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SCIENCES AS OPEN SYSTEMS

THE CASE OF ECONOMICS

**Novembro de 2007
Oficina nº 289**

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OFICINA DO CES
Publicação seriada do
Centro de Estudos Sociais
Praça D. Dinis
Colégio de S. Jerónimo, Coimbra

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Sciences as Open Systems The Case of Economics²

Abstract: Unity/disunity and specialization/unification are usually thought of in terms of opposing duals. As such, they have marked the debate about science for a number of years. In this paper it is argued that connections (and the isolative strategies we adopt) are crucial and that an understanding of sciences as theoretical open systems has the potential to break the barrier between specialization and unification. A suggestion is made to consider open systems of knowledge as the way to manage both our cognitive limits and the ultimate, ontological, interconnectedness of the world. Taking this route, it is shown that the full adoption of an open systems approach in economics will have deep implications for the way the discipline is understood and developed as well as how it relates to the other social sciences.

1. Introduction

*Utopia is on the horizon.
I get two steps closer, and it moves two steps away. I walk
ten steps and it is ten steps further away.
No matter how much I walk, it will never be reached.
So what is utopia for? For this it serves: to walk.*

Eduardo Galeano

Disunity rather than unity seems to characterize better the present situation and the dynamics of contemporary science. The growth of knowledge is still primarily the product of specialized research. New, ever more specialized fields continue to emerge and, in a number of cases, scientific developments lead to fragmentation and disintegration. But it is also true that many important advances have been made as the result of conceptual, theoretical and

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² A first version of this paper was presented at the First Lisbon Colloquium for the Philosophy of Science - Unity of Science. Non Traditional Approaches, Lisboa, Teatro da Trindade, 25-28 October 2006.

methodological borrowings and spillovers across the sciences. Several transformations in the direction of unification are detectable within and between specialized sciences. Also, pleas for unity and integration (whatever these mean) continue to be made.³

Trends towards both integration and disintegration are observable in the social sciences. This is also the case in economics. Conflicting tendencies and tensions are perceptible in the recent evolution of the economic science, from the economics-centred reductionist movement towards unification known as ‘economics imperialism’ to the other more pluralist, two-way approaches, which one may accurately describe in terms of import-export trade, mutual inspiration and conceptual/theoretical contamination. Noticeable in this context are interdisciplinary exchanges – both horizontal and vertical⁴ – which have moved research frontiers and have given place to innovative, now very dynamic areas of research in economics, such as ‘law and economics’, socioeconomics, behavioural economics, experimental economics, neuroeconomics, evolutionary economics, econophysics and complexity economics.⁵ It is also the case that some of these areas of research may threaten the old disciplinary unity.

What does it mean today to speak of the *unity of science* in such a context? Are there prospects – after all the criticisms against Vienna Circle’s project on the unity of science – for any kind of successful pursuit of unification within and between sciences?

Science is plural. All we have (and what is reasonable to foresee) are *sciences*. The idea of Science as a Grand Unified Theory (or approach), or the requirement that all sciences be expressed in a common language (e.g. mathematics) or pursued with the same method (*the scientific method*, whatever that means), seem to face insurmountable difficulties. Nevertheless, my belief is that the *utopia of unity* (and the search for coherence, within and across sciences) should be kept at the back of one’s mind, even if just as an aspiration, an unreachable ideal which leads us to transgress disciplinary boundaries (in an overall context

³ As Pombo (2006: 29) noted, the idea of “unity of science” means a variety of things, each of these meanings being connected to a different conceptual context and set of problems. A similar view can be found in Hacking (1996), who suggested three different “unities” of science: a *metaphysical belief* (or sentiment) in one scientific world, reality or truth; a *practical precept* to look for the connections between phenomena; and a single standard or *mode of scientific reasoning*.

⁴ We call “horizontal exchanges” to interactions taking place between social sciences such as economics, sociology, political science, anthropology, and law. “Vertical exchanges” occur when social sciences take inspiration and seek guidance and insight from lower-level physical, cognitive and life sciences.

