Karl Popper's Contribution to Austrian Economics, the Quality of Science and Critical Thinking

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The Austrian-born philosopher Karl Popper charted new direction in the philosophy of science in the 1930s with Logik der Forschung (The Logic of Scientific Discovery 1959). His ideas can be recruited to support the little-known Austrian school of economics, to improve the quality of scientific research and to indicate how a unit on critical thinking can be a core subject in liberal education. If Popper's ideas are robust then the main features of his thinking should be the common property of all educated people. Some would say the same applies to Austrian economics.

The paper begins with a summary of the key features of Popper's critical rationalism followed by an introduction to Austrian economics and the way that some of his ideas can elevate the profile of the Austrian school. The paper then turns to the rising tide of concern about the quality and reliability of the scientific research that is published in some fields. Finally there is a proposal for short course to introduce various forms of critical appraisal of ideas that could be a core component of liberal education to promote imaginative problem-solving and lateral thinking.

POPPER'S CRITICAL RATIONALISM

In his introduction to Popper's philosophy Mark Notturno wrote "Popper was an outspoken champion of rationalism and a constant critic of subjectivist and authoritarian tendencies in science and society." (Notturno, 2003, Preface). His philosophy can be described as critical rationalism with a historical and evolutionary approach. He liked to sum it up in two nutshells. One is the critical rationalist credo "*I may be wrong and you may be right, and by an effort we may get nearer to the truth*". The other is the four-stage problem solving scheme that is described below.

Wade Hands demonstrated the difference that it makes to perceive Popper as a critical rationalist rather than the more usual "falsificationist", a label that implies that his ideas are merely a variation on the theme of logical empiricism. Hands is a leading contributor to the literature on the philosophy and methodology of economics and for many years he was a critic of Popper's views until he radically changed his perception. He wrote that Popper is best depicted as a *critical rationalis*t and he concluded that critical rationalism fits both the practice of mainstream economics and Popper's specific contribution to social studies - Situational Analysis and the Rationality Principle.

> If Popper's real message is critical rationalism, rather than falsificationist rules, then the method of SA seems to be quite fine. Popper explains in detail how to modify a particular SA explanation when it seems to be in conflict with the empirical data, internally inconsistent, or in conflict with more corroborated theories - if there are many paths to effective criticism, then preserving the RP and modifying the rest of the SA could be a perfectly reasonable response. The critical rationalist reading of Popper's philosophy thus relaxes the tension between scientific rationality and SA social science and it does so within a framework that is both more contemporary than, and devoid of many of the problems of, strict falsificationism." (Hands, 2001, 301).

Popper (1902-1994) was born in Vienna, the son of a prominent liberal lawyer with scholarly interests. He dropped out of high school and attended lectures at the university as an unmatriculated student, trained as a cabinet-maker and eventually matriculated. In 1928 he qualified to teach high school science and mathematics after a course that included a doctoral thesis on habit formation in children. He worked on the philosophy of science in his spare time and in 1935 he published *Logik der Forschung* that appeared many years later in English (Popper 1959).

He criticized the traditional idea that scientific theories are developed by collecting observations followed by confirmation of the theories with more observations. He argued that the creation of theories is a matter of inspiration and guesswork because new ideas arise as conjectures or speculations and the really vital function of observations is to act as *tests or attempted falsifications* of theories.

In the 1960s biological themes became more prominent in his work and he contributed to the revival of evolutionary epistemology by exploring the principle of natural selection in relation to the development of scientific theories and other forms of knowledge. Evolutionary epistemology is concerned with problem-solving and error-elimination under various forms of selective pressure unlike theories of knowledge that focus on the justification of beliefs and the numerical probability of theories.

Popper started with the old idea that knowledge grows by trial and error or in more learned terms by conjecture and refutation. He postulated that every organism from the amoeba to Einstein can be described as constantly engaged in problem solving (not necessarily consciously of course). Innovations in the plant and animal world arise from mutations which generate new reactions, new organs, new forms of life. For humans the most important innovations are new ideas. Living organisms confront selective pressures exerted by the biological environment and competing forms of life. Ideas meet the competition of alternative theories, critical arguments and experimental tests.

The central motif of Popper's evolutionary epistemology is a cyclic four-step problem-solving schema:

P1 ---> TS ---> EE ---> P2, P3, P4 etc

The starting point is a problem situation. In response the organism generates tentative solutions. These are subjected to the process of error elimination by various selective pressures. Humans can make the process of error elimination conscious and systematic by critical discussion and experimental testing. In the course of these activities new problems emerge.

