

# To observe or not to observe: Complementary pluralism in physics and economics

Edward Fullbrook<sup>1</sup> [University of the West of England, UK]

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## Introduction

This quotation from **Einstein** expresses the essence of what this paper hopes to say.

Whether you can observe a thing or not depends on the theory which you use. It is theory which decides what can be observed.

[Said to Werner Heisenberg during his 1926 Berlin lecture, quoted in Salam, 1990]

Rarely, and probably never, has a major discipline experienced systemic failure on the scale that economics has in recent years. Its fall from grace has been two-dimensional. One, economists oversaw, directly and through the prevalence of their ideas, the structuring of the global financial economy that collapsed. Two, except for a few outcasts, economists failed to observe, even before the general public observed, the approach of the biggest financial meltdown of all time. Never has a profession betrayed the trust of society so acutely, never has one been in such desperate need of a fundamental remake.

As an epistemological event, the 2008 meltdown of the global financial system ranks with the observation of the 1919 solar eclipse. If professional practice in economics resembled that in the natural sciences, then in the wake of the recent global disaster economists would be falling over each other to proclaim the falsity of their theories, the inadequacy of their methods and the urgent need for new ones so that they could observe economic reality.

It is now evident to nearly everyone except economists, and increasingly even to many of us, that our collective failure to see the coming of the calamity before it occurred and the fact that the system that collapsed had been tailored to fit mainstream teachings means that our profession harbours fundamental misconceptions about the way economies, most especially their markets, function.

**But there exists in economics a malaise more fundamental than its theories themselves.** The malaise concerns how economics regards and uses its theories, and it is this and its relation to the teaching of economics that this paper addresses, because it is really this that must be corrected if economics is to be made less a facilitator of human disaster in the future.

I need to be clear about what I mean by the word “pluralism” in an epistemological context. So here is the definition which this paper presumes.

“Pluralism” refers to

- some degree of acceptance

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- of two or more mutually inconsistent theoretical frameworks
- which pertain to the same or overlapping domains of reality.

So, given multiple theoretical frameworks within a field of study, there are three variables in that definition of pluralism:

1. degree of acceptance
2. degree of mutual inconsistency, and
3. degree or extent of overlapping domains.

With regard to the first of the three variables, the degree to which mutually inconsistent theoretical frameworks are tolerated or accepted or valued by practitioners of a scientific or scholarly discipline, this paper makes a distinction between what I call **competing pluralism** and **complementary pluralism**.

I am going to begin by considering complementary pluralism, because it is the kind with which we as economists are least, or even not at all, familiar. Its paragon exemplification is 20<sup>th</sup> century physics. And, having begun with Einstein, I am going to continue to draw examples directly from physics.

## Physics

Every scientific pursuit launches itself from a conceptual framework, a set of presuppositions about the nature of reality that, by providing a radical simplification of reality, makes investigation possible. These include such things as

- a classification of entities,
- which properties of those entities are taken into account,
- the types of connections recognized,
- whether all events are determinate or not,
- the nature and direction of causal relations,
- and whether or not there exist structural relations as well as aggregate ones.

In this way a conceptual framework defines a particular point of view toward its object of enquiry, and consequently, different conceptual frameworks offer different points of view. Or in Einstein's words, they determine "whether you can observe a thing or not."

For example, what one observes when one looks at Michelangelo's statue of David depends on the standpoint from which it is observed. Therefore, a full appreciation of David requires observing it from more than one perspective. Likewise, knowledge accumulation often depends upon investigating empirical domains through more than one conceptual lens. The acceptance of this view has been embraced by modern physics, because the profession realizes that the advancement of knowledge of the physical world ultimately depends on it.

The celebrated physicist David **Bohm** describes the pluralist nature of knowledge accumulation as follows.

What is called for is not an *integration* of thought, or a kind of imposed unity, for any such imposed point of view would itself be merely another fragment. Rather, all our different ways of thinking are to be considered as different ways of looking at the one reality, each with some domain in which it is clear and adequate. One may indeed

compare a theory to a particular view of some object. Each view gives an appearance of the object in some aspect. The whole object is not perceived in any one view but, rather, it is grasped only *implicitly* as that single reality which is shown in all these views. When we deeply understand that our theories also work in this way, then we will not fall into the habit of seeing reality and acting toward it as if it were constituted of separately existent fragments corresponding to how it appears in our thought and in our imagination . . . [Bohm, 1983, pp. 7-8]

It is this ethos regarding the advancement of knowledge within a discipline that I call “complementary pluralism”. My term “competitive pluralism” refers to a very different state of affairs, one where different theories are routinely treated as competitors, and where implicitly the theories are seen not as means contributing to understanding but rather as ends in themselves.

