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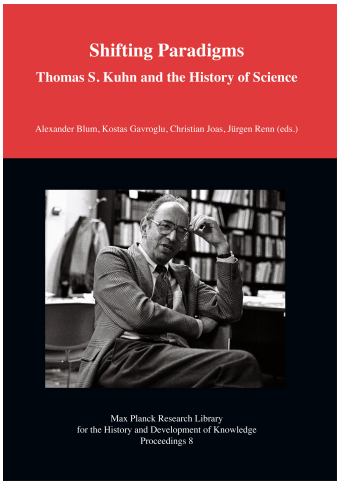

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Chapter 15
Science, Politics, Economics and Kuhn's Paradigms

José M. Sánchez-Ron

Introduction

More than ever before, Thomas Kuhn's *The Structure of Scientific Revolutions* has opened the door of history of science to sociological considerations. Scientific revolutions, Kuhn taught us, do not start because normal science definitively fails—we can never be sure of that—but because a part of the scientific community becomes disillusioned with the dominant paradigm. In this sense, it is sociology, not logic, that explains the change of paradigm, sociology or the hope for better science in the future. Kuhn wrote:

> Paradigm debates are not really about relative problem-solving ability, though for good reasons they are usually couched in those terms. Instead, the issue is which paradigm should in the future guide research on problems many of which neither competitor can yet claim to resolve completely. A decision between alternate ways of practicing science is called for, and in the circumstances that decision must be based less on past achievements than on future promise. (Kuhn 2012, 156)

However, if we talk about "future promises," then we enter a world inhabited by more than experiments, data and theories; we enter in a world in which scientific expectations, as well as political decisions and how the public views science (that is, "cultural values"), affect the directions that scientific research will take in the future.[1]

[1] Prominent among those who have illuminated some of the external influences in the development of science is Paul Forman, especially in two works; in his classic "Weimar Culture and Quantum Mechanics," he argues that the crisis that permeated Germany after its defeat in World War I led a number of distinguished physicists and mathematicians to reject or limit the validity of causality in physics, and to incorporate acausality in the interpretation of quantum mechanics. Later on, in 1987, he showed that the military funding of research during the Cold War affected the direction of research carried out by physicists in the United States. Paul Forman, "Weimar Culture, Causality, and Quantum Theory, 1918–1927: Adaptation by German Physicists and Mathematicians to a Hostile Intellectual Environ-

Kuhn, Politics and History as a Way to Act in the World

As Mary Jo Nye pointed out, "a political view is not explicit in Kuhn's writings. He did not set out on a political mission to become a public intellectual and tried to avoid political readings of his work" (Nye 2011, 250). Of course, we should not blame him, because political considerations were not present in his book; most of history of science is pursued along the same lines. However, such intentions are rather strange, for did Kuhn not teach us that we must also look further than mere science, and that social elements (perceptions, beliefs, hopes and so on) are in fact, very important? Did he not prioritize history over logic? When we ask ourselves such questions, we are led to think about the purpose of history—not only history of science—and the moral obligations, if any, of historians. "The responsibility, the obligation, of a historian is to tell the truth as he sees it, the whole truth and nothing but the truth. He should not allow himself to be a propagandist or to be used by propagandists. This is the great temptation and the great danger of history as a profession because history is, after all, the case that one makes for almost any political case"; so wrote Bernard Lewis, the reputed historian of the Middle East, in his memoirs. Of course, the "history" he refers to may be any history: political history, economic history, military history or history of science (Lewis and Churchill 2012, 140).

Yes, history can be used in perverse ways, but even so, there are other scenarios besides the purely intellectual one of reconstructing the past for its own sake. Almost immediately after writing the previous sentence, Lewis in fact stated: "By the study of history we can arrive at some better understanding of the nature of the human predicament in this universe; of what we can do and what we can't do; of where we are and, with luck, where we are going. History may serve us as a guide or as a teacher" (Lewis and Churchill 2012, 142).

