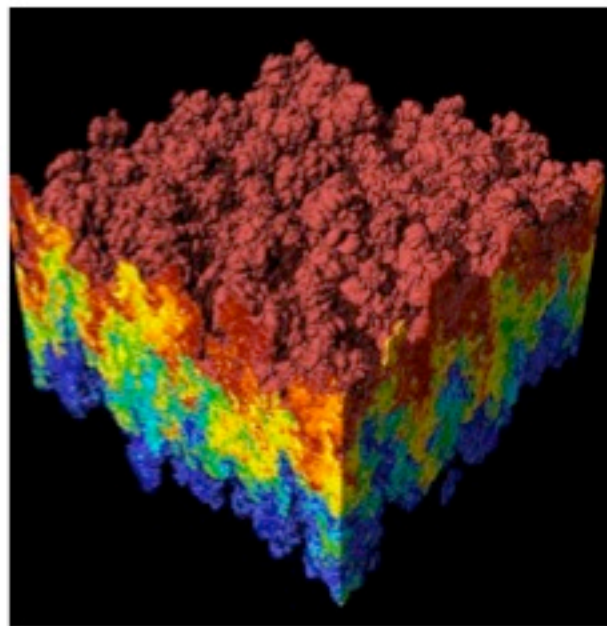**The Think Loft at Solvay Advanced
Polymers in Alpharetta, GA.**

A conceptual framework: Idea Space

Metropolis Hastings - Monte Carlo

Sampling Complex Spaces

Math Minute 1

Given x_t sampled from $P(x)$

choose a candidate x'

$$x' = F(x', x_t)$$

$$\alpha = \frac{P(x')}{P(x_t)}$$

Math Minute 2

$$\alpha = \frac{P(x')}{P(x_t)}$$

If $\alpha \geq 1$ then $x_{t+1} = x'$

If $\alpha < 1$ then

$$x_{t+1} = \begin{cases} x' & \text{with probability } \alpha \\ x^t & \text{with probability } 1 - \alpha \end{cases}$$
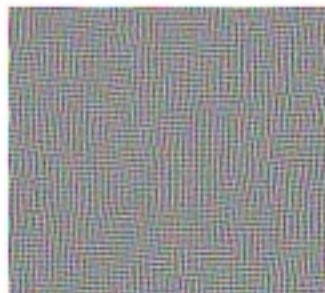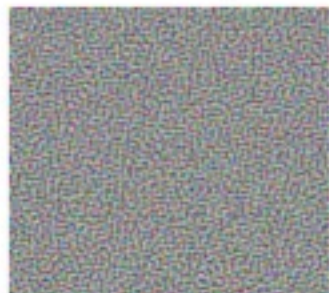
Math Minute 3

