



SCIENTIFIC PROGRESS AND PRADIGMS

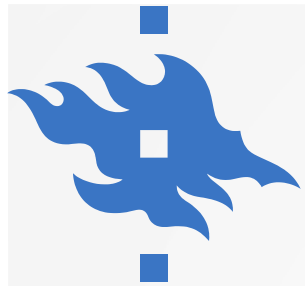
Tuomas Vesterinen





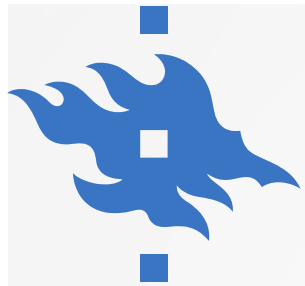
MY PART OF THE COURSE

- Scientific progress and paradigms
- Classification and kinds of things
- Explanation and understanding



MY RESEARCH: PHILOSOPHY OF PSYCHIATRY

- Philosophy can help to critically examine our assumptions about psychiatric disorders
- What kinds of things are mental disorders?
 - How to classify them?
 - Relationship between the brain and mind?
 - Cross-cultural variation?
 - Values in research and classification?
- What is the right kind of explanation: psychoanalysis, phenomenology, cognitive science, molecular neuroscience?
 - How are the explanations and their phenomena related: reduction, pluralism?
- Ethical questions



OVERVIEW

- Traditional view of scientific progress & logical positivism/empiricism
- Karl Popper
- Thomas Kuhn's paradigms
- Criticism and legacy



IS SCIENTIFIC PROGRESS SPECIAL?

- *Enlightenment*: Humans were thought as rational and knowledge as power
- Knowledge should be used for the benefit of human kind: belief in progress
- Unlike in religion, ethics, art, there seems to be objective criteria for scientific progress
- Naïve view: the discovery of *the complete true story of the world*
- Cumulative and linear knowledge gathering of the world through “scientific method”
- But since the 1950’s and 1960’s this belief has been challenged



Frontispiece of Diderot's *Encyclopédie*. Reason and philosophy revealing truth. Drawn by Charles-Nicolas Cochin, 1764



YOUR TAKE ON SCIENTIFIC PROGRESS?

- What is progress in science?
- Is it the same in all the sciences, e.g. natural and social sciences?
- Progress in your field? E.g. technology, arts?



LOGICAL POSITIVISM/EMPIRICISM

- Scientific explanation is credible because of observation, experiment and test
- New logic to clarify natural language
- Theoretical terms are meaningful only in relation to observational language
- *Verifiability theory of meaning*: knowing the meaning of the sentence is knowing how to verify it (*excludes traditional philosophy, ethics, theology?*)
- Progress cumulative through reduction

Ayer (1979) when asked what was wrong with logical positivism: "nearly all of its was false".