Even I understand that history of science justifies itself independently of any practical considerations, I am also sympathetic to the well-known idea the Italian philosopher, critic and educator, Benedetto Croce (1866–1952), puts forward in his book, *La storia come pensiero e come azione* (1938). He wrote:

> Historical culture has for its object the keeping alive of the consciousness which human society has of its own past, that of its present, that is, of itself, and to furnish it with what is always required in the choice of the paths it is to follow, and to keep in readiness for it whatever may be useful in this way, in the future. (Croce 1949, 199)

ment," (1971), "Behind Quantum Electronics: National Security as Basis for Physical Research in the United States, 1940–1960", (1987). For comments on Forman's work, see Carson, Kojevnikov and Trischler (2011); Schweber (2014).

In a similar vein, in his *Autobiographical Reflections*, John Stachel wrote:

> But one must not only continue to learn, to guard against all rigidity of belief, all dogmatism. One must continue to act in the world, not to be paralyzed by the knowledge that all opinions are fallible. We must act to change the world, our personal world, our social world, our intellectual world, guided by the best current beliefs, but always ready to change these in the face of new information. Our knowledge may fallible, but it is corrigible! (Stachel 2003, xiv)

In a different context but with a similar possible reading, Paul Forman wrote:

> [M]ore and more it is coming to be accepted that in social and humanistic studies, and particularly on history, the scholar's recognition of significance […] is inseparable from judgments of good and bad, desirable and undesirable. (Forman 1991b, 72)

And here Forman quotes Louis Galambos: "Moral judgments […] have always characterized the best historical scholarship" (Galambos 1983, 493).

I do not know if Galambos' dictum is true. Regardless of whether or not it is true that "moral judgments have always characterized the best historical scholarship," I believe that we, as historians of science, should consider intervening in the present as part of our profession, a profession that does not limit itself to looking at the past for its own sake. Scientists—and many professionals from other disciplines—claim, with evident reasons, that their profession is useful to society. There is no reason why historians of science should not try to show that they, too, are useful to society besides the obvious and of course important achievement of helping to understand the scientific past. Actually, such a claim has been put forward before: Forman noted that Hunter Dupree, the highly respected historian of American science, was not reluctant to offer history-based advice on science policy. In addition, Lewis Pyenson pointed out that when our discipline was founded, one of its major goals was supposed to be "clarity to act in the present on the basis of an understanding of the past."[2]

History of Science, Public Opinion and Newspapers

The question, or at least one of them, is how to intervene in the present. Here, I want to argue that one way historians of science can act in the present world is to participate in public discussions by writing in newspapers. Some scientists, especially physicists, have been doing this for a long time, even creating journals

[2] See Forman (1991a); Pyenson (1989). In this regard, see Brush (1995, 223).

(*Bulletin of the Atomic Scientists*, established in 1947, for example). Clearly, this is thought of as a way of influencing both public opinion and political decisions.[3]

For quite a number of years, I have been using history of science to write articles of opinion in what is considered to be Spain's (and Hispanic America's) main newspaper, *El País*. I have attempted to use specific episodes taken from the history of science in order to defend different points of view related to questions of present social relevance. Let me give some examples: On 19 February 2011, I published an article entitled "Juventud, maldito Tesoro" (Youth, Damned Treasure). Here I discussed the terrible present unemployment figures among Spaniards—between 40 and 50 percent, for youths and young adults. This implies that the best of them must go abroad to find work. I was interested particularly in the case of young scientists who especially suffer from the present situation. My argument was that young Spanish scientists, the best of them, should be given the opportunity to lead a great project. I mentioned in particular the creation of the new, well-endowed National Centre of Cardiological Illnesses, whose leadership was offered to an eminent, though rather old cardiologist who had carried out his career in the United States at Mount Sinai Hospital in New York. To defend my point, I explained that when in 1884 Cambridge University searched for a replacement for Lord Rayleigh as director of the Cavendish Laboratory, the position went to the young physicist, J. J. Thomson. Thomson was far from having the scientific credentials of the first two directors of the Cavendish Laboratory, James Clerk Maxwell and Lord Rayleigh, but over the course of his career, he would bring years of glory to the Institute, to Cambridge University and to England.[4] What is difficult for institutions, I argued, is to identify the genius when it is not yet fully manifested; to give young scientists the opportunities and facilities to put forward all their creative abilities, something that in general it is out of reach for older, more established scientists.