This approach to scientific knowledge has at least two important consequences; (1) it resolves conflicting ideas about the various processes and activities which are involved in creative thinking and problem-solving and (2) it highlights the importance of finding unresolved issues (problems) and the willingness to recognize them, even to create them!

On the first point the evolutionary schema can be used to challenge views about science that can tend to promote antagonism between the rational (scientific) and the imaginative (literary) frames of mind. For example Peter Medawar in his book *Pluto's Republic* described the tension between the romantic and the rational views of science; the romantic points to the poetic inspiration involved in creating new theories while in contrast the rationalist makes much of data collection, experimentation and logical analysis. This conflict has broad cultural implications. The triumph of Newtonian mechanics was widely perceived as the full flowering of the so-called inductive method to find the truth by accumulating observations. This achievement provoked a revolt by romantics and poets who could not stomach a view of human activity that had no place for the imagination. Nor could they accept the mechanical universe. The result of this

collision has been a kind of cultural clash with imagination set against reason, the organic set against the mechanical, the inspiration of the poet set against the empiricism of the scientist.

Popper's theory offers a cure for this cultural conflict by harmonising the relationship between the various elements of the situation for both scientists and artists and indeed for anyone. These elements include traditional beliefs, criticism, logic, imagination and experimental trials. These elements each have a role to play and so there is no need for the tensions and antagonisms that flow from partial and narrow views of problem-solving and creativity, whether in science, art, technology or daily life. A helpful selection of Popper's thoughts can be found in David Miller's *A Pocket Popper* (Miller, 1983) and in a collection of "Cliff's Notes" for Popper's first five books Champion (2016).

On the second point the schema brings out the importance of recognizing problems and working on them in a critical and imaginative spirit. In this schema a problem functions as an ecological niche to be colonised by tentative solutions. Problems are welcomed as a challenge, not an impediment to science because they are the growing point or perhaps a habitat for new species of ideas. This provides a theory of discovery, based on the creative function of criticism. To grasp the full power of evolutionary epistemology it is necessary to understand this creative function of criticism in generating problems that can be seen as spaces for new ideas Problems are the habitat where new ideas grow and criticism has two functions, which are about equally valuable: (1) to eliminate error and (2) to reveal new problems, i.e. new habitats. Thus Popper's theory brings out both the error elimination and the creative function of criticism and we need to maximise the play of criticism to get the best out of both its functions.

Watson and Crick systematically used the critical approach in their pursuit of the double helix structure of DNA. As Crick described it:

> Our other advantage was that we had evolved unstated but fruitful methods of collaboration, something that was lacking in the London group. **If either of us suggested a new idea the other, while taking it seriously, would attempt to demolish it in a candid but non hostile manner**. This turned out to be quite crucial. In solving scientific problems of this type, it is almost impossible to avoid falling into error…Now, to obtain the correct solution of a [complex] problem usually requires a sequence of logical steps. If one of these is a mistake, the answer is often hidden, since the error usually puts one on completely the wrong track. **It is therefore extremely important not to be trapped by one's own mistakes**." (Crick, 1988, 70) [my emphasis].

In an interview he stated "It's getting rid of false ideas which is the most important thing in developing the good ones... You should not get bogged down with experimental details. You should make some sort of bold assumptions, and try them out" (Wolpert and Richards, 1989, 94-5). Richard Feynman was an exemplary critical rationalist. He famously said "science is organized skepticism in the reliability of expert opinion" and he introduced his students to scientific discovery as guessing followed by the deduction and computation of results from the guess to check with experimental observations (Feynman, 2013). This is what Popper called "conjecture and refutation". It seems that Feynman never encountered Popper's ideas and his impatience with philosophy and the soft social sciences was legendary (Feynman 1985).

Popper's student Bartley described four forms of criticism: (1) experience; (2) theories; (3) problems; and (4) logic (Bartley, 1982, section xiii onward). The criticism by test or experience is closely related to the main concern of theories of knowledge which are based on observations. The crucial difference is that for critical rationalists the observations are designed to *test* ideas, not to *verify* or *confirm* them. Of course good theories will pass a lot of tests but that is not the end of the matter because even the best theories have rivals and also internal problems which call for more work. The second form of criticism "by theories" consists of comparing the assumptions and implications of the theory under consideration with other well-tested theories. Criticism "by problems" or "check on the problem" means assessing how effectively the theory (or the policy proposal) addresses the problems that it was formulated to solve.