In the economics profession there appears to be a common and ingrained misconception regarding the role and nature of pluralism in the natural sciences. If asked whether the statement “Physics has a long tradition of encouraging pluralism” is true or false, many economists would, I suspect, answer “false”. So I feel obliged to present some more primary examples directly from the literature of physics to show that this view is fundamentally mistaken. I am concerned with the period roughly from the 1880s to the present. For evidence I will, in addition to Einstein and Bohm, look at what four other preeminent physicists, who together roughly span this period, have said regarding pluralism in physics.

I begin with Heinrich **Hertz** (1857-1894). Hertz was first to detect the electromagnetic waves predicted by Maxwell’s unification of electricity and magnetism. Subsequently Hertz wrote a textbook, *The Principles of Mechanics Presented in a New Form*. In it he offered a new theoretical framework congenial to the new developments. In the book’s introduction, intended for advanced physics students, he sets out what he understands to be the prevailing epistemological ethos in his profession in the late 19<sup>th</sup> century. He writes:

In endeavouring thus to draw inferences as to the future from the past, we always adopt the following process. We form for ourselves images or symbols of external objects. . . . The images of which we here speak are *our conceptions of things*. [Heisenberg, 1962, p. 154]

. . . various images of the same objects are possible, and these images may differ in various respects . . . [Heisenberg, 1962, p. 155]

. . . we cannot decide without ambiguity whether an image is appropriate or not; . . . One image may be more suitable for one purpose, another for another . . . [Heisenberg, 1962, p. 156]

It is important to understand that Hertz was not making a case for pluralism here, but instead merely describing to the physics student the basis of the ethos of complementary pluralism that he saw as characterizing his profession, and thereby as being the context into which his book was introducing a “new system of mechanical principles”, a new “mode of conception”, a new “mode of treatment”, a new “mode of thought”. All those are Hertz’s phrases.

A second account of the operation of pluralism in physics is provided by Louis **de Broglie** (1892-1987), one of the principal founders of particle physics. He writes as follows:

. . . the quantum of action compels us today to employ “complementary” descriptions to account for the phenomena on the atomic scale. By this term we are to understand descriptions which are certainly complementary but at the same time, taken strictly, incompatible . . . ; each of these complementary descriptions is an “idealization” *permitting us to present certain aspects of the phenomena under consideration, but not all the aspects.* [emphasis added]

The best known instance of such complementary descriptions is supplied by the two descriptions of Matter and Light by means of waves on the one hand and of corpuscles on the other. The employment of each idea . . . *has proved essential for the interpretation of some phenomenon or other*, but the two ideas still remain, despite every effort, incapable of being reduced to terms of the other, and the only connection that can be established between them is of a statistical nature. [emphasis added] [Broglie, p. 277]

This is an even more robust pluralism than the one Hertz describes, as it identifies the necessity of deploying within the same domain theories that are incompatible.

Werner **Heisenberg**'s [1901-1976] understanding of the need for an ongoing pluralism is perhaps even more radical. He writes:

. . . it was found that already in the theory of electricity an analysis using these concepts was no longer possible, and therefore in the investigation of this new domain of experience there emerged new systems of concepts leading to a final mathematical formulation of the laws of electricity.

And then speaking generally of systems of concepts and laws, Heisenberg writes:

. . . we cannot expect [its] concepts and laws to be suitable for the subsequent description of new realms of experience. It is only in this limited sense that quantum-theoretical concepts and laws can be considered as final, and only in this limited sense can it ever happen that scientific knowledge is finally formulated in mathematical or, for that matter, in any other language. [Heisenberg, 1962, p. 27]

And there is a quote from near the end of Heisenberg's life that is very close to the Einstein quote with which I began.

What we observe is not nature itself, but nature exposed to our method of questioning. [Wikiquote]

The leaders of the next generation of physicists continued to emphasize the importance of pluralist practice as a basic requirement for the advancement of their science. For example, Richard **Feynman** [1918-1988], celebrated for expanding the theory of quantum electrodynamics and particle theory, spoke to his students as follows in one of his published lectures.