My second example is an article I published on 1 February 2009, the year of the 150th anniversary of the publication of Charles Darwin's *Origin of the Species*, under the title "El ejemplo y las lecciones de Darwin" (The Example and Lessons

[3] "Eugene Rabinowitch intended," wrote Patrick David Slaney, "*Bulletin of the Atomic Scientists* to be an institution of scientific internationalism in the early Cold War. He hoped that the Bulletin might serve, faute de mieux, as a site of international contact that would allow his vision of the scientific life to contribute to peace and stability in the shadow of the atomic bomb" Slaney (2012, 114). Scientists also used books as a way of defending their ideas and of influencing political decisions. A splendid example in this sense is Steven Weinberg's *Dreams of a Final Theory: The Search for the Fundamental Laws of Nature* (1993), which was clearly intended as a defense of the construction of the Superconducting Super Collider accelerator.

[4] "In December 1884, I was," wrote J. J. Thomson, "to my great surprise and I think to that of everyone else, chosen as [Rayleigh's] successor. I remember hearing at the time that a well-known college tutor had expressed the opinion that things had come to a pretty pass in the university when mere boys were made professors" Thomson (1936, 98).

of Darwin). My purpose was not just to remind *El País* readers of the anniversary and celebrations that were going on throughout the world in that year (although of course I took this opportunity to explain the importance of Darwin's book). I wanted to criticize the new presentation of creationism—the so-called "Intelligent Design"—as well as a declaration by Queen Sophia of Spain, who had said that: "Religion should be taught to children at schools, at least until a certain age: children need an explanation of the origin of world and of life." Other instances I have used as examples include Einstein's views on the Jewish problem to illustrate my views on the Israeli-Palestinian conflict, and the decline in Robert Oppenheimer's scientific production when he became an administrator and leader of scientific projects (Sanchez-Ron 2002, 2004).

My own experience is that these newspaper articles are well received by the public, which leads to another positive consequence: they serve to socially promote our discipline.[5] Emphasizing and using the history of science in such a way fits well with the goals Kostas Gavroglu and Jürgen Renn mention in the introduction to their volume in honor of Sam Schweber, *Positioning the History of Science*: "After more than a century, the history of science is still in search of a wider audience […] In any case, the history of science today has turned out to be dramatically different from what its founding fathers imagined" (Gavroglu and Renn 2007, 3).

Kuhn, Political Revolutions and the Search for New Political Paradigms

As I pointed out earlier, while a political view is not explicit in Kuhn's writings, in *The Structure* he refers to the parallels between scientific and political revolutions:

> Political revolutions are inaugurated by a growing sense, often restricted to a segment of the political community, that existing institutions have ceased adequately to meet the problems posed by an environment that they have created. In much the same way, scientific revolutions are inaugurated by a growing sense, again often restricted to a narrow subdivision of the scientific community, that an existing paradigm has ceased to function adequately in the exploration of an aspect of nature to which that paradigm itself had previously led the way. In both political and scientific development the sense of malfunction that can lead to crisis is prerequisite to revolution […]

[5] In the troubled and changing times we are living in, throughout the whole world, it might be a good idea to consider producing a collective monograph—this is another of my proposals here—whose chapters deal with some of the main problems that the world is currently facing, chapters which use some episodes taken from history of science.

