PHIL/PSYCH 256 INTRODUCTION TO COGNITIVE SCIENCE

Week 12: Integration

Futures for Cognitive Science

- Rejection because of challenges?
- Hybrid models?
- Theoretical neuroscience?
- Multilevel explanations
  - psychological, neural, molecular, social
  - incorporation of body & world
  - many applications, including consciousness

Levels of Mechanisms

	Parts	*Relations*	*Inter-actions*	*Changes*
Mole-cular	Molecules	Chemical	Reactions	Chemi-cal
Neural	Neurons	Synapses	Excita-tion	Firing patterns
Psych'l	Represen-tations	Consti-tuents	Computa-tions	Infer-ences
Social	Persons, groups	Associa-tions	Commu-nication	Group actions

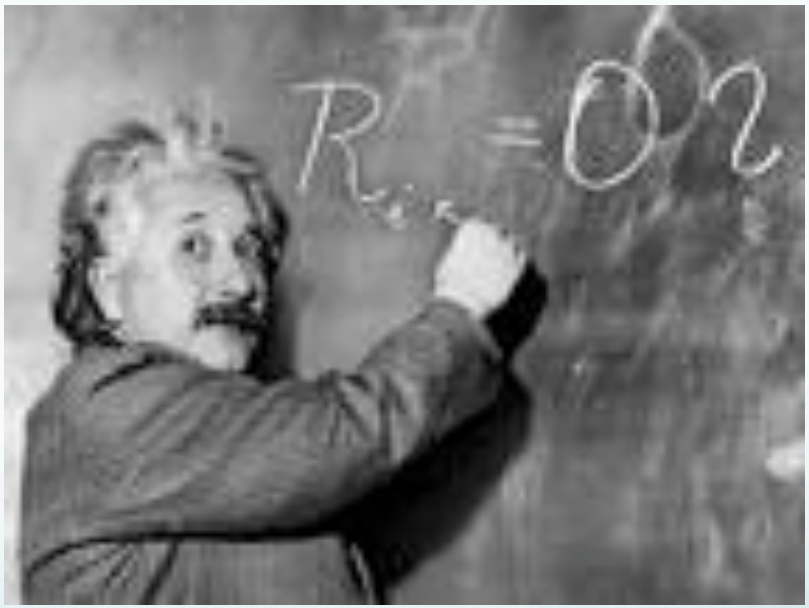
Relations between levels

- Reductionist
  - parts/whole: groups are made of persons with brains made of neurons made of molecules
  - interactions at higher level result from interactions at lower level
- Multilevelism: Pay attention to all relevant levels and their interactions.

- Non-reductionist
  - changes at higher levels can cause changes at lower levels
  - e.g. social stress affects cortisol levels

How do people create new ideas?

- Explanation = mechanism
- Mechanism = system of parts that interact to produce regular changes
- E.g. bicycle
- Innovation: science, technology, social, art.



