Approaches to Economic Science

Part 2: What is Social Science?

(Module MW26.1)

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Outline:

Basic Literature:

- Chalmers, A.F. (1999), *What is the thing called Science?* 3rd ed., Open University Press. (avalibale also in german language: *Wege der Wissenschaft. Einführung in die Wissenschaftstheorie*, Springer: Berlin)

References to more specific literature can be found in the slide collection.

Parts of the program will be discussed in the exercise lessons. The candidates are expected to prepare texts, to make small presentations (as a part of the cumulative exam), and to participate actively in the discussion.

A brief overview can be found in:

- Beed, C. (1991), Philosophy of Science and Contemporary Economics: An Overview. *Journal of Post Keynesian Economics* 13(4), 459-494.

A prominent work is

- Blaug, M. (1980), The Methodology of Economics. Cambridge.
- Blaug, M. (1988), Economics through the Looking Glass. London.

Some further advanced texts on methodology:

- Cartwright, N. (2007), Hunting Causes and Using Them: Approaches in Philosophy and Economics. Cambridge.
- Cartwright, N. (1999), The Dappled World: A Study of the Boundaries of Science. Cambridge University Press.
- Pitt, J.E. (ed.) (1988), Theories of Explanation. Oxford University Press.

Some economic journals addressing this topic:

- Journal of Economic Methodology
- Economics and Philosophy
- Journal Economic Perspectives

Questions

- What is science? What distinguishes science from non-science, pseudo-science, myths, religious beliefs, ideology etc.?
- Is there a cardinal difference between *scientific knowledge* and *belief*? Is science completely free of things you "have to believe"?
- Since disciplines like physics and economics are very different, do they have comparable methodological basis? If physics is without any doubts a "hard (natural) science", is it legitimate to transfer its methods e.g. to social science?
- If social sciences like economics have their own appropriate methodology, are they in the same sense "scientific" as physics?
- If science is distinguished to non-science by its *method how knowledge is generated*, how can this method be described? Is it universally valid? There cannot be a scientific answer in the sense that science authorizes its own base $\Rightarrow$ philosophy of science or methodology $\Rightarrow$ controversial debate. There is no fixed common sense what makes science "scientific", but there are a couple of arguments.

2.1 Starting with facts: observations and experiments

A first "naive" step:

- Science is based on **facts**. Facts are understood as things that can "objectively observed" – as opposed to opinions, beliefs etc.
- This statement implies that there is a **methodology of observation** (e.g. experiment) which leads to the same results irrespective of the observing person, and that the facts exist independently from the observer.
- If conclusions are based only on objective observations then also the conclusions should be objective.
- Physics in the 17th century: observable facts could be proven by everyone since the same method is used (e.g. telescope, physical experiment), then the induced knowledge is based on observation rather than on authority (e.g. bible/church, Aristoteles)

2.1 Starting with facts: observations and experiments

- Birth of Positivism and Empirism:

$$\text{Facts} \Rightarrow \text{observation} \Rightarrow \text{knowledge/theory}$$

- Basic assumptions of Empirism:
  1. Facts could be objectively observed. This means that an observational method could be specified that leads to the same results independently from the observer.
  2. Facts are *prior to theory* and independent from the theoretical viewpoint. Theory is generated on the basis of facts by means of *inductive principles*.
  3. Facts constitute a stable and reliable basis of science (the world is governed by "laws")
- All assumptions could be challenged. We will focus on point 2.

2.1 Starting with facts: observations and experiments

The methodological view of Positivism
(according to Beed (1991), there might be different opinions):

1. Scientific knowledge is the only valid knowledge. Metaphysical statements, norms, value judgements, opinions are not valid knowledge.
2. Empirical data are the *only source* of valid knowledge (except for mathematics/logic).
3. Knowledge is generated by data via *inductive* methods.
4. Generalizations, principles, theories must be *verifiable* by empirical data.
5. There is a *universal* scientific method in all fields of experience.

Any idea about first objections?

a) The act of observation

- Naive understanding: Information flows from the real world to the observer.
- But: Observation is an *active* and *constructive* process,
  - structure of senses and cognitive pre-concepts; neuronal system is *closed* and neuronal correlates (sensual impressions, thoughts) are produced in an autopoietic way,
  - translation of stimuli by technological manipulation so that they could be perceived,
  - theoretical pre-knowledge (example see below).

  Thus, an observation is "objective" to the extent that other observers share the same pre-conditions.
- If an observational act is constructive, it tells something about the observer, not only about the observed "reality".