> This genetic aspect of the parallel between political and scientific development should no longer be open to doubt. The parallel has, however, a second and more profound aspect upon which the significance of the first depends. Political revolutions aim to change political institutions in ways that those institutions themselves prohibit. Their success therefore necessitates the partial relinquishment of one set of institutions on favor of another, and in the interim, society is not fully governed by institutions at all. Initially it is crisis alone that attenuates the role of political institutions as we have already seen it attenuate to role of paradigms. In increasing numbers individuals become increasingly estranged from political life and behave more and more eccentrically within it. Then, as the crisis deepens, many of these individuals commit themselves to some concrete proposal for the reconstruction of society in a new institutional framework. At that point the society is divided into compelling camps or parties, one seeking to defend the old institutional constellation, the others seeking to institute some new one. And, once that polarization has occurred, *political recourse fails*. Because they differ about the institutional matrix within which political change is to be achieved and evaluated, because they acknowledge no supra-institutional framework for the adjudication of revolutionary difference, the parties to a revolutionary conflict must finally resort to the techniques of mass persuasion, often including force. Though revolutions have had a vital role in the evolution of political institutions, that role depends upon their being partially extrapolitical or extrainstitutional events. (Kuhn 2012, 92–94)

Suggestive as these ideas are, Kuhn did not try to develop such well-founded words about *political* revolutions. As is well known, *The Structure* is limited only to *scientific* revolutions; not even *technological* revolutions—which, by the way, may give rise to sociopolitical revolutions—were considered.[6] Nevertheless, five decades after the publication of *The Structure*, we find that the political situation in some parts of the world fit quite well with Kuhn's schema. I am referring to the protests that took place in the last few years in countries like Spain, Greece and Portugal, and even though they are not similar, those in Tunisia and Egypt. Especially in the case of the southern European countries, the masses that gathered asked for radical changes in the political systems that direct their countries. Reporting on the manifestations that took place in Spanish cities like

[6] "Kuhn is mainly silent on the matter of the pursuit of science for practical applications," Nye (2011, 250).

Madrid, Seville, Granada and Valencia, Elizabeth Flock of the *The Washington Post* reported on May 18, 2011 that "many demonstrators referred to the protests as a 'Spanish Revolution'." The protests were in fact not limited to southern Europe. The Spanish example, also referred to as the *15-M Movement* (*Movimiento 15-M*; *M* standing for "May"), or the *Indignants Movement* (*Movimiento de los Indignados*) crossed the Atlantic and arriving in the United States, first in New York (September 2011), with the denominated "Occupy Wall Street" movement, and later reaching Chicago, Los Angeles and Seattle. As if the time was ripe, in 2010 Stéphane Frédéric Hessel, a diplomat and writer, had published a booklet *Indignez-vous!*, which became a bestseller, selling 3.5 million copies worldwide and translated into many languages, from Swedish, Greek, Hebrew and Hungarian to English, Spanish, Italian, German, Portuguese and Japanese. *Indignez-vous!* provided, so to say, ideological support for the first "indignants," the Spanish *indignados*.

To these national difficulties and reactions, and of more far-reaching consequences, there are the changes taking place worldwide, changes related to the emergence of new world powers, (China above all), and to the technological revolution that has emerged from the digital world.[7] Europe is becoming aware that it must renounce the "Enlightenment spirit"—a spirit continued in what is called Welfare State, with health and educational services available to all its citizens—which seems to have guided Europe's history for the last two centuries. Confronted with the limitations they are increasingly experiencing via privatizations, European citizens are feeding the ranks of the *indignants*, who are searching for a new political order, new institutions and new systems of representation. To achieve this, they are refusing to participate in well-established institutions, such as parliaments or political parties. We can say that "old" and "new" politics are incommensurable. And at this point enters Kuhn and his paradigms.

In an article published in April 2012, the prestigious journalist Juan Luis Cebrián wrote: "Emphasis must be placed in that we are not only confronted with a crisis, but with a structural change, a new paradigm whose foundation is the loss of influence and prestige of Occident" (Cebrián 2012).[8] Indeed, the present social situation can be accommodated quite well to the schema Kuhn presented in *The Structure*. It seems that the political paradigm in which many Europeans lived throughout the last century or so is facing an increasing number of anomalies.

