


## Explaining Mental Illness


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## Outline

1. Mental illness
2. What is explanation?
3. What is mind?
4. What is disease?
5. Breakdowns in mental mechanisms
6. Depression



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## 3-Analysis of Mental Illness

- 1. Exemplars:** depression, anxiety, schizophrenia, bipolar disorder, autism, etc.
- 2. Typical features:** problems in thinking, emotion, social functioning, etc.
- 3. Explains** cognitive, emotional, and social dysfunctions  
Explained by ???

Concepts are Semantic Pointers: Blouw, Solodkin, Thagard, and Eliasmith, in press, *Cognitive Science*.

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## Styles of Explanation: Different Patterns

1. Explanation is telling a story that answers a question. Narrative, e.g. Freud
2. Explanation is explaining away, elimination. E.g. Szasz, Laing, Foucault
3. Explanation is deduction from scientific laws.
4. Explanation is showing how something results from a causal mechanism. ✓

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## Mechanism



Mechanism = system of interconnected parts whose interactions produce regular changes. Salmon, Bechtel, Craver, Darden

Changes may be emergent, i.e. belonging to wholes but not to parts because they result from interactions of parts. Wimsatt, Bunge

Mechanisms break: parts, interactions.

Produce=cause.

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## 3-Analysis of Causality

**1. Exemplars:** pushes, pulls, motions

**2. Typical features:**

- a) Sensory-motor-sensory patterns – infants
- b) Regularities: children
- c) Manipulations: children
- d) Statistical dependencies + causal networks  
+ connections: scientists, philosophers

**3. Explains:** why things happen, why interventions work. Explained by ???

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## Theories of Mind



1. Mind=soul (dualism, e.g. Descartes)
2. Mind=nothing (behaviorism, e.g. B. F. Skinner)
3. Mind=computer (functionalism, e.g. Turing)
4. Mind=brain (identity theory, e.g. J.J.C. Smart)

Current: Mental processes are brain mechanisms. ✓

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## Semantic Pointers (Eliasmith 2013)



Semantic pointers are patterns of neural firing that:

1. provide *shallow meaning* through symbol-like relations to the world and other representations;
2. expand to provide *deeper meaning* with relations to perceptual, motor, and emotional information;
3. support complex syntactic operations;
4. help to control the flow of information through a cognitive system to accomplish its goals.

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## Emotions are Semantic Pointers

Emotion = bind (concept or belief, cognitive appraisal, physiological perception)

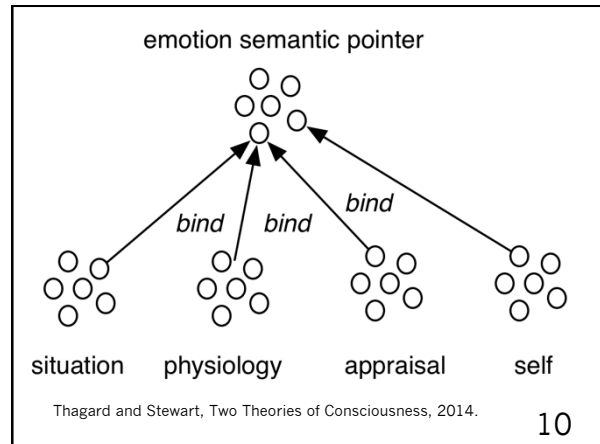
Example: being happy to be in Paris = bind (Paris, appraisal, physiology)

Emotions are brain mechanisms.

Thagard and Aubie, Emotional Consciousness, 2008.

Thagard and Schröder, Emotions as Semantic Pointers, 2014.

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## What is disease, illness, disorder?