As long as physics is incomplete, and we are trying to understand the other laws, then the different possible formulations may give clues about what might happen in other circumstances.

and

We must always keep all the alternative ways of looking at a thing in our heads, so physicists . . . pay but little attention to the precise reasoning from fixed axioms.

One of the amazing characteristics of nature is the variety of interpretational schemes which is possible. [Feynman, 1965, pp. 53-54]

The direct contradiction between the basic concepts of relativity and quantum theory, the pinnacles of physics, has almost inevitably led physicists both to emphasize pluralism's necessity for advancement of scientific knowledge and to articulate the epistemological logic underlying the criterion of "appropriateness" asserted by Hertz.

The complementary pluralism of physicists takes it for granted that without utilizing different conceptual systems that often contradict each other, our understanding of physical matter would be a small fraction of what it is. For example, compare the two best known and most important post-Newtonian theories with regards to how they conceive the basic entities, properties and connections of the physical realm.

General relativity conceives of space and time as continuous; quantum theory conceives of them as discontinuous.

General relativity conceives of matter as particulate; quantum theory conceives of it as a wave-particle duality.

General relativity conceives of physical objects as having actual properties; quantum theory describes them as having only potential properties within the given physical situation.

General relativity conceives all physical reality as determinate and all events as in principle having a causal explanation; quantum theory admits indeterminacy and events incapable of causal explanation.

Conceptual differences greater than these are virtually unimaginable. And yet physicists perceive relativity and quantum mechanics not as competing theories, but rather as different and complementing conceptual approaches to the fundamentals of physical reality. This radical complementary pluralism, which physicists as a group embrace, is physics' response to the complexity of the domain, physical matter, which they wish to understand. They know and appreciate deeply that, as Einstein said, "Whether you can observe a thing or not depends on the theory which you use."

**And they want to observe as much as possible.** So they use more than one theory, more than one conceptual system. Economics could be conducted in similar fashion if various cultural, institutional and sociological barriers were broken down.

## **Ideology**

These examples from physics show why conceptual pluralism of the complementary sort has proven essential for the broad advancement of knowledge. But in the social sciences, complementary conceptual pluralism is required for another and for some of us a no less important reason: the preservation of democracy. The fact, as explained by Einstein, Hertz,

de Broglie, Heisenberg, Feynman and Bohm, that a conceptual system defines, at the exclusion of others, a point of view toward its object of enquiry has in the social sciences, in addition to its epistemological consequence, an ideological one.

There are two reasons why this is so.

First, the conceptual systems of social sciences can alter the objects of their enquiries by becoming part of the conceptual and belief systems through which humans conceive of themselves and of others and by which they make choices. In the daily functioning of societies this recursive dimension of the social sciences, economics especially, becomes increasingly significant as mass higher education becomes the norm, even more so when as in the United States there is a social science input into most undergraduate degrees.

Second, the social sciences, economics especially, provide means by which governments preserve or reconstruct, sometimes fundamentally, the basic realities of societies. Different conceptual systems, such as institutional and neoclassical economics, present different sets of choices, real or imagined, to be chosen and acted upon by human populations at large.

It can never be the case that each of these sets of choices will equally favour every group in society, so that when a social science falls victim to anti-pluralism it becomes inescapably and profoundly ideological. *If only one conceptual framework is permitted, with the consequence that it alone is inculcated into the citizenry and its leaders, then the choices that in a democracy should be out in the open and belong to the people are hidden from view and the free discussion and informed debate upon which all democracy depends is silently eliminated.*

The neoclassical monopoly in the classroom has meant that it has brainwashed successive generations of students into viewing economic reality exclusively through its concepts.

The key word is “exclusively”. I would be violently opposed to the elimination of neoclassical economics from the economics curriculum because, in its limited way, it offers insights into economic phenomena and should be part of the democratic debate. It is not neoclassical economics itself, but rather the forbidding of all the other approaches to understanding and gaining knowledge of economic phenomena that is so dangerous because it fosters ignorance and undermines democracy.

Nor is the menace limited to economics students. Through journalism, their indoctrination is transferred to the general population, so much so that today many leaders of society, including Presidents and Prime Ministers, no longer know how to think about economic matters outside the neoclassical conceptual system. The solution is simple, economics departments should, like other university departments, be barred from acting in effect as political propaganda centres.

Of course complementary pluralism, the epistemological ethos of modern physics, remains a minority position in economics. It may even remain such among non-neoclassical economists. Here, traditionally pluralism has been indulged only in the competitive sense. But not so long ago even this was daring.