⁵ For a very interesting discussion of the changes occurring in recent economics, in which it is suggested that one uses an import-export model and looks at the history of economics in terms of a (non-regular) cycle of alternating unity and plurality periods, see Davis (2006).

of ‘dialogical encounter’ across disciplines – or ‘interdisciplinary encounters’⁶ – and cross-fertilization) and keeps us looking for *connections* and the *totality*. I claim that one may find a rationale for *unity-in-diversity*⁷ and interdisciplinary exchange in an open-systems understanding of social reality and science. My point is that, against the dualist view of science in terms of unity/disunity,⁸ of ever more specialized, fragmentary (closed and self-sufficient) sciences opposed to reductionist projects of unification, sciences are to be construed (and developed) as *theoretical open systems*, with *emergent* properties irreducible to those of any one of them or to whatever basic characteristic, language or method/logic of inquiry one may consider.

I maintain that this view of the sciences as open systems has the potential to overcome the above mentioned tension between specialization and unification. The basic assumption is that *systems* and *sciences as systems* should be taken as the units of analysis. In this paper I take economics as the focal point. My purpose is to show that the full adoption of an open systems approach would have deep implications on how the discipline is understood and developed. Attention will be paid, in particular, to the ever present dilemma between the ultimate interconnectedness of things and the need to decompose our object of study in order to make it manageable and to generate knowledge. The paper is organized as follows. In the next section the concepts of interdisciplinary isolation and isolative strategies are introduced. In section 3 I discuss the problem of missing connections and the challenge this brings to our analyses based on those isolations. In section 4 open and closed systems are distinguished and some proposals to build economics as an open system briefly reviewed. Some conclusive remarks and suggestions for further research will be outlined in the final section.

2. Interdisciplinary isolations and isolative strategies

In the process of becoming autonomous disciplines, sciences have to define their respective domains of study, which involves delimiting (and to a certain extent closing) their boundaries. A set of explaining items (the *explanantia*) and a set of explained items (the *explananda*) have

⁶ To use Mäki’s label for his recent seminar in the Department of Philosophy at the University of Helsinki (see <http://www.helsinki.fi/filosofia/tint/events/interdisciplinaryencounters.htm>).

⁷ Or, following Hacking’s (1996) terminology, *unity as integrated harmony* of different domains of inquiry rather than *unity as singleness* (“the subsumption of all phenomena under a single principle, law, or language”).

⁸ Following Dow, dualism may be defined as the propensity to classify concepts, statements and events in terms of all-encompassing, mutually exclusive pairs of either/or categories, with fixed meanings (see, for instance, Dow 1996; 2002). Yet, as this author noted, although “[m]ethodological discussion has often focused on duals: induction/deduction, rationalism/empiricism, prescription/description, modernism/ postmodernism [...] none of these purist positions is actually sustainable” (2002: 167).

to be sorted out. According to Mäki (1992 and 2004), all this entails undertaking *interdisciplinary isolations*.⁹ A (theoretical) isolation is defined as a process whereby a set X of entities is assumed to be theoretically removed (‘sealed off’) from the involvement or influence of another set Y (X , the *isolated field*, and Y , the *excluded field*, exhaust all relevant possibilities). An interdisciplinary isolation may then be thought as one which helps define the domain of a scientific discipline *by delimiting and closing its boundaries*.

Isolations are unavoidable. We have to close our minds to many possibilities (at least temporarily) in order to pay attention to a few (Loasby, 2003: 294). Some connections have always to be supposed absent or inoperative.¹⁰ The choice of the isolated field of a science, which includes both its *explananda* and *explanantia*, entails exclusions. These are usually based on *omission*, i.e. the excluded entities, features or aspects tend simply to be ignored and fall outside of the scope of the discipline without any mention of them. They become a “field of silence” (Mäki, 1992: 335-6).¹¹

As what can be explained by a science is constrained by the chosen set of explaining items (Mäki, 2004: 322), the interdisciplinary isolations involved in the choice of both the *explananda* and the *explanantia* – and the consequent boundary lines drawn – become crucial and controversial matters. Various interdisciplinary isolative strategies are observable in economics as well as in the other social sciences regarding these issues. Important dynamics of dispute may arise both regarding the items to explain and the explaining items one science chooses to emphasise. Frequently, these are disputes over different conceptions of the nature of the object of study.