As for the process of forming critical preferences among rival theories, Popper suggested several criteria rather than one over-riding principle which leaves open the possibility that some theories will have different performances on the different criteria. This is consistent with Popper's support for

theoretical pluralism and the desirability of competing research programs. His first proposal applies to major "breakthrough" developments.

> The new theory should proceed from some simple, new, and powerful unifying idea about some connection or relation (such as gravitational attraction) between hitherto unconnected things (such as apples and planets) or facts (such as inertial and gravitational mass) or new 'theoretical entities' (such as field and particles). (Popper, 1963, 241)

Other features of the preferable theory are: it makes more precise predictions and these stand up to more precise tests; it explains more facts; it describes or explains the facts in more detail; it has passed tests where the rival failed; it has suggested new experimental tests and passed them.

POPPER AND THE AUSTRIAN ECONOMISTS

The argument in this section is that some features of Popper's ideas can improve the image of the Austrian school which currently makes up only about 2% of American economists. The Austrians have suffered from the perception that their methods do not meet the standards which have been taught in the philosophy of science since it became professionalised and specialised as an academic discipline under the influence of the logical empiricists led by Rudolf Carnap (1891-1970) and Karl Hempel (1905-1997).

Austrian economics is not widely taught and some background information will be helpful for most readers. It is pursued by a confederation of scholars who trace their intellectual ancestry to the founding father Carl Menger (1840-1921) and his colleagues Eugene Bohm Bawerk and Friedrich Weiser. Other significant early figures were John Bates Clark, Frank Fetter and Herbert J. Davenport in the US, Philip Wicksteed in England and Knut Wicksell in Sweden (Salerno 2010). Prominent Austrians in the next generation were Ludwig von Mises (1881-1973), Friedrich Hayek (1898-1992) and Lionel Robbins (1898-1984) in the first part of his career.

Until the 1930s the members of the school were concentrated in Austria with scattered supporters around the world. Now most of the "Austrians" are in the United States with two prominent hives of activity, one at the George Mason University in Virginia and another at the Mises Institute in Alabama. There are doctoral programs at George Mason University, Texas Tech, Texas Baylor and Virginia. The Austrians are closely affiliated with the Virginia school of public choice theory (Coase, Buchanan, Tullock) and the Ostrom/Bloomington school of public administration.

In the early 20th century the Austrian ideas appeared to be firmly planted in the mainstream of the economics profession but the impact of Keynes in the 1930s and the rise of mathematics in the 1940s transformed the situation. The Austrians rejected the Keynesian revolution and they also object to much of the mathematical analysis that rapidly became standard in the profession after the war. They insisted that mathematical analysis can be misleading if it is not handled with care and insight into the economic issues as well as the mathematical formalism. Consequently the Austrians were widely perceived to be out of date and amidst the mushrooming postwar growth of the profession they became practically invisible until the movement staged a revival during the 1970s (Vaughn 1990, Boettke 2015). Another adverse influence from the 1930s was the rise of the philosophy of science known as logical positivism in Vienna and logical empiricism in the United States.

Mises did not live long enough to see the Austrian revival although he did more than anyone to keep the ideas alive. Prominent in the revival were Hayek, Ludwig Lachmann (1906-1990), Murray Rothbard (1926-1995) and Israel Kirzner (1930 -) . The numbers have increased rapidly in recent years and it is hazardous to mention the names of contemporaries because any short list will give offence to many worthy scholars who are left out! For a concise and masterly account of the progress of the school from Menger to the present day see Boettke (2015).

In the aftermath of the Great Financial Crisis 2008 the Austrians emerged with a deal of credit for the insights they provided into the mechanism of the collapse (Thornton, 2009).

> Several high profile investment advisers and financial commentators have employed the Austrian Business Cycle Theory in their interpretation of the crisis. They have been inspired to revisit this theory as a result of the manifest failure of mainstream macroeconomists to

> foresee or explain the subprime mortgage crisis and its subsequent metamorphosis into a pandemic financial meltdown…a number of economists and journalists associated with the modern Austrian school had warned of an emerging housing bubble during the Greenspan era when the conventional wisdom was that the Federal Reserve System had matters well in hand (Salerno, 2012).