2.1 Starting with facts: observations and experiments

- Many things are not accessable to human sense, additional technology is neded to "see" something (microscope, detectors, algorithm-based inference technologies etc.). We do not "see" facts, but stimuli are translated in another sensual domain.
- *Example from biology*: Many researcher observed cell-division without knowing that this is cell-division since this phenomenon was not known and understood. When the theoretical concept has been developed, suddenly everyone was able to "observe" it. They first have to know what they "shall" see in order to be able to observe a fact.
- Similar effects when interpreting gamma-ray pictures or MRTs in medicine. Without pre-knowledge you observe nothing.

b) Observations as statements:

- Observations are not immediate impressions to the observers' sense, but have to be formulated in statements, using words = linguistic concepts.
- This implies minimal pre-knowledge about that what is described. It requires the use of *descriptions of entities, procedures, concepts*.
- *Example:* Observing a chrystal structure requires an intellectual concept of chrystal structure and a related observational technology which reproduces a pattern we call chrystal structure.
- *Example:* Observing symptoms of a certain disease requires a description of a normal state and about specific deviations from the normal state.
- *Example:* Macroeconomic observational statements make heavy use of concepts like price level, unemployment, income etc.

2.1 Starting with facts: observations and experiments

- *Example:* Observing egoistic behavior in an economic experiment requires a concept of what we call egoistic. Furthermore we observe acts, not behavioral patterns. A pattern which could be classified as egoistic requires theoretical concepts. From these we define an observational technology like an experimental design.

- **Result:** Observational statemnents require some scientific prior knowledge. Therefore, science should be *related to* objective observations, but the latter *cannot be prior to* scientific theory.

c) Observational statements may be false

- There may be false observations, errors, measurement inexactness etc. To falsify a theory, sometimes a single observation may be sufficient. This underlines the importance to account for the possibility of false observations.
- Observational statements may be false: We “observe” that the sun moves around the earth. Thus, the Ptolemean astronomy is “verified” by observations.

d) Observations as interventions

- Observation is an active process of generating data by an observational technology.
- The presence of an observer or of an observational technology may matter: e.g.
  - The body mass of an observer has a gravitational influence on the mechanics of a billiard game.
  - In quantum physics the act of observation may determine the state which would be undetermined otherwise ("Schrodinger's cat").
  - The presence (or even absence) of a person in case of social interaction may modify the behavior.
- Observational statements may influence the observed object, especially in social science (economic knowledge – generated by data – may have an impact on economic behavior).

Could theory logically be deduced from facts
(= facts "induce" a theory)?

The logic of deduction (*Hempel-Oppenheim scheme*):

1) All man will die some day
2) Hugo is a man

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3) Hugo will die some day

where 1) = law/hypothesis, 2) = condition, and 1) + 2) = explanans, while 3) = explanandum or conclusion

Note: The logic of this scheme does not imply anything about the *validity of the explanans*:

1) All cats have 5 legs
2) Carlo is a cat

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3) Carlo has 5 legs

Logical consistency and "meaningfulness" are (to some extent) independent.

2.2 Induction, deduction, explanation

- Inductivism means that **finite** observations are **generalized** to a law or hypothesis. This is the way children learn successfully their environment. But is it a rational basis for science?
- It is unclear whether (and if so: under which conditions) an inductive conclusion may be drawn. From a pure logical standpoint an inductive generalization is **not valid**:

1) Metal X expands when it is heated
2) Metal Y expands when it is heated
3) Metal Z expands when it is heated

⋮ ⋮

All metals expand when they are heated

2.2 Induction, deduction, explanation

Nevertheless there may be good arguments why a generalized statement "holds true". What qualifies a "good" inductive argument (even if there is no *logical* argument to accept it)?

1. *Many* observations
2. Observations must be *reproducable* in a *robust* way (under different circumstances).
3. *None* observation must be in contradiction to the conclusion.

2.2 Induction, deduction, explanation

Problems:

1. What is "many"?
2. Robustness in reproduction means that circumstances of observation may change: Heating metals under different air pressure, with different forms of heating, at different daytimes etc. etc. – where are the limits of variation? Should we reject "irrelevant" variations like different daytimes of metal heating?
3. "No exception" is extremly strong in case of statistical relationships like in social science. But then we have the problem that the conclusion must be valid in "most cases" of observations – what does this mean? When does an observation disprove the generalization?

$\Rightarrow$ Heavy use of normative judgements have to be made to make inductivism work.

2.2 Induction, deduction, explanation

- To a large extent the knowledge is formulated in entities which are *non-observable* (only their postulated effects are):
  - electric field, mass, gravitation force, quantums, quarks etc. in physics
  - preferences, risk, customs, power, norms etc. in social science

  How could we obtain knowledge about these things on a pure inductive way?
- Even if inductivism has no logical basis, it may be an empirically valid method because "it works"?