[7] Representative of the changes that the digital revolution are introducing is what Tina Brown, editor in chief of *Newsweek* wrote about in what was announced as the last print issue of this weekly journal (December 31, 2012): "This is not a conventional magazine, or a hidebound place. It is in that spirit that we're making our latest, momentous change, embracing a digital medium that all our competitors will one day need to embrace with the same fervor. We are ahead the curve."

[8] Cebrián was the first director of *El País*; at present he is the president of PRISA, an audio visual and publisher of the large international group to which *El País* belongs.

"The system is obsolete," is one of the slogans of those who protested in Madrid. In other words, the period of so-called "normal science" seems to be reaching its end. The problem, of course, is finding a new paradigm.

The question here is not which characteristics the new paradigm should have, especially the paradigm sought by new generations, nor is it a question of the global or local, for instance, that would enable Europe to face Asia's threats to its economic and political power. The question I want to put forward here is whether it would be worthwhile considering if the ideas that Kuhn presented in *The Structure* can be extended to the present socio-political world, and which, if any, changes should be introduced in order to achieve them.

Economics as a Niche for Kuhn's Paradigms: Keynes and Hayek

These considerations take me to the following reflection: if, as seems to be the case, paradigms and "normal science" have not proved—apart from the attraction of *The Structure*—to be very fruitful in the realm of history of *science*, an interesting academic task would be to explore other fields. Leaving aside the one I have just mentioned, an interesting case study would be the "clash that defined modern economics," as Nicholas Wapshott recently characterized the confrontation between John Maynard Keynes and Friedrich von Hayek (Wapshott 2012).Such confrontation offers characteristics that remind us of something that Kuhn said in *The Structure*. Keynes' emphasis on the intervention of the state through fiscal and monetary policies in fighting economic recessions and depressions, and Hayek's emphasis that the free market produces a spontaneous order, can be compared to two alternative and conflicting paradigms that influence governmental decisions. That these are alternative economic paradigms was clear from the very beginning. Thus, after reading Hayek's *The Road to Serfdom*, Keynes wrote to Hayek on 28 June 1944:[9] "I should therefore conclude your theme rather differently. I should say that what we want is not no planning, or even less planning, indeed I should say that we almost certainly want more."

However, if we consider the Keynes-Hayek confrontation in the framework of a confrontation of paradigms, several questions arise. The first is the mentioned fact that they are two paradigms that coexist, something that does not fit too well with Kuhn's scheme. This fact was pointed out many years ago by Imre Lakatos and led him to propose the idea of competing scientific research programs. (The coexistence of what we might call the Newtonian and the Cartesian programs in the eighteenth century is a clear example in this sense. It is in such a framework that one can understand the work of Euler, a Cartesian as far his philosophical

[9]Quoted in Harrod (1951, 436).

views extend, who nevertheless contributed to the development of Newton's dynamics). "What [Kuhn] calls 'normal science'," wrote Lakatos, "is nothing but a research program that has achieved complete monopoly."[10] He immediately added something that fits very well with considering Keynes and Hayek's economic ideas as two rival research programs: "But, as a matter of fact, research programs have achieved complete monopoly only rarely and then only for relatively short periods." Indeed, only cursory knowledge of the economic history of twentieth and twenty-first centuries is needed to realize that Keynes and Hayek's theories have alternated in favor of politicians and economists. "Arguments over the competing claims to virtue of the free market and government, now rage as fiercely as they did in the 1930s. So who was right, Keynes or Hayek? [This] is a question that has divided economists and politicians for eighty years [and that still] mark the great divide between the ideas of liberals and conservatives to this day," wrote Wapshott (2012, xiv).[11]