Following Mäki (2004), let us consider a set S of potential *explaining* items – comprising of an isolated subset $S_k^- = \{s_1, \dots, s_k\}$ and a subset of excluded items $S_k^+ = \{s_{k+1}, \dots\}$ – and, similarly, a set M of potential *explained* items also encompassing two subsets – $M_n^- = \{m_1, \dots, m_n\}$, the isolated *explananda*, and $M_n^+ = \{m_{n+1}, \dots\}$, the excluded potential explained items. It is clear that the choice of the boundary lines between S_k^- and S_k^+ , on one hand, and between M_n^- and M_n^+ on the other hand, are of the utmost relevance.

⁹ The ‘interdisciplinary isolation’ conceptual framework, proposed by U. Mäki, will be considered here as a helpful, descriptive device for understanding the process that led to the present situation of compartmentalized and segmented sciences. For a critique of isolation as a method in the social sciences, see Runde (1996) and Lawson’s (1997).

¹⁰ Isolations, Mäki claims, are ubiquitous: “Every concept, model and theory is based on an isolation of a slice of the things and properties in the world to the exclusion of the rest of what there is” (2004: 321).

¹¹ In some cases (although these are more uncommon in interdisciplinary isolations) items are explicitly considered but excluded from the isolated disciplinary field by means of some form of *idealization*, usually through the postulation of limits or ideal types (for instance, setting the value of variables to be 0 or $|\infty|$).

‘Economics imperialists’, for instance, based on a definition of economics as the science of human choice in conditions of scarcity, claim that no area of human action is outside the potential scope of economics. Moreover, the conventional rational choice model, with its origins in economics, is seen as providing “the most promising basis presently available for a unified approach to the analysis of the social world by scholars from different social sciences” (Becker, 1993). The boundary between M_n^- and M_n^+ is thus increasingly pushed forward by means of an employment of the traditional S_k^- of mainstream economics to explain traditionally ‘non-economic’ areas such as marriage and family, education, crime or discrimination.

In contradistinction, another Nobel laureate, Ronald Coase, rejects such a view of economics as a toolbox of universal application, saying that “[t]he analysis developed in economics is not likely to be successfully applied in other subjects without major modifications” (1994: 44). He underlines, instead, a conception of economics based on the centrality of the *economy*, conceived of as intermeshed with other parts of the broader social system. In his view, the distinguishing feature of economics is a concern with the study of the “working of the social institutions which bind together the economic system: firms, markets for goods and services, labour markets, capital markets, the banking system, international trade and so on” (*ibid.*: 41), a study which Coase thought “hardly possible” without consideration of the effects of the other parts of the social system on the working of the economic system itself. That is, an enlargement of the *explanantia* of economics, to include items from S_k^+ , is recommended for an explanation of a redefined M_n^- .¹²

3. The problem of the missing connections

Important as interdisciplinary isolations might be for the constitution of a science as an autonomous discipline, they imply that some connections become concealed or even inexorably lost. Isolations apply only to our thoughts and representations of the real world; not to the phenomena themselves (Loasby, 1999: 14).¹³ As with the ocean, we may separate phenomena into parts and label them (the Atlantic, the Pacific, the Indian, etc.). However, the

¹² As Coase (1994: 46) puts the issue, “the study by economists of the effects of the other social systems on the economic system will, I believe, become a permanent part of the work of economists. It cannot be done effectively by social scientists unfamiliar with the economic system. Such work may be carried out in collaboration with other social scientists but is unlikely to be well done without economists. For this reason, I think we may expect the scope of economics to be permanently enlarged to include studies in other social sciences. But the purpose will be to enable us to understand better the working of the economic system”.