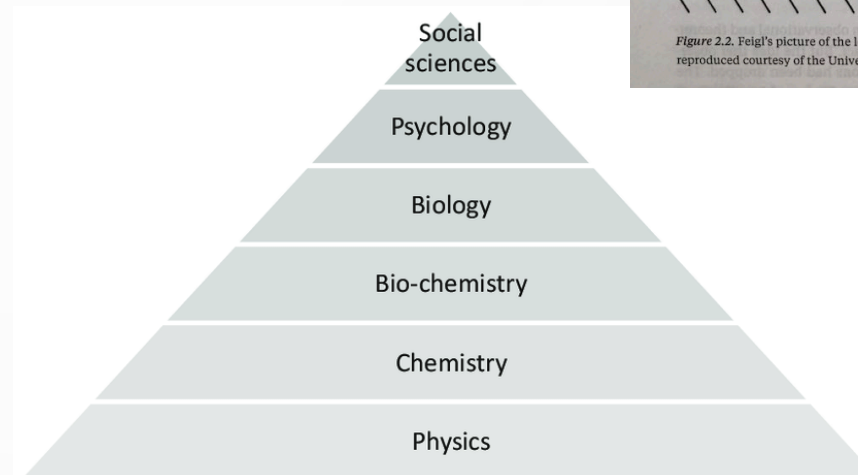
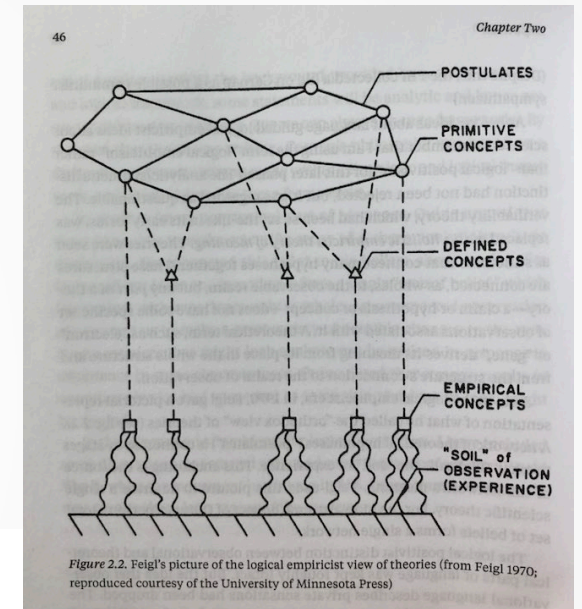
REDUCTIVE PROGRESS AND TWO-STAGE VIEW OF SCI. LANGUAGE

Nagel (1962):

Theories and laws of nature are subsumed under more general theories and laws.

e.g. Galileo's examples can be explained with the more comprehensive Newton's law of gravitation

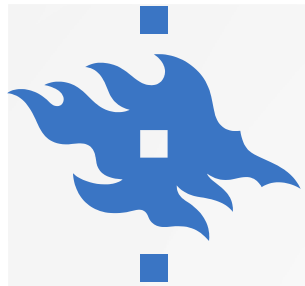
e.g. Thermodynamics explained by molecular chemistry





KARL POPPER

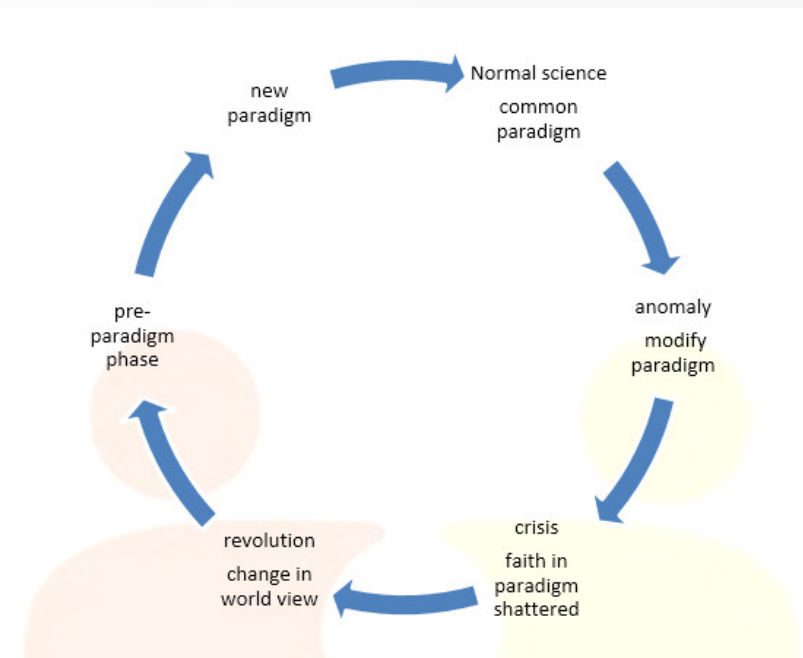
- BUT: Aim is not to find confirmation but to trying to prove theories wrong
- We can never prove our theories, they are only hypothetical
- Science should be risky: we should seek to find empirical evidence against our theories
- Theories are better the more they are falsifiable (not metaphysical, ambiguous etc.)
- But not possible to falsify all statements? (there is a blackhole somewhere?)
- Duhem-Quine thesis



THE STRUCTURE OF SCIENTIFIC REVOLUTIONS (1962)



