2. EXPLANATION BY ELIMINATION AND BY DEDUCTION

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2a. EXPLANATION BY ELIMINATION

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Outline

1. Elimination
2. Science examples
3. Psychology
4. 3-analysis of eliminative explanation
5. When to eliminate?

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Eliminative Explanation

1. Why are people immortal?
2. Plausible answer: they are not.
3. Therefore, eliminate the concept of immortality from scientific explanation.
4. Explain = explain away

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Scientific Eliminations

1. Physics: Aristotelian aether, luminiferous aether, Descartes' vortex

2. Astrology: stars influence events

3. Alchemy: transmutation of metals

4. Chemistry: phlogiston, caloric

5. Biology: divine creation, vital force

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Medical Eliminations

1. Medicine: humours (blood, phlegm, black bile, yellow bile) as causes of diseases

2. Medicine (Chinese): qi, yin & yang

3. Psychiatry: demonic possession

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Social Science Eliminations

1. Race: needed for sociology, medicine?

2. Group beliefs, attitudes; collective unconscious?

3. Intelligence?

4. Class?

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Why Eliminate?

1. Initially, the best explanation of facts is theory T1, using concept C. Aristotle's aether holding the stars.

2. T2 is developed that provides a better explanation than T1, using other concepts. Copernicus + theory of stars as spheres of gas.

3. So we should accept T2, and abandon C.

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Psychology - Behaviorism

Agenda 1920s-1950s: eliminate all mental concepts, including representation, inference, consciousness.

Key people: Watson, Clark Hull, B. F. Skinner.

Philosophical grounds: positivist view that science deals only with observations.

Scientific grounds: all behavior can be explained by environmental learning.

So all mental concepts can be eliminated. 9

Behaviorism Failed

1. Even animal behaviors require mental representations, e.g. mental maps (Tolman).

2. Language learning and comprehension requires complex grammars (Chomsky).

3. Human problem solving requires rules, images, analogies (Simon, Kosslyn, Holyoak, etc.).

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Current Eliminativists

1. Many people vs. soul, immortality ✔

2. Churchlands vs. propositional attitudes ✔

3. Harris & Wegner vs. free will ✔

4. Dennett & Metzinger vs. the self ✗

5. Dennett & Rey vs. qualia (qualitative conscious experiences) ✗

6. Chemero and radical embodied cognitive science versus mental representation ✗

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Discussion

1. Which of these mental eliminations do you find most plausible or implausible?

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3·analysis of eliminative explanation

1. Exemplars: astrology, alchemy, aether, phlogiston, vital force, creation

2. Typical features: concept embedded in a theory that is replaced by a superior one; rejection of old theory and concept

3. Explains: why concepts are abandoned. Explained by: theoretical progress.

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Observations

1. Reduction is not elimination: if consciousness is a brain process, then it exists. Identities are not eliminations. (Thagard 2014, "Explanatory Identities")

2. Elimination requires an alternative explanatory theory. Analysis or explication is not enough to eliminate.

3. Elimination presupposes successful non-eliminating explanations, e.g. narrative, mechanistic, deductive.

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Application to Consciousness

1. Behaviorist elimination failed.

2. Radical embodied elimination fails.

3. Dennett's Cartesian theatre elimination is ok, but there are more complex explanations of consciousness.

Therefore, consciousness is not eliminated.

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2a. Conclusions

1. Explanation by elimination marks scientific progress.
2. Elimination in psychology is controversial.
3. Elimination presupposes other styles of explanation.

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2b. Deductive Explanation

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Outline

1. Covering-law model
2. Examples
3. Strengths
4. Weaknesses
5. Psychological applications

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Deductive Explanation

Explanation is providing a deduction from general laws.

Example: Why does Daniel have a liver?

Deduction: Because Daniel is human, and all humans have livers.

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Covering-Law Model (Hempel)

Law 1, law 2 ...

Condition 1, condition 2

·······································DEDUCE

Explanandum (what is explained)

Laws and conditions must be true

Deductive-nomological

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D-N Explanation

Explanations provide predictions.

Explanations may be causal, but do not have to be.

Statistical explanation is an approximation to deductive explanation.

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Deductive Explanation in Natural Science

1. Physics: use Newton's laws (e.g. f=ma) to predict motion of projectiles. Quantum theory is great for mathematical predictions, e.g. entanglement.

2. Chemistry: use equations e.g. $CH_4 + O_2 \rightarrow CO_2 + H_2O$

3. Biology: use Hardy-Weinberg law in population genetics

4. Medicine: use statistical laws about infection, e.g. by viruses

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Deductive Explanation in Social Science

1. Economics: develop mathematical models to predict effects of economic policies

2. Politics: use game theory to predict voting behavior

3. Psychology: use Bayesian models to explain inference

4. Psychology: explain brain operations as dynamic systems

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Bayesian Explanation

Bayes theorem: P (hypothesis | evidence) =

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

P (evidence)

Assume people have representations of probability and use Bayes theorem to update probability of hypotheses based on evidence.

Problems: Are these representations and inferences psychologically and neurologically plausible? Computational tractability? Causality?

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3-Analysis of Deductive Explanation

1. Exemplars: physics, chemistry, economics

2. Typical features:
   1. Puzzling facts to be explained
   2. Explanatory pattern: deduction from laws in mathematical form
   3. Resulting understanding – satisfaction

3. Deductive explanation explains: desire for mathematical patterns

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Discussion

What examples of deductive explanation can you think of? How available are they for questions you want to answer?

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Strengths of Deductive Explanation

1. Logically and mathematically rigorous

2. Tight connection between explainers and explained: deduction

3. Makes inference to the best explanation clear: which theory enables deduction of most facts

4. Connects explanation with prediction

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Weaknesses of Deductive Explanation

1. Deduction is not sufficient for explanation, e.g. flagpole and birth control pills examples.

2. Deduction is not tight enough for causal relevance.

3. General laws are rarely available in some fields, e.g. biology, medicine, history.

4. Statistical probabilities also have relevance problems: correlation is not causality.

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Improving Deductive Explanation

1. Restrict to domains like physics where mathematical laws are available.

2. Incorporate causal relations, e.g. via mechanisms.

3. Integrate laws and deductions into narrative explanations, e.g. of evolution.

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Application to Consciousness

1. Tononi: consciousness is a mathematical quantity: information integration.

2. Being conscious is having some of this quantity.

3. Problems: mathematical, computational; cell phones are conscious.

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2b. Conclusions

1. Deductive explanations are important in physics and other mathematical sciences.

2. But biology etc. require other styles of explanation.

3. Problems remain about relevance and causality.

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