¹³ Of course, there are also *material isolations* occurring in nature, but apart from some very infrequent cases of spontaneous isolations, they are usually the result of human intervention taking place in an experimental context (*experimental isolations*).

ocean does not stop being a single, immense, interconnected and continuous body of salt water encircling the Earth.¹⁴ Boundaries are a human, artificial construct. The world has no boundaries; it forms a single ontological unity.

It is true that, as already mentioned, we cannot avoid making isolations. As Loasby emphasised, “[k]nowledge grows by division; each of us can increase our knowledge only by accepting limits on what we can know” (*ibid.*: 135). But because it is dispersed and “[b]ecause different people can develop different skills, a knowledge-rich society must be an *ecology of specialists*; knowledge is distributed [...] and being distributed it can grow, *provided that it is sufficiently co-ordinated to support increasing interdependencies*” (*ibid.*: 130, emphases added). Once we subscribe to an understanding of social reality as being highly interconnected and organic, reliance on the sufficiency of segmentations that cut “swathes through the recognised interconnectedness of things” (Chick and Dow, 2001: 714) may lead us astray. Isolations inevitably exclude more or less relevant connections between the phenomena being studied. Our knowledge, as in the case of the elephant described by the seven blind men, can only be partial and incomplete. Error as such is unavoidable and co-ordination of different contributions to knowledge indispensable. However, and this needs also to be stressed, incompleteness is a source of innovation as well. Incompleteness, as Loasby taught us, “is not only a source of problems; it opens up our systems of thought” (2003: 293):

Since our representations are always incomplete, innovation is always possible; we can change the set of elements, revise the internal linkages between them or redefine the external connections. Whether contemplating artefacts, processes, structures, sequences, problems or strategies, we are operating in large combinatorial spaces in which there are, in principle, many options for change. (*ibid.*: 301)

Each science (and the knowledge it produces) is a set of connections that grows by making novel connections (which, very often, also involve destroying and substituting other connections) and it forms, with the other sciences, a wider *open system of knowledge*, in the context of which various connections are established.¹⁵ Since “[l]arge systems typically include sub-systems within which connections are relatively dense, and between which connections are sparse” (Loasby, 2005: 59), the challenge becomes *how to decompose the*

¹⁴ On the beautiful Leibnizian metaphor of sciences as oceans see Pombo (2006).

¹⁵ A system, be it closed or open, is a network, a structure with connections – a *set of elements* (things or ideas) linked by a *set of connections* so as to form a coherent whole (cf. Potts, 2000). As Loasby (2005: 59) emphasised, “not only different sets of elements but also different ways of connecting a given set of elements define different systems”.

object of our knowledge so that the co-ordination of the different strands of thought becomes possible in a coherent and consistent manner.

This brings us back to the nature of the interdisciplinary isolations we undertake. There are limits to these isolations. Such limits, as Mäki (2001) suggested, are determined by our conception of “the way the world works”, that is, they are subject to an ontological constraint. Rival interdisciplinary isolative strategies (dealing with choices of *what* is isolated and *how*) have an ontological basis. The legitimacy of any isolative strategy is always dependent on our conception of the nature of the reality object of study. Items considered to play a *necessary* or *essential* role in the functioning of the world – “ontic indispensability” – should not be excluded from our systems of thought. Similarly, there are “ontic impossibilities” that should make us cautious regarding isolations that lead to theories which “depict the world in such a way that we have reason to believe that the world *does not* function that way, or, more strongly, that it *cannot* function that way, or, still more strongly, that it cannot function at all, given what we know about it” (Mäki, 2001: 385, original emphasis).