1. Disease=set of symptoms, e.g. DSM
2. Disease= social construction: values
3. Disease=physiological malfunction-Boorse
4. Health=functional efficiency with respect to fitness (Hausman, 2012)
5. Disease=breakdown in mechanisms (Thagard, Pathways to Medical Discovery, 2003; What is a Medical Theory, 2006; Mental Illness from the Perspective of Theoretical Neuroscience, 2008)

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## 3-Analysis of Disease

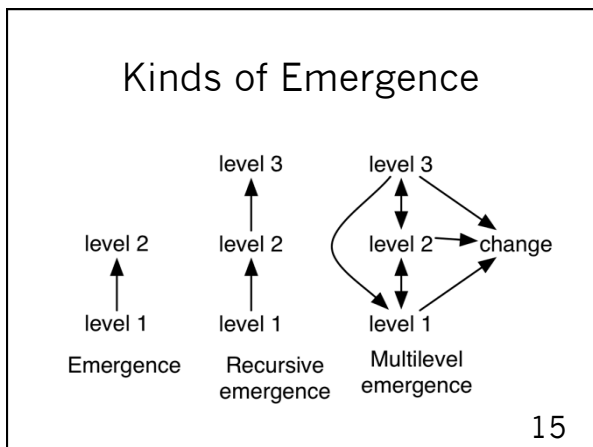
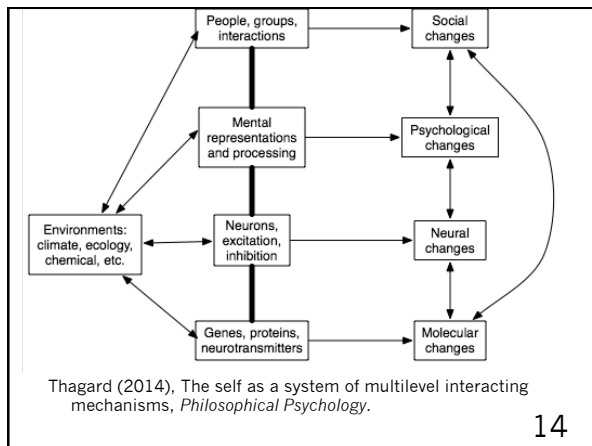
- 1. Exemplars:** influenza, cancer, scurvy, arthritis, heart failure, Alzheimer's ...
  - 2. Typical features:** symptoms, malfunctions, harms
  - 3. Explains:** why people have harmful symptoms
- Explained by:** breakdown in physiological mechanisms

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## Causes of Mental Illness

1. **Neural:** breakdowns in neurons (e.g. Huntington's) and neural interactions (e.g. Parkinson's)
2. **Molecular:** breakdown in molecular pathways, e.g. dopamine, serotonin
3. **Psychological:** breakdown in representations, inferences, and emotions, e.g. Capgras syndrome
4. **Social:** stresses such as childhood abuse, unemployment, relationship problems

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## 3-Analysis of Depression

1. **Exemplars:** Bergman, Hemingway, Kafka, Nietzsche, Plath, etc.
2. **Typical features:** sadness, reduced interest and pleasure, weight changes, sleep changes, fatigue, worthlessness, suicidal...
3. **Explains** why people are sad, suicidal, etc.

**Explained by** breakdown in multilevel mechanisms

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## Molecular Mechanisms

Neurotransmitters, hormones, epigenetics

Evidence based on effectiveness of anti-depressant medications:

- Serotonin reuptake inhibitors (Prozac, Zoloft)
- Serotonin + norepinephrine (Effexor)
- Serotonin + dopamine (Wellbutrin)
- Monoamine oxidase inhibitors

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## Neural Mechanisms

Prolonged sadness = prolonged binding of negative appraisal and physiology to all situations.

Why do antidepressants take weeks to work?  
Neurogenesis (brain-derived neurotrophic factor)

Explanation pattern: stress -> increased cortisol -> decreased neurogenesis in hippocampus -> decreased mental flexibility -> depression

Why do deep brain stimulation and electroconvulsive therapy sometimes work?

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## Psychological Mechanisms

Why does cognitive therapy help?