  1) Induction was successful in situation 1
  2) Induction was successful in situation 2
  3) Induction was successful in situation 3

  ⋮ ⋮

  Induction is always successful
- The principle is "proven" by applying it to the use of the principle? This is logically unsatisfying.

2.2 Induction, deduction, explanation

What induction can do:

Creation of new hypothesis from observation of data. The hypothesis may be related to existing knowledge or hypothesis. That is: the new hypothesis is not *deduced* from data but *inspired* by empirical data.

Smith, V. L. (2002), Method in Experiment: Rhetoric and Reality. *Experimental Economics* 5, 91-110.

From induction to explanation:

Joseph C. Pitt (ed.) (1988), *Theories of explanations*. Oxford University Press.

- If a phenomenon can be deduced to a law or theory, then we say it is explained by the law or theory. We accept a statement on observations as being explained if we deduce it from other things we have already accepted (taken them for true).

  1) Theory, law, hypothesis
  2) specific conditions, circumstances

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  3) Explanation, prediction

- Under condition Y phenomenon Z is explained by theory X.
- Theory can be used to make proper *predictions*: If the theory X holds true and if we have certain conditions Y, then we will observe phenomenon Z.

The *logical structure of an explanation* follows the Hempel-Oppenheim scheme. If we have an observation which should be explained by a theory/explanans, the theory cannot be counterfactual as in the case of the "cat with 5 legs" (see example above). The theory can be valid, the logic of inference can also be valid, but the explanation can nevertheless be meaningless:

1) Anti-baby pills prevent pregnancy
2) Hugo is a man who takes anti-baby pills

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3) Hugo will not become pregnant.

(Hugo will not become pregnant *because* he takes anti-baby pills?)

Another example:

1) When the barometer is falling a storm will appear.
2) The barometer is falling

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3) A storm will appear.

(The storm does not appear *because* the barometer is falling since both phenomena have a common cause.)

What do you think: Does the price level increase (inflation) *because* the money volume growth exceeds the real GDP growth?

An explanation must contain an *additional information*, i.e. a statement which is not an implication of the observational statement.

- *Explanation:* "Fire causes smoke. We observe smoke. The existence of fire is one explanation of this."
- *Not an explanation:* "We observe smoke. This is explained by a smoke-producing event." (That smoke-producing events produce smoke is a pure tautology without explanatory power.)

2.2 Induction, deduction, explanation

- *Example:* In experimental game theory we often observe to a significant extent cooperative behavior/fairness. If the players have simple prefeneces about the material payoffs, this contradicts the prediction of the Nash solution concept. We modify the theory by introducing "social preferences" which imply a preference for cooperative behavior/fairness. Is then the cooperative behavior "explained"? Note, that preferences are unobservable. We conclude from observed decisions to the (revealed) preferences. Is the logic structure of the social preference explanation so different from "smoke-producing events produce smoke"?

Pasche, M. (2008), Zum Erklärungsgehalt der verhaltensorientierten Spieltheorie. *Jena Research Papers in Business and Economics* 04/2008 (RePEc).

The logic structure of an explanation does not imply that the explanans must be a scientific theory:

1) God's will is determining everyone's life
2) Albert suffers from cancer

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3) It is god's will that Albert suffers from cancer

Although this follows the *logic structure* of an explanation, the explanans contains *additional information*, and the explanans may be seen as "confirmed" by experience (at least it cannot be falsified that life is *not* determined by god's will), it is "obviously" not a *scientific* explnation.

As we will see later on, scientific core concepts or paradigms may also be non-falsifiable!

2.2 Induction, deduction, explanation

- *Marxist theory of history* states that in capitalistic econmies there is a struggle of classes and the history will finally lead to a self-destruction of capitalism which end up in a communist society. Everything what happens could be interpreted in the light of this theory so that it *confirms* the theory. Every event could then be "explained" by the theory.
- *Psychology:* Theories based on concepts like "self-esteem" or "conscience" will also explain everything. Example: A. Adler's approach that motives of behavior are primarly determined by self-esteem: Audacious action from the motive of getting over the low self-esteem – avoiding an audacious action because of the low self-esteem. The latter "explains" both contrary actions.
- *Economics:* Choice theory consists of preferences, rationality, and expectations. Given a set of allocations and informations, the resulting choice behavior is explained by rational choice approach. Since preferences are not specified, (almost?) every behavior could be "rationalized".

Result/Summary:

- Observation is a *constructive* act, and sometimes an *intervention*. An observation may be *false*.
- For observational statement we need *pre-concepts* (terms, categories etc.) from *theory*. That is: Facts are *not* prior to theory.
- The logic of *induction* is unsatisfying and *not valid* as a sufficient base for deriving knowledge.
- The qualification of scientific knowledge as being *verified* by empirical data is highly questionable.