x_t values are a Markov chain

Random initial value, then run for many iterations (burn in).
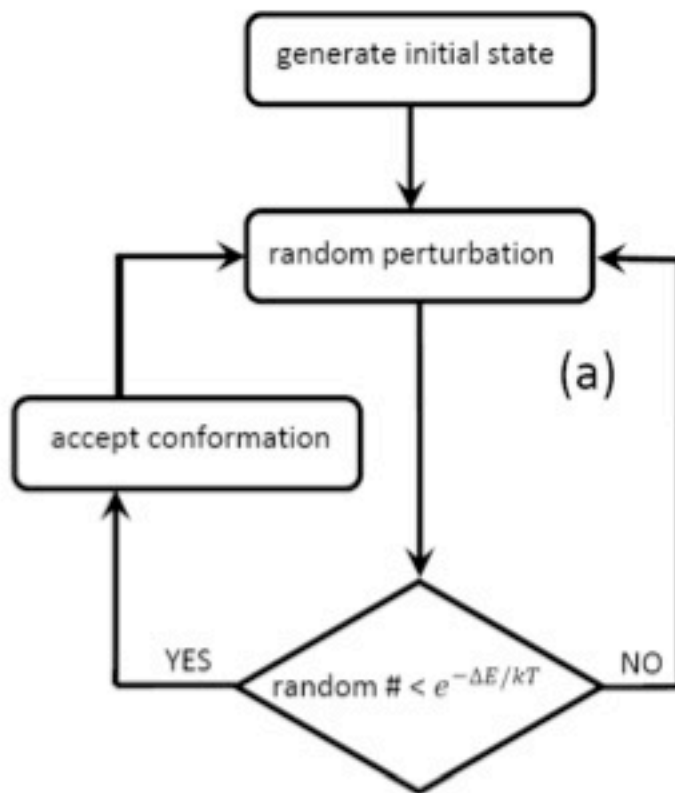
Simulated Annealing - Acceptance rate depends on Temperature function (cooling schedule)
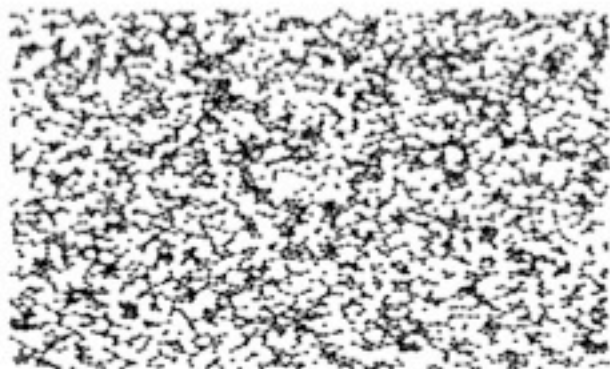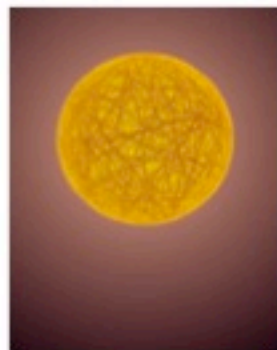
$$e^{-\Delta E/kT}$$

Example potential energy function: similar colours attract at short range and repel at slightly larger distance

Schematic of Metropolis Monte Carlo
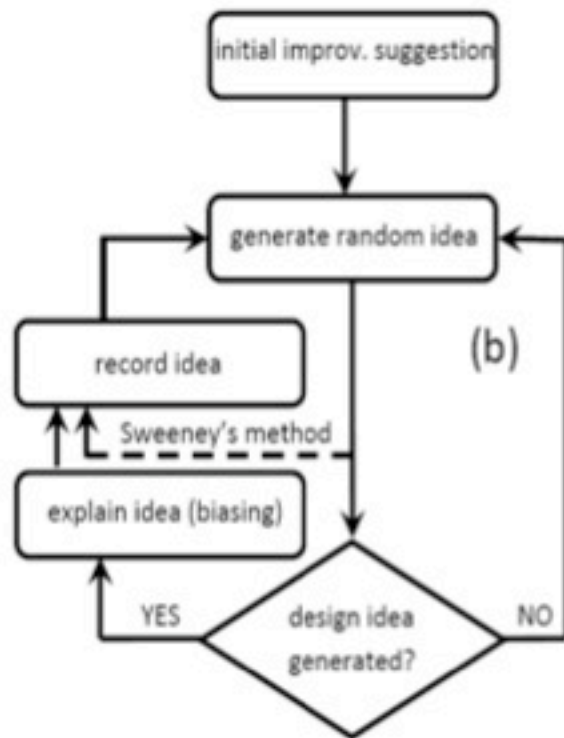
Improv is the RNG of Idea Space

Importance of Humor

Humor may be the equivalent of kinetic energy (essentially temperature) in the Monte Carlo sampling of states of a physical system. Humor provides sufficient energy to broadly sample idea space (think outside the box).

Without humor, idea space sampling only hit local ideas like so many traditional brainstorming approaches.

The equivalence of humor and innovation has been discussed by many people if very boring papers.

Sample Protocol

But can geeks do improv?

"I'll be happy to give you innovative thinking. What are the guidelines?"

Physicists at CERN's Large Hadron Collider were trained in improv comedy by Charna Halpern in an effort to improve their creativity and ability to communicate and work in teams.

Imagination is more important than knowledge.