There are, however, characteristics of Keynes and Hayek's contributions that justify considering them in the framework of Kuhn's theory, especially in the case of Keynes. I am referring to the special role that certain books play in the establishment of a new paradigm; books like Aristotle's *Physica*, Ptolemy's *Almagest*, Newton's *Principia* and *Opticks*, Franklin's *Electricity*, Lavoisier's *Chemistry* and Lyell's *Geology*, all of which were mentioned in *Structure* (Kuhn 2012, 10). In the case of Keynes, we have *The General Theory of Employment, Interest and Money* (1936), a book which that was perceived as revolutionary: "With publication of *The General Theory* in February 1936, Keynes fired the starting pistol for what came to be known as the Keynesian Revolution" (Wapshott 2012, 154).

Conclusion

As Michael Gordin and Erika Lorraine Milam pointed out when introducing a series of essays commemorating the golden anniversary of the publication of *The Structure of Scientific Revolutions*, "Kuhn's *Structure* has stuck with us. There are few books that one can continue to chew over decades after first reading, and even fewer that could generate such a colorful arrays of responses" (Gordin and Milam 2012, 478). However, in spite of such permanence, its relevance to historical studies is far from being clear. As Mario Biagioli explained:

[10] See Lakatos (1970 [1965], 155).

[11] In fact, Keynes himself viewed his book as revolutionary. "To George Bernard Shaw he wrote in January 1, 1935 that he believed he was 'writing a book on economic theory which will largely revolutionize—not I suppose at once but in the course of the next ten years—the way the world thinks about economic problems'," Nasar (2011, 328).

> While *Structure*'s philosophical ambition (though not the methodology) is still found in some science studies literature and among those who pursue 'historical epistemology,' it has always seemed irrelevant to most rank-and-file historians of science. Perhaps perceived irrelevance was masking the field's opposition to all things theoretical or its difficulties in tackling them, but, be that as it may, it was not uncommon to hear that, when he engaged in 'serious historical work' in the later *Black-Body Theory and the Quantum Discontinuity*, even Kuhn no longer sounded too Kuhnian.[12]
>
> Institutional trends only hastened the eclipsing of *Structure*'s role in the discipline. Following the near-complete failure to institutionally integrate the history and philosophy of science and the nearly complete migration of the history of science into history departments, the field either stopped asking philosophical questions altogether or started to frame them through the methodological it borrowed from other disciplines—disciplines it had rarely interacted with before, such as European sociology, cultural anthropology, cultural history, gender studies, and so on." (Biagioli 2012, 480)

While it might be true that most—but not all—historians of science have stopped asking philosophical questions, the sort of analysis that Kuhn introduced in *The Structure* nevertheless has a wider range of possible applications than history of science, or other rather academic fields.[13] In this paper, I have tried to show that Kuhn's ideas, the nature and dynamics of paradigms in particular, can be completed and tested in a series of scenarios that are very relevant in today's world, such as in the fields of politics and economy. More importantly, while Kuhn's model is being completed and tested, it can perhaps provide a good framework for understanding the world and the society in which we live, and in doing so, contribute to making the present more rational. Moreover, history of science is not necessarily foreign to such economic or political scenarios, for have historians of science not made great efforts in the recent decades to integrate their historical reconstructions precisely with political and economic considerations?

[12] I can testify to Kuhn's indifference, after writing *Structure*, to the paradigm's narrative. I was present, sometime in the last two months of 1978 in the lecture that Kuhn delivered at the New York Academy of Sciences, when he presented his then new book, *Black-Body Theory and the Quantum Discontinuity, 1894–1921* (1978). His first words were: "I am Tom Kuhn, and I am not going to mention at all the word 'paradigm'."

[13] "As Kuhn's respondents have demonstrated, the notion of a paradigm shift—which *could be applied to a variety of vocational or intellectual phenomena*—is historically visible at only certain scales and under unfairly controlled conditions;" Gibbs (2012, 512), italics added by the author.

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