One may share a (sophisticated) positivistic viewpoint that science should be related to facts. But empirism and inductivism seem not to be a satisfying base to qualify knowledge as *scientific* knowledge.

2.3 Falsificationism and its limitations: Karl Popper

- Karl Popper (1902-1994), Austrian-British philosopher
  - Falsificationism, Critical Rationalism
  - most influential in social sciences
- Main work (among others):
  - Popper, K. (1934), The Logic of Scientific Discovery
  - Popper, K. (1972), Objective Knowledge: An Evolutionary Approach
  - for a brief overview: www.tkpw.net
- Problem with Marxist theory and also with psychoanalytic theories (examples see above). What is wrong with these theories? Why they are so different from e.g. physical theories?

2.3 Falsificationism and its limitations: Karl Popper

- Inductivistic generation of knowledge is not a logic foundation of science.
- Observations are not prior to theory, observational statements are made on the basis of a priori existing theoretical conspts. *"Every considerable case could be interpreted in the light of the theory."*
- *"A Marxist could not open a newspaper without finding ... confirming evidence for his interpretation of history; ... in the news, ... its presentation ... and especially of course in what the paper did not say."*
- Confirmation/verification of a hypothesis is then meaningless!

$\Rightarrow$ Rejection of the inductivistic method.

2.3 Falsificationism and its limitations: Karl Popper

What qualifies a theory to be "scientific" as opposed to non-science or pseudo-science?

- It must be able to be proven as false by observations. It must be **falsifiable**!
- A scientific theory must say what can **not** happen. It must be possible to construct an experiment or observational design which is able to **disprove** the theory. If an observation contradicts the theory, it is falsified.
- If it does not contradict, the theory is not falsified, but it is not proven as being true.
- Testing theories means trying to falsify them, not to confirm them. A "confirmation" could only count if it was a risky and successless attempt to falsify.

2.3 Falsificationism and its limitations: Karl Popper

Examples:

1. It never rains on Wednesday.
2. All materials expand when they are heated.
3. All objects with a mass fall down to earth in a vertical line if you drop them.

All statements are falsifiable; 1) and 2) are falsified, 3) is not.

Not falsifiable:

1. On Wednesday it rains or it rains not. [Every event must confirm the statement]
2. All points on an Euclidian circle have the same distance to the center point. [Tautology since the Euclidian circle is defined in this way.]
3. The horoscope says that it is possible that you may have luck with betting in this week. [No event can disprove the *possibility* of having luck.]

2.3 Falsificationism and its limitations: Karl Popper

- What's about this?
  1. Given the idiosyncratic preferences the agent will make a rational choice (rational in the sense of EUT or N-EUT).
- Depending on the vagueness/precision of a theory the risk of being falsified differs:
  1. Planet X has an elliptic orbit around the sun.
  2. All planets have an elliptic orbit around the sun.
- There will typically be *many rival theories*. Popper's approach is therefore "pluralistic", and the progress of science is based on *"criticism"* as opposed to *"dogmatism"*. While criticism is based on the *power of method*, dogmatism is based on *authority*. Criticism tries to *falsify*, dogmatism tries to *verify*.

2.3 Falsificationism and its limitations: Karl Popper

- But Popper also admits that to some small extent dogmatism is useful: A new theory will be defended by their proponents against early falsifications. This creates some inertia which enables to explore the explanatory power and implications of the new approach which is helpful to construct a better alternative.
- Popper was very strict in distinguishing science from pseudo- or non-science: Many social sciences as well as psychology are regarded to have a weak scientific status or being pseudo-science.

2.3 Falsificationism and its limitations: Karl Popper

Popper's view on the evolution of science:

- Science evolved from myth: Myths contain conjectures about the world. Some of these conjectures could be regarded as theories as they may contradict to experience. Science tries to extract conjectures from myth and to confront them with experience.
- New and *competing theories* of conjectures are created. The falsification principle serves as a *selection device* similar to natural selection in evolution. *"Our conjectures suffer in our stead in the struggle for the survival of the fittest."*
- Science is therefore are gradual, incremental, "linear" process of eliminating errors. It is a non-directed and "open" process, but showing a clear improvement of scientific knowledge. It brings us closer to truth (nevertheless it is impossible to prove "how close" we are).

Modifications of falsificationism:

- Most scientific statements are about *statistical* relationships. When is a statement falsified? Rejection on a significance level of 80%, 90%, 95%?
- Most theories respond to empirical contradictions by modifying or re-interpreting the theory **ad hoc**:
  "...re-interpreting the theory ad hoc in such a way that it escapes refutation... is always possible, but ... rescues the theory from refutation only at the price of ... lowering, its scientific status."