4. Economics as an open system

One of the most controversial issues which has long separated several heterodox traditions in economics (as well as other social scholars) from the mainstream of the discipline has to do with the way the latter seals off the ‘economic’ from other relevant aspects of the social. One important thread of the mainstream’s interdisciplinary isolative strategy has been to assume the social and institutional system as given (and constant), and any mutual dynamic dependence between the ‘economic’ and ‘social’ realms irrelevant. For analytical purposes, individuals (and their tastes and preferences) are considered as given and the economy as a closed system.¹⁶

This is a system with no connections to its environment or to other systems: a circumscribed domain that is not influenced by external forces and does not exert influence on them. In a more detailed way, we may, following Dow and Chick,¹⁷ define a closed theoretical system as one where all relevant variables are identifiable; the boundaries of the system are definite and immutable and consequently all variables can be clearly classified as exogenous or endogenous (these categories being fixed); the specified exogenous variables are the only ones that can impact on the system (which they do in a known way); the

¹⁶ Of course, if pressed, virtually all economists would accept that the economic realm is an open system. However, the emphasis on becoming a hard science (some refer to ‘physics envy’) led to a central concern with mathematical tractability (particularly noticeable after the Second World War) and a consequent closing of economics.

¹⁷ See Dow (2002: 139-140), Chick (2004: 6) and Chick and Dow (2005: 367).

components of the system (variables, agents, and sub-systems) are separable (independent and atomistic) and constant in nature and the structure of their relationships knowable or random; the structural framework within which agents act, including all the information needed to determine the behaviour of the system, is assumed as given.

Even when some mainstream economists started crossing the traditional borders of economics to deal with more ‘social’ issues (such as crime, discrimination or family issues),¹⁸ they did so without any significant change in their long-established rational-choice toolbox. Human behaviour continued to be analysed exclusively as equilibrium-efficient solutions for problems of allocation of known resources among alternative and clearly defined ends by given individuals. Institutional and other social mechanisms involved in the moulding of individual preferences and purposes remained ignored.

Although the work has been taken up with some (limited) success, there are many who find such asocial rational agents of economics wanting. An increasing number of scholars claim that such an approach does not actually take account of how the world works¹⁹ and argue that an opening of our system of thought should be pursued.²⁰ Institutions and other social structures should be brought into the socio-economic system, not least because they have the capacity to reconstitute agents’ preferences and purposes by acting upon ingrained habits of thought and action (cf. Hodgson, 2002). The economy, according to this view, is not a self-contained system; it is an open subsystem of a much broader network – encompassing society, polity, and culture²¹ – in the context of which it interacts with the other subsystems in a very complex way.

In an open system one or more of the conditions that Dow and Chick considered to be necessary for a closed system do not apply *in some degree*. Boundaries, instead of being isolative, are semi-permeable (allowing various in-fluxes as well as out-fluxes from other

¹⁸ Since the 1950s.

¹⁹ For instance, Wassily Leontief, the Nobel Memorial Prize laureate in Economics in 1973, wrote: “Page after page of professional economic journals are filled with mathematical formulas leading the reader from sets of more or less plausible but entirely arbitrary assumptions to precisely stated but irrelevant theoretical conclusions. [...] Year after year economic theorists continue to produce scores of mathematical models and to explore in great detail their formal properties; and the econometricians fit algebraic functions of all possible shapes to essentially the same sets of data without being able to advance, in any perceptible way, a systematic understanding of the structure and the operations of a real economic system” (Leontief, 1983: viii ff.). The picture, unfortunately, remains up to date.

²⁰ The ‘statements of principles’ of some heterodox economics associations, for instance of the European Association for Evolutionary Political Economy (<http://eaepe.org/eaepe.php?q=node/view/5>) and of the Society for the Advancement of Socio-Economics (http://www.sase.org/index.php?option=com_content&task=blogsection&id=5&Itemid=43) are enlightening in this regard.

²¹ And interlinked with the natural environment as well.

systems) and they are fuzzy and/or mutable. The constituent components of the system as well as the structure of their interrelationships may change in a non-predetermined way as they become in contact with other systems.²²

Several are the voices who have argued for the need to open the discipline of economics and integrate social knowledge. It is not my purpose here to provide an historical account of the scholars and projects that were involved, but at least a brief mention should be made of K. William Kapp's (1961) work on a positive approach to the integration of social knowledge (a '*Science of Man in Society*'), arguably the first most elaborate modern proposal of this kind where the economy is thought of as an open system.