The leading emphases of the school include the salience of dynamic competition and entrepreneurial innovation in the marketplace, the origin of social institutions as the unintended consequences of human action, the subjective theory of value, recognition of the time factor in social and economic processes, and the uncertainty of human knowledge. Those ideas are not unique to the Austrians although they been especially diligent in drawing out their implications. They have distinctive ideas regarding the "boom and bust" business cycle (as described by Salerno), capital theory and especially the methodology and philosophy of research.

The Austrian approach can be described as the "situational analysis of human action", combining the language of von Mises, Talcott Parsons and Karl Popper. A central resource for Austrians is *Human Action* by von Mises, first published in 1949. A similar framework of analysis can be found in *The Structure of Human Action* published by Talcott Parsons in 1937 (summarized in Devereaux, 1964) and in *The Open Society and Its Enemies* and *The Poverty of Historicism* (Popper, 1945, 1957). The common features of the schemes of Parsons, von Mises and Popper are summarised in Champion (2010). The analysis starts with the human actor making plans and taking action to achieve his or her objectives. The actors take account of the various elements in the situation as they are subjectively perceived. These include the resources and capacities of the actors, the opportunities and constraints offered by the physical environment, the institutional framework of laws and regulations, and the social/cultural framework of written and unwritten mores, traditions, values and belief systems.

Some of the elements can change rapidly but many can only be changed slowly and the individual actor has very limited capacity to change the major elements of the situation. The outcome of actions are mediated (limited) by natural laws whether the actors are aware of them or not. The situation offers problems and opportunities for the actor/entrepreneur and Parsons in particular emphasised the element of individual choice and he thought of his approach as a voluntarist theory of human action (Devereaux, 1964).

Economists focus on the economic system, prices and production and the like but the framework is sufficiently expansive to take account of the impact of other factors and to coordinate the work in many areas of the social sciences and humanities. The framework drafted by the "gang of three" in the 1930s could have been used to maintain sociology and economics as an integrated discipline and to sponsor partnerships between economists and all students of social institutions - law, politics, literature, religion and cultural studies at large. There was a window of opportunity for these three leading figures in their respective fields to form a united front across the disciplines of sociology, economics and philosophy to promote the ideas that they shared and to debate the issues where they disagreed. This did not happen; there was no united front, no dialogue to resolve differences and the defective ideas that all three identified in the 1930s became embedded in the rapidly growing community of academics and researchers after the war. Consequently the kind of research programs which were implicit in the situational analysis of human action were blindsided by the dominance of logical empiricism, Keynesianism and mathematical formalism. This is not to decry the use of mathematics but the efficacy of numerical analysis has to be decided on a case by case basis by people who are understand both the mathematics and the economics.

The Achilles heel of the Austrian school in the eyes of the modern mainstream is the claim that the basic principles of economics can be established by logical analysis in advance of evidence (*apriori*) and they cannot and need not be empirically tested. Not surprisingly this position raised eyebrows after the rise of logical positivism/empiricism and Popper's ideas in the philosophy of science created a demand for empirical verification or at least testing of scientific theories. Living in Vienna von Mises saw this coming because he was alert to the activities of the famous Vienna Circle of logical positivists and he wrote a long criticism of positivism in his master work (von Mises 1949).

The strong form of apriorism is apparent in his comparison of monetary theory with geometry where all of the theorems are implied in the axioms. "The quantity theory does not add to our knowledge anything that is which is not virtually contained in the concept of money" (von Mises, 1966, 38). "The starting point of praxeology is not a choice of axioms and a decision about methods of procedure, but reflection about the essence of action…" (*ibid*, 39). Rothbard took the same strong position. "The fundamental axiom that individual human beings act, that is, on the primordial fact that individuals engage in conscious action towards chosen goals [in contrast with reflex or knee-jerk behavior], furthermore, since praxeology begins with a true axiom, A, all the propositions that can be deduced from this axiom must also be true. For if A implies B, and A is true, then B must also be true." (Rothbard, 1976). He asserted that these propositions are justified because they are deduced from the axiom of purposeful action. "Apart from the fact that these conclusions cannot be tested by historical or statistical means, there is no need to test them since their truth has already been established." (*ibid*).

In view of those arguments Mark Blaug wrote "Mises made important contributions to monetary economics, business cycle theory and of course socialist economics, but his later writings on the foundations of economic science are so cranky and idiosyncratic that we can only wonder that they have been taken seriously by anyone" (Blaug, 1992, 81). He quoted Samuelson's famous rejoinder to the Austrians. "Well, in connection with the exaggerated claims that used to be made in economics for the power of deduction and a priori reasoning…I tremble for the reputation of my subject."