  1. If A then it follows B.
  2. Under initial condition X we observed not-B when A was given. Theory is falsified.
  3. Modified theory: If A and condition not-X it follows B.

2.3 Falsificationism and its limitations: Karl Popper

Economics: If we assume simple preferences on material payoffs then we observe violations of expected utility theory in lottery choice experiments. As a response, the axioms of EUT are weakend, extended, modified to cover the observed choice behavior (non-additive probabilities, weighting of probabilities and different weighting of gains and losses, combinations of all that... $\Rightarrow$ N-EUT).

Paradoxon: The more – even unobserved – patterns are compatible with theory, the less the theory explains, it loses predictive power and is more immune to falsification.

Hey, J.D., Orme, C. (1994), Investigating Generalizations of Expected Utility Theory Using Experimental Data. *Econometrica* 62, 1291-1326.

Limits to falsificationism:

- *Logical problem:* Popper argues against inductivism because there are some theoretical concepts prior to observation. It is contradictory that empirical observations then play such a decisive role in falsifying theories: Observatons may be false, (mis)interpreted in light of prior theory, based on pre-conceptions etc. If one takes the anti-inductionist position seriously, than one has to be *sceptical also against the falsificational power of observations*. In some cases it might be undecidable whether theory or observation is false.
- In standard examples ("All swans are white.") only *one* observation is able to disprove a theory which works well in most cases. In absence of a better theory it is reasonable to "immunify" theory by ad hoc modifications (auxiliary hypothesis).

2.3 Falsificationism and its limitations: Karl Popper

- *Initial conditions and auxiliary hypothesis:* Most theories are not simple laws but statements which lead to testable predictions together with initial conditions and auxiliary hypothesis. In case of a contradictory observation it may be unclear which part of the explanans is falsified! (Duhem-Quine problem of complex test designs)
- *Example:* Observation of voluntary "fair" division in a ultimatum game: Do agents act rational but have social preferences instead of pure self-interest? Or do they have egoistic preferences but behave not consistent to them? Or are agents rational and egoistic, but have certain expectations about the irrational behavior of the other players? There might be some experimental designs to answer these questions but since there are always *two* hypothesis (agent has preferences XY, agent behaves rational = consistent to his preferences), it remains undecidable which part of the theory is falsified.

Proposed Homework: Binmore, K., Shaked, A. (2010), Experimental Economics: Where Next? (Working Paper, probably to appear in JEBO).

2.3 Falsificationism and its limitations: Karl Popper

- A theory can be formulated in a way that it is in principle falsifiable and henceforth scientific. But there can be *practical limits to falsifiability*.
- *Example:* Economic theory makes exhaustive use of the *ceteris paribus clause* and of initial conditions which are out of reality. In empirical observations the ceteris paribus conditions and most initial conditions are *never* fulfilled! Theory is logically falsifiable but practically non-falsifiable.
- Popper's view of the evolution of science by menas of pluralistic theory production and falsificational selection is *not in line with the historical process of science*. The development and use of many (physical) theories contradicts the falsificationist view: Theories have often been falsified in an early state, nevertheless they have been propagated and have been proven to be fruitful. In later stages they have been replaced (or generalized) by alternative theories.

2.3 Falsificationism and its limitations: Karl Popper

- *Example:* Kopernikus' theory of planet movement (early 16th cent.) was based on the observational technology of his time. It was been defended against the practical observational evidence (e.g. planet rotation should have the effect that things flow away from earth due to centrifugal force).

  Galilei (early 17th cent.) defended Kopernikus against the Ptolemean astronomy and provided new evidence against the latter by using a telescope. People ask why to trust a telescope more than the eye? Theory of optic gave support to Galilei's argument. A "struggle of different paradigms" seems to be a more proper description of the development of astronomy as an incremental linear progression.

  (see Chalmers (1999) for more detailed historical examples)

2.4 Beyond Falsificationism: developments in methodology

2.4.1 Theories and paradigms: Thomas Kuhn

- Thomas Kuhn (1922-1996), american philosopher and historian, scholar of Popper, but later an opponent to him.

  Kuhn T.S. (1962), The Structure of Scientific Revolutions.
- Theories are treated as *structures*: They *organize* statements about observable things in a certain way. Like Popper he is an *anti-inductionist*: Observations depend to some extent on theory, they are not prior to theory.
- Observation of the history of science: there is more dogmatism and more reference to "authorities" which governs the struggle of ideas than should be expected in a falsificationist view.

