Methodological Manifolds: *Erkenntnistheorie* and the Heterodox Approach

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Abstract

Scientific method in principle is heterodox. There are several *erkenntnis*-theoretical reasons for this (the German *Erkenntnis*-theory literally translates as "theory of knowledge/cognition" and is used here to describe a specific natural science view on what is often called the "philosophy of science"). Scientific theory is necessarily metaphysical in the sense of including conventional and arbitrary assumptions. In order to criticize any point of view, one must have at least another, i.e. for developing scientific theory, there must be other theories. This also applies to methodology. By empirical experience, different methods strengthen specific intuitions of scientists (intuitions here defined as experiences not necessarily accessible to conscious reflection). As a result, the observed facts change as the focus is put on different circumstances, while abstracting from others. Which circumstances are abstracted from is often only a matter of convention. This methodological principle was even found within mathematics with the development of alternative geometries to the long theoretically dominating Euclidean geometry by Lobachevski and Riemann. These geometries are called "manifolds".

This article will argue that in principle a "heterodox" approach can be a scientific meta-methodological (*erkenntnis*-theoretical) frame for economics, which in principle supports the development of new (and fundamentally new) knowledge.

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Manifolds

Scientific method in principle is heterodox. The reasons for this are mostly *erkenntnis*-theoretical (German *Erkenntnistheorie* literally translates as "theory of knowledge/cognition" and is used here to describe a specific holistic, i.e. neutral monism, view on what in mainstream terminology is called "philosophy of science").[2] Scientific theory is necessarily metaphysical in the sense of including conventional and arbitrary assumptions. In order to criticize any point of view, one must have at least another, i.e. for developing scientific theory, there must be other theories.

This all the more applies to methodology. By empirical experience, different methods strengthen specific intuitions of scientists. Intuitions are here understood as perceptional or theoretical experiences, i.e. the meanings resulting from these experiences, which are often not accessible to conscious reflection. As a result, the observed facts change. A focus is put on specific circumstances under which facts appear, while abstracting from others. Which facts are observed and which circumstances are abstracted from is often just a matter of social convention, individual experience or simply coincidence. Additionally, the process most of the times happens unconsciously (see also Hayek 1975). As William James (1905b; 1967, p. 206) noted: "I speak also of ideas which we might verify if we would take the trouble, but which we hold for true although unterminated perceptually, because nothing says 'no' to us, and there is no contradicting truth in sight. *To continue thinking unchallenged is, ninety-nine times out of a hundred, our practical substitute for knowing in the completed sense.* As each experience runs by cognitive transition into the next one, and we nowhere feel a collision with what we elsewhere count as truth or fact, we commit ourselves to the current as if the port were sure." This methodological principle was even found within mathematics with the development of alternatives to the Euclidean geometry by Lobachevski and Riemann. These geometries are called "manifolds".

Manifolds are logically undecidable. Which one is used is a question of practicality (pragmatic usefulness in a specific case) and conventional reasons. Interestingly, this also holds from an empirical point of view. For a long time, Euclidean geometry was considered **the** geometry consistent with empirical observations. But this is only so for space and time observations relatively close to our perceptions as observer. As for instance Einstein showed through his relativity theory, Minkowski's four-dimensional "spacetime" manifold (based on Riemann) is a better description for "very large" astronomical phenomena. It consistently describes more facts. Minkowski's space also applies for our daily human experience of space, although here the differences are too small to be noticed by our senses. Because of this and because Minkowski space is rather tedious to use for daily purposes, Euclidean space still rules. These arguments, notably, are mainly *psychological* arguments for the use of a *mathematical* theory.