Popper's approach offers a corrective to the methodological rhetoric of the Austrians and simultaneously a rejoinder to Blaug and Samuelson. For Popper the test of evidence applies to the explanations and predictions generated by a scientific research program. The program itself is a system of ideas including philosophical and metaphysical framework assumptions and methodological procedures and principles that generate explanations and predictions. Not all of these parts are amenable to empirical testing and this applies to the natural sciences as much as the human sciences.

Hence it is not a departure from standard scientific practice to make use of untestable propositions. The critical rationalist does not insist that all the premises and presuppositions in scientific discourse should be verified, merely that they stand up to criticism as well or better than other options (Hands, 2001, 301). Recall the four forms of criticism: empirical tests are a particular kind of criticism but they are not appropriate for all assumption, especially those of methodology and the philosophical framework assumptions of the program. They prove themselves at one step removed - by the power of the explanatory theories and the research programs that they generate.

The basic principles of Austrian economics such as the axiom of action can be regarded as working assumptions in the form of indispensable methodological procedures and assumptions which are required in all sciences. The axiom is often described as "self-evidently true" but it is better to describe as a methodological assumption that contributes to explanatory theories which are tested by their capacity to account for the phenomena under investigation, such as money, the Great Depression, unemployment, inflation and trade cycles including the Great Financial Crisis.

Popper made two other relevant contributions. One is the framework of Situational Analysis and the Rationality Principle which is functionally equivalent to the Austrian approach using the "axiom of human action" (Popper 1994). The second is to introduce students to the critical/creative problem-solving approach of the scientist who operates like an entrepreneur in a world of intellectual problems and opportunities, generating conjectures which are tested and criticised in the laboratory and the marketplace of ideas. Students who bring this approach to a course on Austrian economics will have less to unlearn than students who have encountered the philosophy of science in the more usual mode of collecting data and attempting to confirm theories. Harper explicitly drew on Popper's evolutionary epistemology in his work on entrepreneurial activities (Harper, 1996 and 2003).

THE QUALITY OF SCIENCE

There is a rapidly-growing literature on problems in the quality of published research. The editor in chief of *Lancet* wrote "The case against science is straightforward: much of the scientific literature,

perhaps half, may be simply untrue…Science has taken a turn towards darkness" with reference to small sample sizes, invalid analyses, conflicts of interest and obsession with fashionable trends (Horton, 2015). There is concern about the increasing incidence of retractions and the higher rate of retractions in high impact journals (Fang et al., 2011) and the dangerous liaison of science and politics (Butos and McQuade, 2006). Less than 12% of articles in 2004 in *The Journal of Economic Theory* passed three tests – stating a theory, explaining why it mattered and testing it (Klein and Romero, 2007). There are problems of replication of results and politicization in some fields. Another concern is the declining publication of negative results (Fanelli, 2012).

Popper provided two ways to approach this complex of issues. One is the social or institutional analysis of scientific and industrial progress which he proposed in *The Poverty of Historicism*. The other is the approach of critical rationalism and multi-faceted criticism to offset tendencies to confirmation bias that are built into the courses in the philosophy of science which focus on confirmation and the quest for inductive probabilities.

In *The Poverty of Historicism* Popper confronted Comte and Mill who adopted a psychological approach and regarded progress as inevitable due to the progressive tendencies in the human mind. Popper noted that there are other tendencies in the human mind such as forgetfulness, laziness and dogmatism. Instead of the psychological approach he urged a search for the *conditions* of progress using a situational approach to *imagine* ways that progress could be stopped. This is a very counterintuitive approach and it is presented in a few highly compressed paragraphs, summarized below.

Popper did not pursue these early thoughts in depth and others made important contributions. The art historian Ernst Gombrich applied Popper's ideas to a wide range of issues including the drift of linguistic usage, architecture, the popularity of modern art and trends in music and fashion including hemlines (Gombrich 1974). Ian Jarvie published a major work to explain what he called Popper's "social turn" to institutional analysis almost a decade after Popper died (Jarvie, 2001). He previously applied the situational approach in sociology (Jarvie, 1972). Roger James applied critical rationalism to some episodes of central planning in Britain (James, 1980) and Tyrell Burgess used Popper's approach in education planning and administration in Britain (Burgess, 1985). Paul Knepper explained the work that has been done on "situational crime prevention" inspired by both Popper and the Austrian economists (Knepper 2007).