2.4 Beyond Falsificationism: developments in methodology

2.4.1 Theories and paradigms: Thomas Kuhn

- Theories are often replaced by other theories which are based on *completely new concepts*: Physicists like Newton have to introduce *new concepts and terms* like "mass" and "force", Maxwell has to introduce the "field".
- New theories are sometimes *"revolutionary"* rather than an incremental improvement.
- Concept of a "**paradigm**": a theoretical framework consistening of certain concepts, convictions, terms, and methodological practices which governs the theory development within this paradigm. A paradigm tells the researcher what entities exist and how they are related. It provides a kind of "map" which guides the researcher.
- A paradigm often implicitely consists of metaphysical convictions, e.g. Newton's paradigm ("world as a mechanic machine").

2.4 Beyond Falsificationism: developments in methodology

2.4.1 Theories and paradigms: Thomas Kuhn

- If more and more empirical evidence accumulates that falsifies or challenges theories (and their ad hoc modifications), the paradigm gets into a *"crisis"*. The empirical evidence is understood as *"anomalies"*.
- A new paradigm may arise and replace the old one, including the old theories (*"paradigm shift"*). Afterwards we have again a phase of *"normal science"* within the new paradigm.
- *Example:* Ptolemean geocentric astronomy is replaced by the heliocentric astronomy.
- *Example:* Newton's physic operated well on a medium scale but is disproven on a very large scale (astronomy) as well as on the small (sub-atomic) scale. It was replaced by Einstein's relativity theory.
- *Example:* In most sciences there had been the principle of strong causality: Small changes in the cause has small effects. From chaos theory we know that this is not neccessarily the case. Weak causality: A causes B (without implications about the magnitude of changes)

2.4 Beyond Falsificationism: developments in methodology

2.4.1 Theories and paradigms: Thomas Kuhn

- Researchers may be critical to theories but more or less dogmatic regarding the paradigm they are operating within.
- New paradigms are propagated by authorities. Old paradigms can often be replaced after their main proponents have died. Accepting a new paradigm is similar to religious conversion. Thus, Kuhn's approach is related to a theory of science as a social system ("scientific community").
- Different paradigms are *incommensurable*. They use different terms and concepts which prevents from a direct comparison of their explanatory power. Even if they use the same terms, they have different meaning (e.g. "energy" in the physics of Newton and Einstein). Thus, it is problematic to interpret scientific progress in a linear way which "approximates truth". There is no "accumulation of knowledge" $\Rightarrow$ Kuhn as an opponent to Popper.

- A new paradigm resolves the "puzzles" oft the replaced paradigm, but it creates new "puzzles". A new paradigm does not ony provide new answers to old questions, but creates new types of questions, using new terms.
- Thus, Kuhn's approach to science is in a certain sense **relativistic**. There is no clear criterion to discriminate between "good" and "better" theories. This is one of the most important flaws of the approach.
- *Problem:* There is often no fixed definition of a paradigm. It evolves due to the scientific process.

Example: The neoclassical paradigm in economics

- Constitutional elements:
  - Methodological individualism (coming from a liberal (normative) position)
  - Rationality (methodological instrumentalism, instrumental character of behavior/choices)
  - Equilibrium
- As every paradigm this provides powerful universal tools to build theories about all economic phenomena. For a neoclassical economist it is not possible to start an anaylsis from entities like social system, institution, class, economic aggregate. It is not possible to understand behavior depart from some kind of maximizing behavior (e.g. guided by social norms).

2.4 Beyond Falsificationism: developments in methodology

2.4.1 Theories and paradigms: Thomas Kuhn

- Since the scientific thinking is guided by the paradigm it may be hard to accept that a paradigm is *not constitutive* for the scientific discipline.

Proposed homework:

- Davis, J.B. (2006), The Turn in Economics: Neoclassical Dominance to Mainstream Pluralism? *Journal of Institutional Economics* 2(1), 1-20 *OR*
- Davis, J.B. (2008), The turn in recent economics and return of orthodoxy. *Cambridge Journal of Economics* 32(3), 349-366.
- Arnsperger, C., Varoufakis, Y. (2006), What Is Neoclassical Economics? The three axioms responsible for its theoretical oeuvre, practical irrelevance and, thus, discursive power. *Panoeconomicus* 53(1), 5-18 (also available as a working paper)

- Imre Lakatos (1922-1974), Hungarian mathematician, physicist and philosopher.
- Criticizes Popper's "naive falsificationism" as well as Kuhn's relativistic concept of paradigms.
- The main problems of Popper's falsificationism we have discussed above, draws back to Lakatos: (i) since observations are partially theory-based, they cannot be a sufficient reason to falsify a theory, (ii) observations disprove a bundle consisting of theory, initial conditions and auxiliary hypothesis, henceforth a contradictory observation does not neccessarily falsify the theory, (iii) the falsificationist approach contradicts the observed process of science.