Cultural manifolds and adaptive concept formation in science

As Lloyd and Sivin (2002) have described, also cultural (and thereby economic) phenomena and theories in principle fit this theoretical frame. They call this theoretical enlarged concept "cultural manifolds". As science in a general sense (i.e. not only Western science) is part of culture, this concept can in principle be applied by *Erkenntnistheorie* to become a meta-methodological tool in economics (mainstream economic methodology has unfortunately been relatively weak on questions of *Erkenntnistheorie*). Multiple scientific cultures offer

[2] The following article is based on a specific world view. Other world views are certainly possible and might provide very different conclusions. Nevertheless, a change in world view also implies a change in the fundamental conceptual meanings. This might give an "unfamiliar feeling" to the use of (linguistically familiar) concepts in this article. The ideas on which this is based can unfortunately be elaborated here only very briefly and abbreviated for the fact that many readers might be unacquainted to them. More detailed versions on specific aspects are therefore provided as references at the end of the article.

manifold perspectives on what are economic facts and the circumstances under which they appear. The *erkenntnis*-theoretical problem lies in the possibility to compare such perspectives and gain new knowledge from this diversity.

This problem can be resolved by an *erkenntnis*-theoretical understanding of the experiential and methodological underpinnings of each economic theory understood as a cultural manifold. What are logically basic concepts are not automatically perceptionally basic for a theory. Axioms are not necessarily used often. Instead, many economic concepts and proto-economic concepts are used intuitively, thereby not as explicit axioms or they cannot be recognized as such.

For instance, from this perspective, symbols are not a prerequisite, but a result of our concept of consciousness. Hadamard (1945, p. 89) mentions an example, which the economist Sidgwick reported to the International Congress of Experimental Psychology in 1892. In his reasoning on economic questions, "the images were often curiously arbitrary and sometimes almost undecipherably symbolic. For example, it took him a long time to discover that an odd, symbolic image which accompanied the word 'value' was a faint, partial image of a man putting something on a scale". Thus the symbol of the concept of "value" was constructed from the sensations of using (or observing somebody to use) a scale. The actual usage of a scale (haptical/enactive doing) in this case provides the empirical meaning for a proto-economic concept.

The current scientific or economic concept can thereby be the result of a genetic adaptation process. One might not remember how one experienced sensations before such a process. Ernst Mach (1905) generalizes this by stating that "Every human discovers within himself, when waking up to his complete consciousness, already a completed image of the world, to which accomplishment he did not at all willingly contribute to and which he accepts on the contrary as a gift from nature and of the civilization and as something immediately intelligible. This image was built up under the pressure of the practical life; extremely valuable, in this regard, it is inerasable and never ceases to act upon us, no matter which are the philosophical views that we will later adopt." The "conscious" aspect of concepts thereby has to be considered as the result of ones' initial world view, not as the origin of it.[3]

Nevertheless, there are some general concepts otherwise one could not speak of "science" or "economics". Based on such general concepts and questions of consistency and breadth of facts described, one can develop a (by-and-large) consistent multi-methodological approach. This approach is inherently "heterodox" in an *erkenntnis*-theoretical sense.

Methods of thinking in science

Before the question, if the ideas can be generalized for scientific and economical thought in general, one first has to elaborate, if different methods of thought "train" scientists to think in a specific way, but not another.[4] Also one has to question, if such specialization is necessary for science in principle and especially for teaching future scientists. For instance, if one demands to teach mathematics to economists, is it also a question of which mathematical method of thinking to teach? Will this make different economists, though all are trained in mathematics?

Elaborating on questions like this from a mathematician's perspective, the Hadamard (1945, pp. 100), for instance in his "Different Kinds of Mathematical Minds" distinguishes like Poincaré between geometrically and algebraically thinking mathematicians as well as intuitive and logical mathematicians.[5] According to Hadamard, these distinctions do not only

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[3] Our limited memory of our early childhood might be a result of many experiences (clusters of sensual elements) not fitting to the conceptual gestalts formed later.

[4] For more details on this, see Siemsen (2010c).