In the context of late 20<sup>th</sup> century economics, the idea of encouraging pluralism of any kind was regarded as profane. And complementary pluralism was unthinkable. This is manifest in the history of the International Confederation of Associations for Pluralism in Economics

(ICAPE), formerly named the International Confederation of Associations for Reform in Economics (ICARE). The “aims and purposes” spelled out by its brave and ahead-of-their-time founders in 1993 included the following:

to promote a new spirit of pluralism in economics, involving critical conversation and tolerant communication among different approaches, within and across the barriers between the disciplines ....

The very idea that they were seeking to promote “tolerant communication” reveals a desperate state of affairs. But beyond the virtue of tolerance and perhaps some enhancement of career opportunities it was not altogether clear why they were promoting pluralism.

However, ICAPE’s avowed reason for supporting pluralism changed decisively in 2000. That was the year the organization changed its name, “pluralism” superseding “reform”. Along with the name change, the board issued a statement that, knowingly or unknowingly, embraced the ethos of modern physics:

the belief that theoretical pluralism and intellectual progress are complements ....

Coming from a generation of economists who had no comprehension of complementary pluralism, this was a courageous and seriously innovative move. It was also an idea nearing its time. That same year the idea was also put forward in Paris by a small group of French economics students. And those students put forward the idea of complementary pluralism for economics with such vigour and flair and optimism, and articulated it so well that they started a world-wide movement. Their [Autisme Economie Manifesto](#), included the following.

Out of all the approaches to economic questions that exist, generally only one is presented to us. This approach is supposed to explain everything by means of a purely axiomatic process, as if this were THE economic truth. We do not accept this dogmatism. We want a pluralism of approaches adapted to the complexity of the objects and to the uncertainty surrounding most of the big questions in economics.

The students phrase, “approaches adapted to the complexity of the objects” is an in-your-face radicalization of the demand for a complementary-pluralist economics because it inverts the traditional but implicit philosophical idealism of economics, whereby the approach takes precedent over the object of inquiry, the observation and reality of the latter being admitted only to the extent that it is illuminated by the former.

In the past this disposition has characterised not just neoclassical economists, but the various schools generally. In the context of this tradition, the naked spirit of empiricism in the students’ petition, their demand that economics should observe the real world, was, and for many economists continues to be, shocking.

## **Conclusion**

The eminent contemporary physicist Jean-Philippe **Bouchaud** [2008, pp. 9, 291] recently commented as follows:

the crucial difference between physical sciences and economics . . . is . . . the relative role of concepts, equations and empirical data. Classical economics [meaning today’s mainstream] is built on very strong assumptions that quickly become axioms: the



rationality of economic agents, the invisible hand and market efficiency, etc. An economist once told me, to my bewilderment: “These concepts are so strong that they supersede any empirical observation.”

Regarding this refusal to observe, Bouchaud writes:

there is a crucial need to change the mindset of those working in economics . . . They need to move away from what Richard Feynman called Cargo Cult Science: a science that follows all the apparent precepts and forms of scientific investigation, while still missing something essential.

[Bouchaud, 2008, p. 292]

Economics missing essential, the will to observe, will not be acquired until the profession embraces full-heartedly the elemental truth emphasized by Einstein:

Whether you can observe a thing or not depends on the theory which you use.

And elaborated by Hertz:

We form for ourselves images or symbols of external objects. . . . One image may be more suitable for one purpose, another for another . . .

And by Broglie:

each of these complementary descriptions is an “idealization” permitting us to present certain aspects of the phenomena under consideration, but not all the aspects.

And by Heisenberg:

we cannot expect concepts and laws to be suitable for the subsequent description of new realms of experience.

And by Feynman:

We must always keep all the alternative ways of looking at a thing in our heads, so physicists . . . pay but little attention to the precise reasoning from fixed axioms.

And by Bohm:

One may indeed compare a theory to a particular view of some object. Each view gives an appearance of the object in some aspect.

This complementary pluralism voiced by the most eminent members of the physics profession over the past 130 years should be the goal of the economics profession. The path for economics from epistemological degeneracy to respectability will be long and arduous. But so also was physics’ escape from the axiomatic monism policed by the Vatican.

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**Author contact:** [edward.fullbrook@btinternet.com](mailto:edward.fullbrook@btinternet.com)

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