- Kuhn's approach is relativistic since paradigms are regarded to be incommensurable, so there is no rational basis for a comparison and no basis to identify something as scientific "progress".
- Lakatos tries to resolve both problems by replacing the term "paradigm" by *"research program"*. Some theories and concepts are more influential and more constitutive than others.
- A research program consists of a *"hard core"* which has similar functions like the "paradigm".
- In addition there is a *"belt"* of theories and hypothesis which are related to the hard core but add several assumptions. The hard core provides some "heuristics" how theories in the belt are to be constructed and modified.

- Theories in the belt can be falsified by empirical observations. As they are modified or replaced, the theoretical hard core is defended or *"immunified"* against falsification. The explanatory power of a "core concept" can therefore not be challenged seriously by *few* observations.
- Similar to Kuhn's paradigm shift also a research program can change. In contrast to Kuhn, Lakatos belives that there is a rational basis to compare the explanatory power of different research programs. The change of research programs takes place on the basis of the scientific discourse, not by propaganda. It is bsed on arguments rather than convictions.

- Example: The hard core of Newton's physic are the mechanical laws of motions and the laws of mass attraction.
- *Example:* Neoclassic as a research program with "rationality" as one core concept. In the "belt" a theory may consider "self-interest". This theory can be falsified by the experimental results e.g. of ultimatum games. Since the belt theory can be replaced by adding social preferences, the core concept is kept intact and is defended against falsification. The "heuristic" of research within the research program is to find preference functions which fit the empirical data.

Problems:

- It is not always possible to distinguish clearly between hard core and belt; there is not always a consensus about this.
- The (near) non-falsifiability of the hard core is a problem for its status as science.
- The rules of scientific progress and the criteria when a theory is a "progress" remain unclar.
- The history of scientific development supports Kuhn's view as well as Lakatos' view (both partially – or both can be interpreted as a *frame* to interpret the history of science.)

- Paul Feyerabend (1924-1994), Austrian philosopher (but worked in the US, GB, Germany and Switzerland)

  Feyerabend, P. (1974), Against Method. Outline of an anarchistic Theory of Knowledge.
- Started as a critical rationalist in a Popper tradition, but developed a pure *anarchistic position* of the philosophy of science.
- What has methodology done so far in order to specify scientific knowledge as opposed to non-science? The answer is disillusioning.

- Inductivism failed, pure falsificationism failed. Also Kuhn's and Lakatos' methodologies have their flaws. There is an ongoing debate about a "correct", "rational", or "appropriate" methodology. There are no first principles from which we can deduce a valid methodology which distinguishes precisely scientific knowledge from non-science. Each methodological attempt to qualify scientific research and theorizing has its flaws. It is impossible to resolve methodological problems by introducing a new methodology, including negative ones like falsifiabiity.
- A methodology is not able to force a scientist to follow it. Each methodology can be refuted by the researcher with arguments of other methodologies. The most important requirement for scientific rsearch is *freedom* to do that – also freedom understood as the absence of a commitment to a certain methodology.

- This anti-dogmatic position is in tradition with falsificationism.
- *"Anything goes."* Science is what scientists do. Pure relativism, but relativism is not the problem, it is seen as a solution. (Or: the solution is that there is none.)
- There is therefore neither a criterion of what is a scientific "progress", nor a clear criterion what distinguishes science from non-science. Scientific development is guided by individual preferences of the researchers and the social processes within the scientific community.

Problems:

- Most scientists and philosophers feel uncomfortable with pure relativism.
- Freedom is only the absence of force, it is *negatively* defined. In the philosophy of society, freedom is created and guaranteed by a "civil contract" (Hume). Without rules there is no real freedom! Feyerabend does not provide comparable rules, hence his notion of freedom is incomplete and unsatisfying.
- Compared to the empirical picture of scientific development, there is much more coherence and absence of anarchy as it could be expected in Feyerabend's perspective.

Moderate re-interpretation:

- There is *no universal* methodology, but there are well established and "proven" methodological practices.
- These methodological practices may change in time. Such changes are not governed by fixed rules, but they are also *not arbitrary*.

a) Realism and Anti-Realism

Realism:

- Observable phenomena do *really* exist.
- Each theory which describes observational phenomena uses entities which are not directly observable. If a theory is convincing and successful, then we should consider that the underlying non-observable entities also *really* exist.
- Examples:
  - "Black holes": First considered by theory; observations are interpreted "in light" of the theory.
  - "Higgs particle": Research to "prove" its existence is still going on.
  - "Quarks": (similar to Higgs particle)
  - "Preferences": Do they "exist" or are they a pure descriptive concept to formalize behavioral regularities?