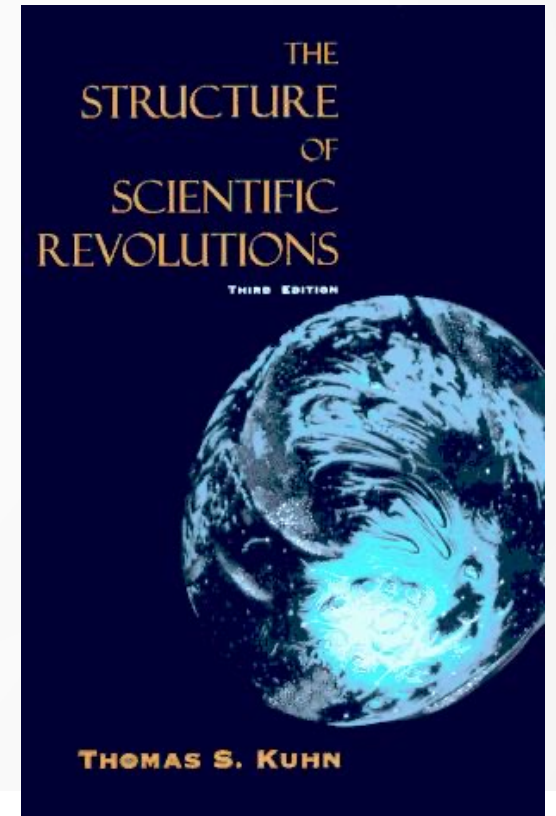
- Pre-paradigm → normal science → anomalies → crisis → revolution → new normal science → anomalies → new crisis
- Discipline gains structure when it adopts a *paradigm*
- *Normal* science enables concentration on specific (miniscule) *puzzle-solving* tasks
- *Crises* appear when many unsolved puzzles pile up, and a new approach appears that seems promising
- If enough scientists "convert" to the new approach, a revolution takes place in favor of the *new paradigm*





PARADIGMS AND NORMAL SCIENCE

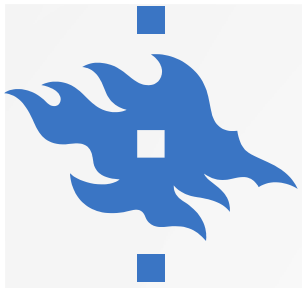
- Mature/normal science is governed by a *single paradigm*
 - Criteria for problems which are considered relevant in the discipline
 - Conceptual, theoretical, instrumental, methodological tools for solving them
 - Criteria for measuring success
 - Conventions and forums for publishing and communiting
 - (Kiikeri & Ylikoski)
- Pre-pradadigm stage: e.g. social sciences
- Stuck in fundamental questions





PARADIGMS AND NORMAL SCIENCE

- Paradigm enables concentration and specification
- Discipline progresses through puzzle solving
 - Governs observations and experiments
 - During normal periods, scientists assume that the paradigm offers the means to solve the puzzles
 - Inability to solve puzzles is the scientists fault, not the paradigms
 - Puzzles that are not solved, are considered as anomalies, not falsifications
 - Most cannot articulate their paradigm, it is implicit
- Exemplars: model examples of puzzles and how to solve them
- Disciplinary Matrix: same education, metaphysical assumptions, cognitive values (aims)



CRISES AND REVOLUTIONS

- There are always puzzles that paradigms cannot solve (Godfrey-Smith: models of the world are always incomplete representations of the complex world?)
- Anomalies: cannot be explained with the means of the paradigm, or is an observation that is in contradiction with the paradigm
 - Anomalies possible only within paradigm expectations
 - Sometimes those puzzles pile up and undermine faith in the paradigm
- But only when a new approach is available, reasonable to give up on the old paradigm
 - When most have lost their faith, there is room for a new paradigm