[5] For instance the intuitive mathematicians would be careful to use the distinction between true and false as absolute. For them, the "third" (neither true nor false) cannot be excluded. The exclusion is a logical

concern the preferred field of work and of elaboration, but even the "type" of proofs the mathematicians would find. Hadamard describes this for Poincaré and Hermite. Poincaré's proofs were always immediately intelligible in their genesis, i.e. how Poincaré had come to his idea. Of his teacher Hermite, Hadamard (1945, p. 109) remembers, that he on the contrary seems to have been so intuitive, that "the accuracy [of his results] was certain, but whose origin in his brain and way of discovery he did not explain and we could not guess." The cognitive gap to his way of thinking was seemingly large[6]: "Methods always seemed to be born in his mind in some mysterious ways." Hadamard describes even more extreme cases, such as Fermat's theorem. In a posthumously discovered note, Fermat had stated that he could prove a specific theorem, which became one of the most famous puzzles in mathematics ever. It was actually proven more than 350 years later. A similar case is Galois (Hadamard 1945, pp. 110), who proved a theorem (shortly after which he died) requiring mathematical concepts, which at his time was not even remotely invented. Similar examples can also be found between different sciences, which promote different methods of thought, such as the natural sciences versus the social sciences. This can also be found between different kinds of approaches to a science, such as between "Neoclassical" or "Marxian" economics.

Are these phenomena "given", or just an unintended and hitherto not explicitly analyzed by-product of the development of science? Can methods (and using multiple methods) be specifically trained? And if so, are there advantages of this type of training? The eminent psychologist Edward B. Titchener was one of the first, who in psychology tried such training in an auto-education experiment (Titchener 1909, p. 98). He trained himself to think in concrete rather than abstract images, because he thought that visual images would help him to avoid becoming too rigid and metaphysical in his way of thinking.[7] He found that he achieved quite some success with this behavioural therapy. It is hereby not so much interesting what he trained, but that it was possible to train one's intuition regarding scientific thought. What Titchener did in fact from the point of view taken here was training the **method** of his intuition. Therefore, it seems to be possible to do so even at later age (Titchener was already well into his scientific career when he tried).

A similar account to this psychology of metaphysics was given by the geologist Thomas C. Chamberlin.[8] In an article for Science (1890), he proposed a method of deliberately pursuing "multiple hypotheses" in order to avoid premature explanation "when it runs before a serious inquiry into the phenomenon itself. […] The moment one has offered an original explanation for a phenomenon which seems satisfactory, that moment affection for his intellectual child springs into existence. […] There is an unconscious selection and magnifying of the phenomena that fall into harmony with the theory and support it and an unconscious neglect of those that fail of coincidence. There springs up, also, an unconscious pressing of the theory to make it fit the facts, and a pressing of the facts to make them fit the theory. […] Dust and chaff are mingled with the grain in what should be a winnowing

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simplification, a convention. It is not mathematically or logically necessary. This convention can be helpful in terms of simplification, or it can be misleading and faulty, depending on the case.

[6] This relates to a specific question of genetic enquiry, namely the replicability of ideas. If one does not understand an idea, looking into how the idea was historically developed (including the difficulties) tends to be a good approach. Also this is a central question for the popularization of science (in the sense that everybody should be able to understand scientific ideas, see Siemsen 2010a). It is a basic question for science education. The basic hypothesis is that one can teach everything, but maybe we have not found a good way to teach for many things. For this one might need to look more closely into the intuitive ways of learning.

[7] Titchener (1909, p. 12) stated that "More serious is the temptation to allow one's visual schemata to harden, to become rigid. I have constantly to fight against the tendency to premature systematisation."

[8] Chamberlin was the intellectual "competitor" of Lyell (see Oreskes 1999), who was the intellectual father of Darwin's ideas on geology and of the accumulation of many small changes over long periods of time resulting in seeming gestalt shifts. Chamberlin was inspired in his ideas by G.K. Gilbert, who – although a geologist – had a strong influence from ideas in physics and mathematics. The details of the genesis of the ideas concerned here still need detailed research.