Anti-realism:

- There is no logical reason to believe that these entities really exist. Science is full of errors, but theories may work well even if they are proven to be incorrect like Newton's physic.
- *The explanatory value of a theory does not depend on the metaphysical assumption that entities really exist*. We cannot learn something from this assumption. A theory just "works". This is a functionalistic view of scientific theory – as opposed to the view that science uncovers the "truth" about the reality.
- History of science shows that later theories which replace the current one will also explain the observed phenomena. Perhaps they will not rely on the same entities as the current theory. Then we are blamed that we have "believed" in the real existence of the entities (e.g. the substance "ether" in the physics of the 17th cent.)

b) Why should reality obey laws?

(not discussed here)

c) Bayesian approaches

(not discussed here)

See Chalmer (1999) and the work of Cartwright (1997, 2008) for further discussion.

d) Radical Constructivism

(based on the idea that the neuronal system of an observer is a closed autopoietic system; not discussed here)

2.5 Realism versus Instrumentalism: The "as if" approach

Friedman, M., 1953. The methodology of positive economics. In Friedman, M., (Ed.) Essays on Positive Economics. Chicago University Press, Chicago.

- Related to anti-realism position, *theories as instruments of prediction*.
- Economic theories should be judged by their predictive power, not by proving if their underlying assumptions are valid, realistic etc.. The underlying assumptions are "unrealistic"? So what?
- Example: We treat agents "as if" they are rational maximizers.
- All ingredients of the "rational man hypothesis" may be disproven e.g. in experimental economics. Nevertheless it could be seen as a valid explanatory theory as long as the predictions do not systematically contradict the data.

2.5 Realism versus Instrumentalism: The "as if" approach

- But: A model of a competitive market which is populated with rational agents may explain the convergence to the equilibrium price well (as observed in experimental markets). Nevertheless, economics is also interested in explaining individual behavior. In this context, the rational man model does a poor job. If we aim to build a *consistant and cohrent framework* of economic theory (e.g. a "microfounded" model of market behavior), then the neoclassical market model is unsatisfying regardless it's predicitive power in *this* case.
- It is not a proper argument to say that the underlying assumptions are "unrealistic" in the sense that the entities "do not really exist". It is more convincing to argue that an underlying assumption or hypothesis is disproven by observation.
- But if e.g. the assumption of a perfect market could be rejected by disproving the ingredients of this concept, also deviations from this hypothesis may lead to similar results, so that e.g. for simplicity reasons it may be justified to argue "as if" the market is perfect.

2.5 Realism versus Instrumentalism: The "as if" approach

- However, there may be several other underlying hypothesis about markets which would also lead to similar results and could be regarded as "working" in a functionalist way.
- If a rival market theory with the same predicitive power is based on entities and assumptions e.g. about individual behavior which are not disproven, then this rival theory enables more coherence and consistency in economic theory. It could be regarded as scientific progress.
- Scientific progress means that new theories which replace old ones have more explanatory power to understand observable (real) phenomena. In a structural sense theories are realistic but the entities do not need to "represent" the reality.

2.5 Realism versus Instrumentalism: The "as if" approach

Proposed Homework:

- Berg, N., Gigerenzer, G. (2010), As-If Behavioral Economics: Neoclassical Economics in Disguise? *History of Economic Ideas* 18(1), 133-165.
- Gul, F., Pesendorfer, W. (2005), The Case for Mindless Economics, Working paper.
- Weibull, J. (1994), The "As If" Approach to Game Theory: Three Positive Results and Four Obstacles *European Economic Review* 38(2-3), 868-881

2.6 Science as a social system

- From philosophy of science or methodology to sociology of science
- "Scientific community" (Kuhn)
- Building "schools" of thought, building paradigms.
- Comunication structures, habits/customs, reputational mechanisms, rules and incentive schemes of publishing, agenda setting, mechanisms and incentive schemes of making an academic career etc. govern the process of research and define what is noticed and accepted and what is not.
- The incentive system of publication: "Publication as prostitution" (Frey)
- Rankings as an instrument of allocation of academic resources and career opportunities.

2.6 Science as a social system

Proposed Homework:

- Frey, B.S. (2010), Withering Academia? Institute for Empirical Research in Economics University of Zurich, Working Paper No. 512
- Frey, B.S. (2003), Publishing as prostitution? Choosing between one's own ideas and academic success. *Public Choice* 116, 205-223.

2.7 Social science and the society

(Freytag)