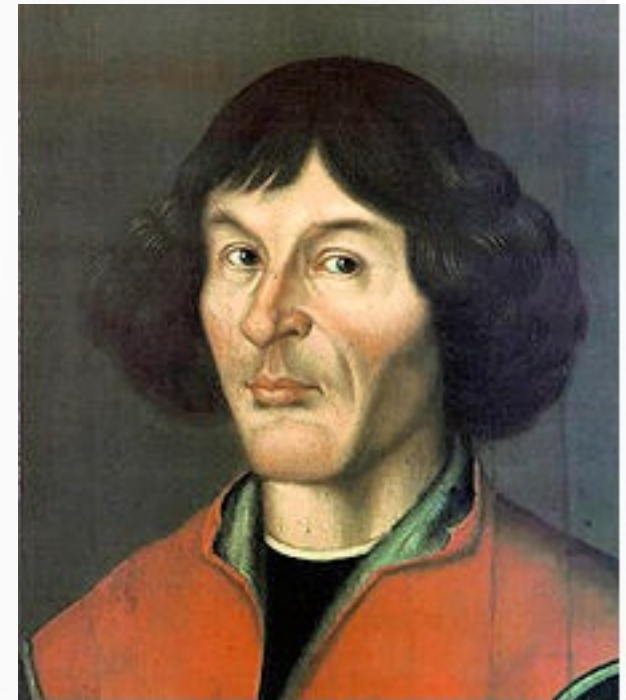
CRISIS AND REVOLUTION

- Crises appears when scientists loose faith the paradigm
 - New scientists and people outside of the descripline suggest wild novel hypothesis
 - Scientists participate in philosophical and metaphysical discussions (cf. what are psychiatric disorders?)
- If a new paradigm appears, it can lure novel scientists
 - Can solve some of the anomalies
 - Ritains puzzle-solving abilities
- New paradigms are radically different from old ones
- They hold different questions as legitimate and relevant
- They have different concepts and standards
- Resembles religious conversion or Gestalt-swich
- Not individual scientists, but the community as a whole

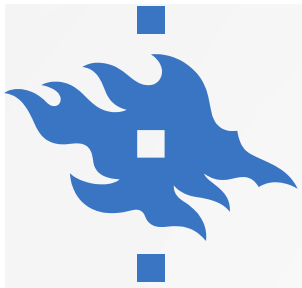


EXAMPLE: THE COPPERICAN REVOLUTION

- Ptolemaian system was successful at predicting the position of planets and stars
- Had many anomalies: discrepancies in predictions
- But adjustments were made in the model: “compounded cycles”
- De Revolutionibus (1543)

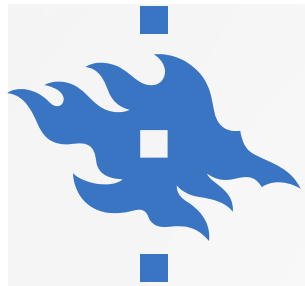


Portrait, 1580, Toruń Old Town City Hall



REVOLUTIONS

- Kuhn's examples
 - Aristotelian physics to Newtonian mechanics
 - Phlogiston chemistry to Lavoisier's theories
 - Non-evolutionary biology to Darwinism
 - Newtonian mechanics to relativistic and quantum mechanics
- Also
 - Psychodynamics to neurobiological psychiatry (partly parallel)



INCOMMENSURABILITY

- No common measure to compare theories in cosequitive or competing paradigms
- Gestal switch: all at once
- Kuhn's three versions of incommensurability:
 - Between paradigms
 - Translatability problem
 - Taxonomic shift
- Theoretical terms gain their meaning holistically in relation to each other in a theory

Welche Thiere gleichen ein-
ander am meisten?



Kaninchen und Ente.



CRITICISM

- Revolutions not common
- Exaggerates agreements in normal science, and disagreements in crises
- Problems with his concept of rationality (understood very thinly)
- Relativism?
 - Kuhn: “after a revolution scientists are responding to a different world”
 - Is the world socially constructed? Science resembles witchcraft?
 - Nominalism?
- Paradigm is given 21 meanings
- Why should there be only one paradigm at a time?





EXAMPLES OF PARADIGMS?

- Can you come up with examples of paradigms in science?
- What would a paradigm and revolution in your discipline mean? E.g. technology, art