process." But for Chamberlin, this does not speak against the use of theory without which facts collected become "dead" and "unmeaning". It rather argues for a better process regarding the two aspects. When facts are sought and chosen, there are two types: the initial, open search of all aspects of phenomena and the later, experimental search along the line of specific questions and hypotheses. "[The multiple working hypotheses method] differs from the former method in the multiple character of its genetic conceptions and of its tentative interpretations." Finally, Chamberlin adds that "The imperfections of our knowledge are more likely to be detected, for there will be less confidence in its completeness in proportion as there is a broad comprehension of the possibilities of varied action, under similar circumstances and with similar appearances. So, also the imperfections of evidence as to the motives and purposes inspiring the action will become more discernable in proportion to the fullness of our conception of what the evidence should be to distinguish between action from the one or the other of possible motives."[9]

From an *erkenntnis*-theoretical perspective, one should add that one can also apply multiple perspectives and multiple methods of inquiry or additional to multiple hypotheses instead. But all these will not ultimately make one's view impartial. Therefore one needs to be aware of the fact that science is always a narrowing of attention to a few aspects and maybe to the seemingly most important single one.[10] "Local" investigation in terms of pursuing a single hypothesis, a single perspective, a single method or even an investigation of teleological nature is possible and can sometimes be very productive – if one does not forget the limitations relative to the general frame of investigation. In this sense the investigation of this article is also one-sided, but necessarily and "consciously" so. Even if sometimes the mentioning of its limitations may sound a bit tedious.

Equally, when a theory is rejected, it tends to be rejected in totality (see also Kuhn 1962) including its "good" parts. Later, the "good" ideas are rediscovered, often under a different name, but with similar contents.[11] Ideas can thus become conscious, unconscious and then conscious again. Actually, most ideas – even in science – have to be considered to be (and remain) unconscious, as Hayek (1975) noted.[12] Also for individuals, ideas tend to become successively unconscious and intuitive, especially if acquired in one's youth. This is what Wittgenstein described with the metaphor of a "ladder" one can "throw away" after having climbed it.[13] But if one "throws away" the ladder, the next people cannot follow anymore. The genetic origins of one's ideas become hidden. One does not tend to retrace

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[9] Similar methods of accessing ideas from different parts of our intuition were developed by the Dadaists and Surrealists. There are for instance descriptions of deliberately creating "automatic writings", not directed by a voluntary conscious reflection. These games were of course initially focussed on stimulating artistic creativity by following "wild" associations. Nevertheless, the method of using games later led to a focus of "unlocking" unconscious ideas. The applications of such methods in psychology, such as the Rorschach test, are well known.

[10] Thus, in this view, causality becomes a "working principle" of human enquiry instead of a law of nature. The supposed causal relation is only the currently best known empirical description. Several such descriptions might be equal and undecidable as manifolds. The theoretical expectation might be disappointed by further (more detailed, different, etc.) empirical observations.

[11] An example is for instance the concepts of "gestalt" and "emergence", which are basically used to describe by-and-large the same phenomena, though their mainstream usage falls in different time-periods.

[12] The mention of Hayek is not coincidental here. He is known as an economist, but first studied psychology and wrote one of his earliest works "The Sensory Order – An Inquiry into the Foundations of Theoretical Psychology" based "particularly" on Mach's ideas (Hayek 1952; 1963, p. vi).

[13] Wittgenstein (1922, 6.54): "My propositions [in the *Tractatus*] serve as elucidations in the following way: anyone who understand me eventually recognizes them as nonsensical, when he has used them – as steps – to climb up beyond them. (He must, so to speak, throw away the ladder after he has climbed up it.) He must transcend these propositions, and then he will see the world aright." Basically, Wittgenstein is thereby stating that logically speaking, the *Tractatus* is superfluous, while genetically, it is not. In this sense, the genesis process needs to be considered to be always prior to logic. The changing of world views is for instance not independent from "metapsychical" questions, such as the role of crutches or of intuition in the process.

one's steps in order to find the origin of potential mistakes in intuition. This as well can happen with the various influences of fundamental ideas.