Innovation: psychology

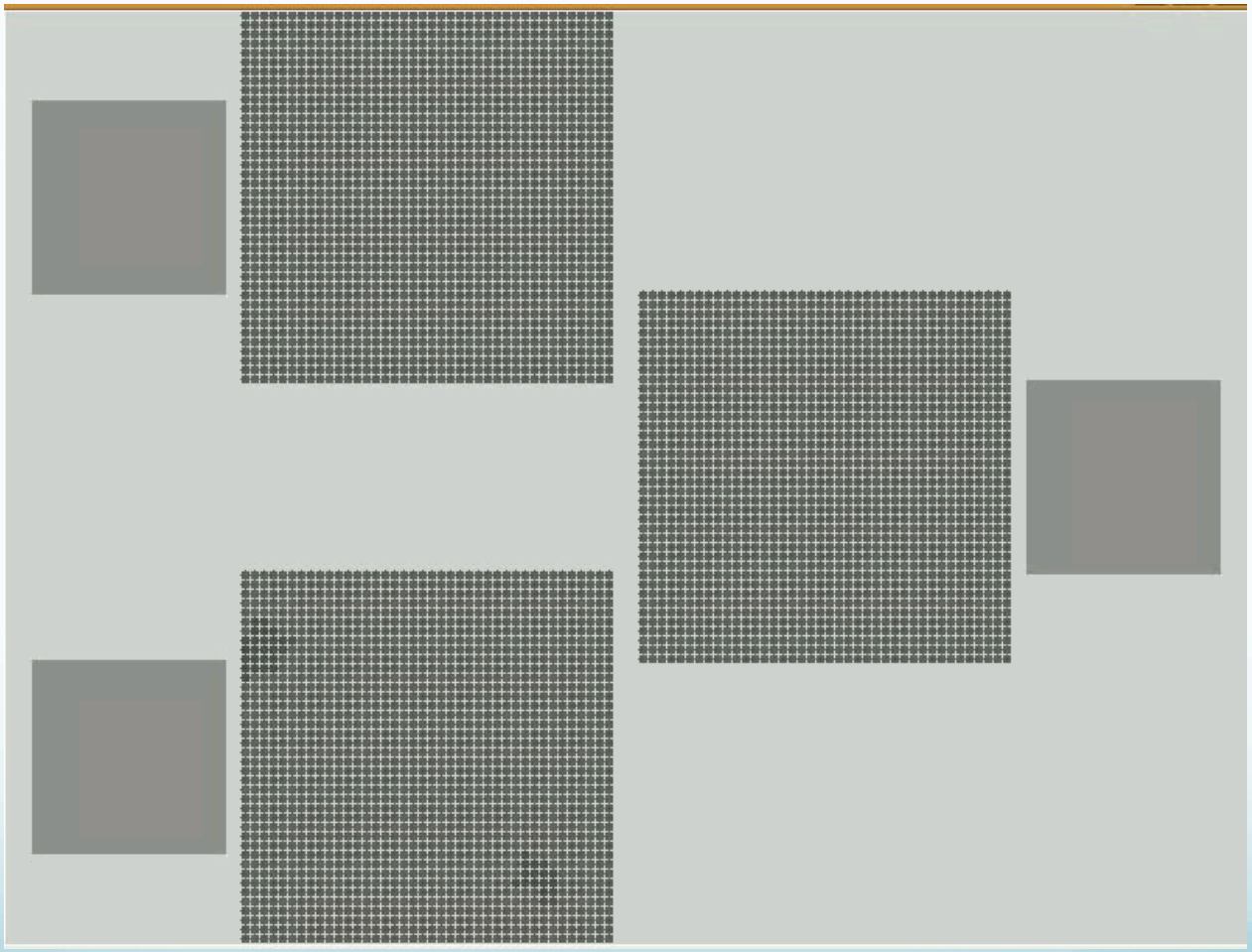
- Rules: new causal connections
- Concepts: conceptual combinations
- Images: generate novel diagrams
- Analogies: apply relevant cases

Innovation: neural

- Emotion: integration of cognition and emotion -> consciousness.
- New ideas result from emergent binding, in which superordinate neural assembly groups bind other neural groups in productive ways.

Convolution in Action

(Stewart, Eliasmith)



Innovation: molecular

- Dopamine: pleasure (Isen)
- Amphetamines: Erdos
- LSD: Crick

Innovation: social

- Social groups (labs, teams, etc.) should function to bring new ideas together.
- Research project: How do groups change as the result of individuals representation of the themselves in groups. E.g. culture.
- Conclusion: explanation of creativity should be social, psychological, molecular, AND neural.

Habits of Highly Creative People

Thagard, Hot Thought, ch. 12

- *Psychological:* Broaden to more than one field. Read widely. Use analogies. Work on different projects. Use visual and verbal representations. Use multiple methods. Seek novel mechanisms. Expect the unexpected. Get excited.
- *Social:* Find smart collaborators. Organize good teams. Communicate results. Study others. Listen to people.
- *Neural, molecular:* exercise, relax, use drugs wisely.

Discussion Questions

- What do you think are the biggest successes of cognitive science?
- What do you think are the biggest problems?
- What do you see as the most promising levels for future investigations of creativity?

Your future in cognitive science

- Major applications: decision making, education, human-machine interaction, intelligent systems.
- Strategy:
  - Identify levels of explanation most relevant to your interests.
  - Adopt relevant methods, e.g. experiments, simulations.
  - Keep track of relevant research at related levels.
  - Integrate levels: molecular, neural, psychological, social.

Cognitive Science at UW

- Cognitive Science Option
- PHIL 255: Philosophy of mind
- PHIL/PSYCH 447: Seminar in cognitive science
- SYDE 556: Simulating neurobiological systems
- Research assistants

Key points

- Cognitive science has been successful in using computation/representation to explain how people perform many important psychological phenomena.
- Explanations in cognitive science employ explanations at multiple levels.
- Challenges can be met by expanding the computational-representational approach to include brain, body, world, and social interactions.

One-minute Essay

- What is a level of explanation?

1. Please write your name clearly in the top right corner.
2. In a LARGE BLOCK letter, place the first letter of your last name at the top left.