Cognitive therapy adjusts beliefs, goals, and emotions.

Helps with re-appraisals concerning loss, rejection, self-worth, etc.

Avoid rumination (repeated negative thoughts)

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## Social Mechanisms

Social causes of depression:

1. Childhood abuse
2. Bereavement
3. Unemployment
4. Relationship failures
5. Social rumination

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## Implications

Depression results from multilevel emergence of prolonged negative emotions because of breakdowns in neural, molecular, psychological, and social mechanisms.

Treatment: try to restore functioning of ALL mechanisms.

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## Conclusions

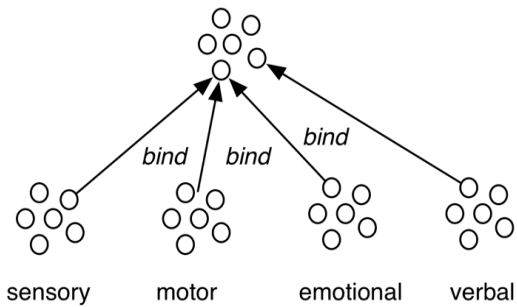
1. Biological explanations are descriptions of causal mechanisms.
2. Mental mechanisms are neural, but also molecular, psychological, and social.
3. Mental illnesses result from breakdowns in multilevel mechanisms.



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### FORMATION

semantic pointer



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## Binding in the Brain

Synchrony: neurons fire in temporal coordination

Syntax: e.g. Shastri, Hummel

Consciousness: e.g. Crick, Engel, Scherer

Convolution: activity of neural populations becomes "twisted together": convolve.

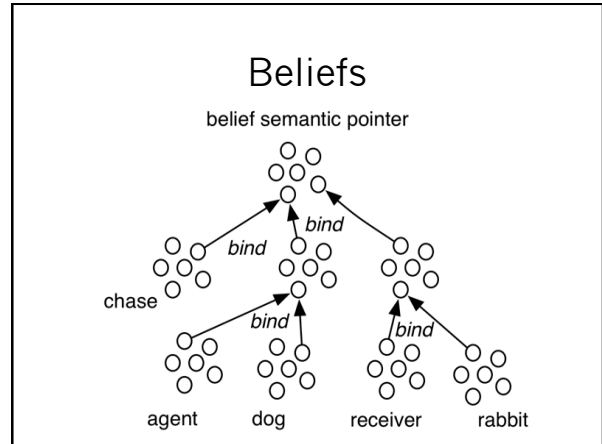
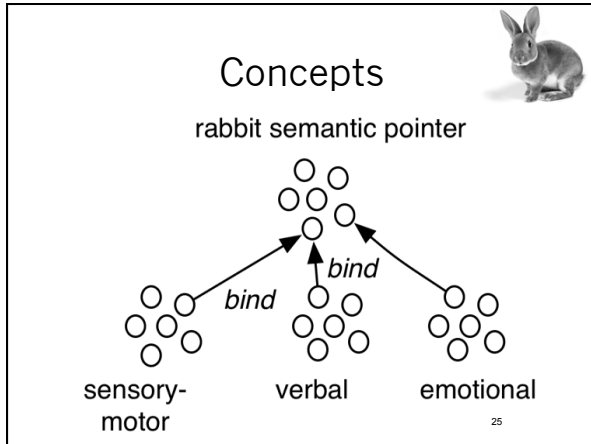
Representations are braided together.



Eliasmith has shown how neural populations can perform convolution.



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### Three Mechanisms

Parts	Interactions	Emergent result
Neurons	Excitation, inhibition, synaptic connections	Representation by firing patterns
Neural groups	Recursive binding	Semantic pointers
Semantic pointers	Interactive competition	Conscious experience

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### Emergence

Emergent properties are possessed by the whole, not by the parts, and are not simple aggregates of the properties of the parts because they result from interactions of parts.

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