As for stopping progress in science, Popper proposed that this might be achieved in various ways.

> By closing down or controlling laboratories for research, by suppressing or controlling scientific periodicals and other means of discussion, by suppressing scientific congresses and conferences, by suppressing Universities and other schools, by suppressing books, the printing press, writing, and, in the end, speaking. All these things which indeed might be suppressed (or controlled) are social institutions…Scientific method itself has social aspects. Science, and more especially scientific progress, are the results not of isolated efforts but of the free competition of thought. For science needs ever more competition between hypotheses and ever more rigorous tests. And the competing hypotheses need personal representation, as it were: they need advocates, they need a jury, and even a public. This personal representation must be institutionally organized if we wish to ensure that it works. (Popper, 1961, 154-5)

Popper also used the social approach to suggest how science can achieve a degree of objectivity through cooperative criticism of the kind practiced by Watson and Crick. When he wrote about this in the 1930s and 1940s the sociology of knowledge was becoming popular under the influence of Marxists and others such as Karl Mannheim. This approach aimed to explain our personal beliefs as a reflection of the social and political climate of ideas around us.

Popper did not challenge the importance of intellectual influences. However he turned the sociology of knowledge on its head to argue that it is a mistake focus on the *formation of subjective beliefs* because this does not engage with the proper object of inquiry, namely *knowledge as a public or inter-subjective social product*. In other words we are students and critics of spoken and written propositions and arguments, not subjective beliefs or states of mind. Thus it follows that the objectivity of science, such as

it is, does not arise from the lack of prejudices among scientists or their unique impartiality. Instead it depends on a process of more or less free criticism in the scientific community.

It may be said that what we call 'scientific objectivity' is not a product of the individual scientist's impartiality, but a product of the social or public character of scientific method; and the individual scientist's impartiality is, so far as it exists, not the source but rather the result of this socially or institutionally organized objectivity of science. (Popper, 1966, 217).

It is important to note that criticism may be more or less free and this raises some issues about free speech and the factors which limit criticism. Following Popper's line of thought to promote scientific objectivity it seems that we need such things as diversity of ideas (points of view and theoretical pluralism), clear formulation of the problems that the theories are supposed to solve, and access to journals, seminars and conferences to facilitate critical discussion. Some of these requirements have to be provided by individual scientists, especially new ideas and imaginative criticism while others are social and institutional.

Turning to the contribution of the philosophy of science to the quality of scientific work and especially the declining publication of negative results, it may be that the function of criticism is underplayed in teaching the philosophy of science compared with the effort devoted to confirmation theory and the technical aspects of assigning inductive probabilities to theories. In addition much of this work proceeds in isolation from "live" problems in science. Mulligan and associates deplored this tendency in philosophy at large (Mulligan, Simons and Smith, 2006) and a recent example is a contribution to *The Oxford Handbook of Philosophy of Science* (Sprenger, 2016).

Sprenger posed two problems of induction; first whether inferences beyond the evidence are justified and second, assuming a positive answer to the first, to assess the various methods used to justify inferences about the future performance of general scientific theories. Regarding the first problem he briefly noted Popper's critical approach and work by Deborah Mayo on testing in some specific scientific situations. That could have led to a survey of work by philosophers in relation to substantive scientific problems, such as Alan Chalmers on the contribution of philosophy to the development of atomic theory in chemistry (Chalmers, 2009). This could arouse the interest of working scientists. However almost all of the paper addressed the latest developments in probability theory without seriously engaging with any contemporary scientific issues. There is an impression of a mighty engine of philosophical thought which is not transmitting any power to the wheels of science.

AN INTRODUCTION TO PHILOSOPHY AND CRITICAL THINKING

Critical thinking is an important part of philosophy and this section suggests how a short course on critical thinking could be part of a Philosophy major or indeed a part of any liberal education curriculum. The idea is to introduce the four types of criticism suggested by Bartley (above); the test of experience; the test of comparison with other theories; the check on the problem; and the test of logical consistency. This could be pursued at school, it could be used for an introduction to university courses in philosophy, it could be a core subject for all tertiary students. The students would explore the implications and applications of the four methods of criticism applied to some theories or beliefs which interest the class. The topics should have some scientific or practical relevance but it would be unhelpful to select the most pressing issues of the day if these generate too much polarization of opinion to permit a civil discussion.