For Kapp, human actions and economic decisions did not take place in closed or even semi-closed systems; they occurred within a network of relationships involving four dynamic structures which were connected by a process of continuous open interaction: kinship, production and distribution, political systems and noetic systems²³ (cf. 1961: chapter VI). The economy was assumed to be an emergent component of a wider network of bio-physical-cultural relations, a stratum of a multi-layered reality.²⁴ In consequence, in his view, "a new approach which makes it possible to deal with the dynamic interrelations between economic systems and the whole network of physical and social systems and, indeed, the entire composite system of structural relationships" (1976: 97) was needed.

This would entail, Kapp thought, a search for an integration of social knowledge based on the definition of 'common-denominator concepts'²⁵ – understood as abstractions derived from observed regularities in behaviour (the so-called 'real types') – that would "provide an orderly and unambiguous framework for the comprehension of the elementary facts and

²² von Bertalanffy, one of the originators of General System Theory, distinguished an open system from a closed one in terms of the interrelations with their respective environments. While a closed system is one where there is no exchange of materials, in an open system import and export would take place, with continuous influxes and outfluxes and a consequent change (generation and destruction) of the components of the system (cf. Bertalanffy, 1973). Such a conception is here largely subscribed. However, following some more recent authors (see, for instance, Chick and Dow, 2005; Loasby, 2003; Mearman, 2005), I wish to emphasise that openness and closure *are not duals*; they occur in a continuum and we should think of them in terms of *dimensions* and *degrees* of closure.

²³ "Since these four substructures are connected by a process of continuous interaction, it follows that modifications in one must lead to transformation of the whole" (Kapp, 1961: 115).

²⁴ A stratum (an entity or aspect) of reality is said to be emergent, or to possess emergent properties, "if there is a sense in which it has arisen out of some 'lower' level, being conditioned by and dependent upon, but not predictable from, the properties found at the lower level" (Lawson, 1997: 176), thus turning the higher-level stratum irreducible to the lower-level one.

²⁵ "Just as we look for a common denominator when we intend to add or subtract different fractions, so must we find or construct 'a set of common-denominator concepts in terms of which we can express *the otherwise incommensurable concepts* of our different disciplines, subject matters and cultures.' [quotation from Northrop]" (Kapp, 1961: 127, emphasis added).

uniformities of human nature and social processes” (Kapp, 1961: 127). Those concepts should be comparable in comprehensiveness, generality and explanatory importance for social inquiry to those of gravity in physics or evolution in biology. Accordingly, they would have to “cut across the subject matters of several disciplines” and “ought to be broad enough to encompass as many phases and aspects of human behavior as possible” (*ibid.*: 128). For Kapp, *man* (and *human nature*) and *culture* were such concepts. Without integrating concepts, no communication between social disciplines would be possible.

In Kapp’s view the “unified science of man in society” that would result from such an endeavour would respond to the “essential unity” and openness of the subject matter of the different social disciplines. However, it would not imply the unreasonable end of specialization and of division of labour in scientific work. This time specialization would be *problem-centred* (we could say thematic) and *determined by the nature of the problem or problem area under investigation* rather than disciplinary.²⁶

It is enlightening to read K.W. Kapp in his own words:

By making it clear that all social analysis deals with events and processes which occur within a broader and indeed unitary context, scholars working on special problems are forcefully reminded of the essential unity of their subject matter and come to see their special problems within the broader social context. In this way and not by imposition from the outside, lines of communication and real cross-fertilization will become possible and will actually take place. The traditional division of labor will then no longer block the way to interdisciplinary cooperation but will give rise to a tendency toward a general unification of scientific endeavors and results. In short, it is the unity of the subject matter and of the results of scientific research which will bring the social sciences closer together and induce social scientists to put their researches to the point where the present compartmentalization is replaced by a unified science of man in society. (1961: 204-5)