Additionally, it seems that this phenomenon does not apply to all ideas in a similar way over time. For (genetically) fundamental epistemological or "early" ideas, there are strong differences. These differences have to do with the closeness of the ideas to the phenomenal or sensational (i.e. genetically "early") level of experience.[14] This concerns especially the closeness to empirical proto-scientific concepts from which later the scientific concepts are constructed. For instance, even strong "Machians" often do not later remember Mach's influence. As Einstein told to his friend Besso in 1948 (Speziali 1972, Doc. 153): "Now, as far as Mach's influence on my development is concerned, it was certainly great. […] How far [Mach's writings] influenced my own work is, to be honest, not clear to me. In so far as I can be aware, the immediate influence of D. Hume on me was greater. […] However, as I said, I am not in a position to analyze what is anchored in unconscious thought." As a result, in scientific (and especially economic) theory, genetically early concepts tend to be undervalued, while the logical relations tend to be overestimated in specific parts of concept formation. This is one of the main reasons for the dominance of "mainstream economics". But from a methodological perspective, the genetic-psychological aspects have to be regarded as prior and *erkenntnis*-theoretically at least as equal in importance (see also Mach 1905).[15]

Heterodox methods in economics

Even if these elaborations can only provide a brief overview on the *erkenntnis*-theoretical and methodological questions involved, the concept of methodological manifolds shows that a "heterodox" approach can be a scientific frame for economics. What is meant here as heterodox is not fundamentally defined as what it is not (i.e. "non-orthodox economics"), but as a meta-methodological (*erkenntnis*-theoretical) foundation of economic research. This frame can cover many more economic facts as any single method in economics and it is at the same time relatively consistent, e.g. at least as consistent as other methods. It is especially *erkenntnis*-theoretically consistent, i.e. it uses a consistent world view, which provides a theoretical advantage rare to be found in economic theory.

But as it became clear from the former arguments, this view entails some further implications, which go beyond the initial question of heterodoxy as a scientific method. First it raises the question of teaching economics with multiple methodologies. This idea certainly is not new in itself, but here it is based on a strong *erkenntnis*-theoretical foundation. It is actually the basis of whole (and empirically successful) science education systems, such as the one in Finland (see Siemsen & Siemsen 2009, Siemsen 2010c) and elaborate science educational theories (see Siemsen 2010b).

Secondly, the meta-methodology can be used for analyzing fundamental inconsistencies of concepts in existing economic theories (see for instance Siemsen 2010c) and the inconsistency of switches of world views within a theory. Especially in mainstream economics, for instance, it is usual to switch from a logicist/mathematical world view to a physical world view, especially in the use of statistics (see also Krafft 1962). The necessary *erkenntnis*-theoretical "cuts" are often neither noted and rarely reflected upon. Local concepts, such as the use of "action" are generalized by analogy, again without reflection and careful testing on the applicability of such analogies. Such omissions are *erkenntnis*-theoretically avoidable, which would greatly benefit the consistency of the theory in question.

Thirdly, as a result from the former argument, methods can be compared and evaluated according to their generality and to the genetic and/or logical basis of their foundational

[14] The reasons will be elaborated in more detail later.

[15] There is additionally a meta-theoretical case for metapsychical analysis, see Siemsen (2010c). This has for instance been attempted by Schmolders, Schröder & Seindenfus (1956) on Keynes' psychological concepts.

concepts. This method of conceptual history (existing economic theories necessarily have a historical dimension) has already been used and developed especially by Koselleck (2003).

Finally, the approach of methodological manifolds can be used in order to reconstruct a more general version of economic theory, one which can make use of many findings and facts from existing theories and bring them together. Such a reconstruction would provide an inherently heterodox approach because of its multi-perspective view without sacrificing scientific rigour in conceptual clarity to postmodernist arbitrariness. It is probably not by chance that one of the founders of post-modernist ideas in science, Paul Feyerabend, was also an advocate of this world view. Nevertheless, his interpretation certainly takes some of the foundational issues too lightly, which led to many misinterpretations among his followers. A methodological relativistic view is not necessarily arbitrary, even if it is necessarily unfinished. From this necessarily unfinished view, always new (and fundamentally new) knowledge and new syntheses can in principle be developed. It tends to be a very creative methodological basis for innovative science.

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