Explaining the test of evidence and experience could lead into the philosophy of science, the logic of experimental design and hypothesis-testing, to a study of rules of evidence in law, to the use of diagnostic tests by doctors, motor mechanics or plumbers, and to the use of clues by detectives and archaeologists. The test of comparison with other theories would raise questions about the weight and authority to be assigned to assumptions imported into arguments from other domains. For example the psychological theories assumed by literary critics, the physical theories assumed by geologists, the sociological theories assumed by engineers, the economic theories assumed by politicians. This part of the course should open student's eyes to the interdependence of the disciplines and the artificial nature of boundaries between subjects. At the same time students may learn how to use readily available resources, including other

students and staff to pursue problems from one discipline to another (for example by walking from the Philosophy Department to Physics or Life Sciences).

The check on the problem can lead in particularly interesting directions. This part of the course could indicate how a revised formulation of a problem may be decisive, how background theories can unconsciously direct how problems are identified and formulated, how fashions, fads and funding can influence the direction of research. It would lead to a study of the history of ideas, showing that problems have histories that philosophical problems usually have their roots elsewhere, in science, or religion or in social and moral dilemmas that powerful themes can leak from one discipline to another and preoccupations often run in parallel in more than one field.

The section on logic would call for study of both the formal and informal methods of argument. Formal logic concerns rules of inference and the way that logical steps can be used to draw out the consequences of an argument or of a scientific theory, perhaps for testing or for technological application. Informal logic encompasses the tricks of debate that may be used to cover up logical and factual defects in a position. Discourse by politicians, creation scientists and advertisers would furnish material for critical study.

If this approach is used for philosophy students it could be followed by exploratory reading of the Great Philosophers, though preferably not until the students have a firm sense of their own interests and problems. In this mood they might be less deferential to the greats, more critical and at the same time more willing to learn. This would contrast with the common situation where the young student is confronted with the soaring abstractions and profound arguments produced by the titans of the past. The novice is likely to be overwhelmed (who am I to criticise the great?) or else clings to a critique provided by the teacher. The result is likely to be either a student who is inducted into a system of thought or a graduate who is highly skilled in certain methods and techniques which are not necessarily connected to issues outside philosophy.

It is important to note that this approach is very different from most of the literature on critical thinking surveyed by Miller (2005). He discovered that there was a great deal of effort dedicated to critical thinking in recent times, citing an annotated bibliography of material on critical thinking with 903 books and papers published between 1980 and 1991 (Cassell and Congleton, 1993). Scanning the literature he found that practically all of it defined the purpose of arguments in terms of justification of beliefs and persuading other people to come to the same point of view. He quoted a typical example from the preface of a book on the philosophy of argument. “Argument is a social practice, arguable part of the core of any culture…the finding of reasons to justify beliefs and the response to disagreement by rational persuasion.” (Blair, 1999).

The purpose of the course proposed here is very different from justification and persuasion because it is focussed on the *criticism* of arguments and it can be explained in the language of used by Stuart Firestein in his book *Ignorance: How it Drives Science* (Firestein, 2012). More precisely, *discovering ignorance* (unsolved problems) drives science. Criticism a la Watson and Crick uncovers ignorance especially false assumptions and that drives the quest for better assumptions and new ideas. According to Firestein the great Italian physicist Enrico Fermi told his students that an experiment that successfully proves a hypothesis is a measurement and one that doesn’t is a discovery – an uncovering of new ignorance (Firestein, 2012, 57). Firestein’s book could be the text for the course.

CONCLUSION

Popper has a low profile these days judging from the negligible references to his work in *The Oxford Handbook of Contemporary Philosophy* (Jackson and Smith, 2005) and *The Oxford Handbook of Philosophy of Science* (Humphries, 2016). He enjoyed a high profile during the “philosophy of science” wars in the 1960s and 1970s but he became classified as a transitional figure between the logical empiricists and the new waves generated by Kuhn, Lakatos and Feyerabend. It seems that he went out of fashion before the full implications of his critical rationalism and evolutionary epistemology were explored (Champion, 2011). In the philosophy and methodology of economics that view is strongly

supported by Hands (2001). This paper argues that there is still plenty of mileage in Popper's work including a potentially fruitful partnership with Austrian economics, a contribution to improve the quality of science and ideas to promote critical and imaginative thinking.

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