Kapp’s project remains largely (and unfairly) ignored both in economics and in the social sciences more widely. Nevertheless his message has not been completely forgotten. Geoff Hodgson, for instance, one of the most distinguished contemporary European institutional economists, regrets what he called “the Grand Canyon in academic research and departmental organization between ‘economics’ and ‘sociology’”, responsible for the fact that

²⁶ This would mean to reject, as Kapp did, the current practice in economics of deducing conclusions from a narrow, disciplinary concept of man (*homo economicus*) which isolates one particular motif of human behaviour (calculative rationality) and leaves to other social sciences those (‘non-rational’) patterns of behaviour that do not take fully into account the real costs and expected benefits of one’s actions. These other forms of behaviour, Kapp claimed, should also be considered as an integral part of our concept of man – of what he called the ‘institutional man’ (cf. Kapp, 1968: 93).

“many of the most interesting questions in social science have become lost in the intervening abyss” (Hodgson, 1994, 69) and projects economics “as just one facet of an eventually unified social science discourse, embracing sociology, anthropology, history, psychology and political analysis” (1996: 107).

More recently, Tony Lawson, the well-known Cambridge leader of the critical realist project of *economics as social theory*, similarly claimed that “there is no legitimate basis for distinguishing a *separate* science of economics”. It would be “at most a division of labour within a single social science”. Further, Lawson holds, “if economics is to be distinguished as a strand of social research, it cannot be according to its own ontology, methodological principles or substantive claims, but in terms of its particular focus of interest” (Lawson 2006: 499-500; see also 2003: 161-4).

Another important contribution towards an understanding of economics as an open system comes from the pluralist/Babylonian approach to knowledge, as developed by Sheila Dow and Victoria Chick in several of their works.²⁷ The two economists tackle the important and difficult issue of how to segment our object of study (conceived of as an open and organic totality) in order to make it manageable and to generate knowledge. In their view, a strategy of decomposing that object into isolated components/subsystems is legitimate and can be harmlessly pursued by means of *partial* analyses if the ultimate interconnectedness of things is kept at the back of our minds and is at some point brought to the fore. This means that such partial analyses must also be *provisional*. Further, they claim, as in the case of a rope, the strength of our studies increases when connections, within and across systems, are taken into account by employing a range of “parallel, intertwined, and *mutually reinforcing*” strands of thought and chains of reasoning.

5. Conclusion

The real world is an evolving and complex network of interconnected bio-physical-cultural open systems yet our possibilities of knowing it as a unity are rather constrained. The challenge is how to decompose our object of study (and build connections) in a way that makes co-ordination of those partial attempts to generate knowledge coherent. This, I believe, is the fundamental problem behind concerns regarding unity/disunity of science.

²⁷ See, in particular, Dow (1996: chapter 2; and 2003) and Chick and Dow (2001).

Unity/disunity and specialization/unification tend to be thought of in terms of duals. This misguides discussion. Trends towards both integration and disintegration characterize recent scientific developments. Specialization and attempts at unification are reasonable, although many times also conflicting, responses to the need to advance knowledge. Both have an ontological rationale. While specialization has its foundation in the human cognitive limits, the latter is to be associated to the interconnectedness of the world.

A sounder approach to the problem of unity/disunity of science, as suggested in this chapter, is to construe and develop sciences as theoretical open systems. We need open systems of knowledge in order to manage our cognitive limits and the ultimate interconnectedness of our world. In the social realm this entails conceiving and working towards an eventually unified social science, in the context of which each social discipline is merely a branch, justified by the unavoidable division of labour and distinguished from the other disciplines by its particular focus of interest.

This represents a major challenge for our current disciplines. Adopting an open systems approach will have deep implications on how each discipline is understood and developed. As we have seen, important work has already been done in this direction but a lot remains to be done in terms of clarification and elaboration. One fundamental task has to do with what constitutes the ‘focus of interest’ of each social discipline. In particular, what is the meaning of the ‘economic’ in this new context? How is economics differentiated from sociology and the other social disciplines? These are questions requiring a reply and further research.

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