What is Knowledge?

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Outline

1. Questions about knowledge
2. 3-analysis of knowledge
3. Structure of knowledge
4. Knowledge and mind
5. How knowledge grows

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Knowledge Questions

1. What is the mental structure of knowledge?

2. How does knowledge grow?

3. Avoid: what is the definition of "know"?

4. Avoid: do we know anything?

Method: consider alternative answers and choose according to coherence with all knowledge.

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3-analysis of KNOW

Exemplars: perception, testimony, everyday inference, scientific inference

Typical features:
  True, or at least approximately accurate
  Justified, by perception and inference
  Belief, or some other kind of representation
  Reliably caused

Explains: How we operate in the world, social interaction, technological success

Explained by: Mental operations

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The Structure of Knowledge

Analytic philosophy: knowledge is a relation between a person and a proposition (propositional attitude).

Declarative knowledge that, e.g. Paul knows that Bratislava is the capital of Slovakia.

Problems: what is a person, and what is a proposition?

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The Structure of Knowledge

Declarative knowledge that neglects:

1. Procedural knowledge how, e.g. Paul knows how to type.

2. Multimodal knowledge of, e.g. Paul knows wine. (knowledge by acquaintance)

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Knowledge and Mind

If mind=brain and semantic pointers are the fundamental neural representations, then ask:

1. What are knowledge that, how, and of?

2. How are pieces of knowledge formed?

3. How does knowledge grow?

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Knowledge That

1. Beliefs are semantic pointers resulting from concepts (lecture 2).

2. Knowing that is having a neural belief, either active (pattern of firing) or stored (set of synaptic connections that generates a pattern of firing).
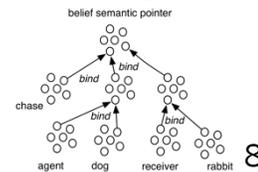
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Knowledge Of

1. Perceptions and emotions are patterns of neural firing resulting from sensory inputs and binding operations.

2. Knowing wine is having perceptual experiences and concepts based on them, developing in humans into verbal concepts.

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Knowledge How

1. Methods are rules, IF pattern 1 THEN pattern 2.

2. The patterns can be multimodal, e.g. sensory, motor, kinesthetic, emotional. Patterns are semantic pointers.

3. Hence knowledge how does **not** reduce to knowledge that!

4. Knowledge how is crucial for sports, surgery, science, relationships, etc.

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How Does Knowledge Grow?

1. It doesn't: skepticism.

2. Foundationalism: knowledge builds from a foundation in:
   a) Sensory experience: empiricism
   b) Pure reason: rationalism

3. Coherentism: knowledge builds by adding and subtracting pieces that fit together coherently.

4. Bayesianism: knowledge uses probabilities to make inferences.

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Foundationalism Fails 1

Empiricism fails because:

1. All perception requires inference beyond sensation.

2. Sensory experience alone cannot generate scientific knowledge of entities like atoms, viruses, genes, etc.

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Foundationalism Fails 2

Rationalism fails because:

1. There are no a priori truths, completely independent of experience.

2. Other knowledge cannot be derived from a priori truths.

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Coherence Metaphors

1. Bonjour: Hanging together

2. Peirce: Cable, not chain

3. Neurath: Ship

4. Quine: Web of belief, bootstraps

5. Haack: Crossword puzzle
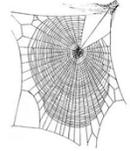
These are all vague and remote from psychological mechanisms.

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Coherence is Constraint Satisfaction

1. Elements: propositions, actions, concepts, etc.

2. Positive and negative constraints

3. Maximizing coherence (hanging or fitting together) is a matter of maximizing constraint satisfaction.

4. Algorithms: neural network, semantic pointer, greedy, etc.

Thagard 2000, *Coherence in Thought and Action*

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Explanatory Coherence

1. Performs inference to the best explanation in a holistic but efficient way.

2. Elements are hypotheses and evidence.

3. When hypotheses explain evidence, they cohere (positive constraint).

4. Competing hypotheses are incoherent (negative constraint).

5. Maximizing coherence produces the best explanation of the evidence.

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Explanatory Coherence Examples

1. Scientific theories, e.g. Darwin, Lavoisier, Copernicus, dinosaur extinction ...

2. Legal decisions concerning criminal guilt

3. Philosophical questions e.g. God, other minds

hypothesis 1 – – – – – –hypothesis 2

evidence 1   evidence 2
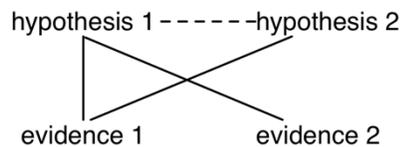
Why Accept This Account of Coherence?

1. It has been worked out in mathematical and computational detail: Thagard Verbeurgt 1998.

2. The computational model has been used to simulate many important historical, everyday, and philosophical cases.

3. It explains the growth of everyday and scientific knowledge.

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How Knowledge Grows, Coherently

1. Observations (sensory, experimental) have some priority without being foundations.

2. Hypotheses that explain observations can become accepted because they are part of the overall most coherent account.

3. Adding new evidence and hypotheses may require rejection of previously accepted evidence and hypotheses in order to maximize coherence, e.g. in scientific revolutions.

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Connect to Semantic Pointers

1. Elements are semantic pointers:
   a) Evidence can be perceptions or beliefs
   b) Hypotheses are beliefs or diagrams
   c) Concepts
   d) Actions and goals

2. Coherence relations are complexes of synaptic connections between the sets of neurons in different semantic pointers.

3. Coherence gets maximized by neural functions. Thagard and Aubie 2008.

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Knowledge Synthesis

Semantic pointer architecture therefore explains why:

1. There are different kinds of knowledge – that, how, of.

2. Knowledge grows by coherence algorithms that allow multimodal representations and revolutions.

3. Knowing is having a set of coherent neural representations that approximately correspond to the world.

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Problems

1. Does coherence guarantee truth? No, but we have evidence it moves in that direction.

2. Multiple coherences? No, because of perceptual priority.

3. Circular? Not viciously.

4. Apply to philosophy?   Other kinds of coherence: deductive, analogical, conceptual, deliberative, emotional.

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Conclusions

1. Knowledge consists of semantic pointers.
2. Justification is based on reliable processes, e.g. explanatory coherence.
3. Truth can be achieved – lecture 5.
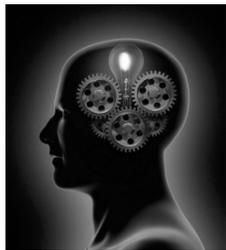
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Coherence > Bayesian

1. Does not require dubious interpretation of probability (subjective or frequency)

2. Does not require vast number of unknown probabilities

3. Computationally tractable

4. Allows loops in causal networks

Bayes theorem: P (hypothesis | evidence) =

P (hypothesis) X P (evidence | hypothesis) /

P (evidence)

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