Orders, Orders, Everywhere ... On Hayek's *The Market and other Orders*

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Abstract: This review essay of *The Market and Other Orders* (volume 15 of the *Collected Works of F. A. Hayek*) uses the essays collected in the volume as a vehicle to discuss certain key issues raised by Hayek's work, including that the knowledge required for plan coordination is provided not only by prices but also by formal and informal social rules; that the capacity of the price mechanism to coordinate people's plans is best viewed as an emergent property of the market system; that this emergent coordinative power also forms the basis for the process of group-selection in Hayek's theory of cultural evolution; that the nature of the interaction between the overall order of actions and the causal powers of other emergent entities is shaped by social structures; that Hayek's notion of 'order' is different from the economist's notion of 'general equilibrium'; and that Hayek's ideas anticipate those of modern complexity theory.

Keywords: Hayek, complexity, emergent properties, systems, evolution, group selection, rules, order.

1 INTRODUCTION

Friedrich Hayek was a scholar of uncommon breadth and depth whose work will be a source of insight for many years to come. Over his long career his interests spanned a wide range of subjects including psychology, economics, political philosophy, the philosophy of (social) science, and intellectual history. It is perhaps, therefore, something of a surprise to find an extraordinary consistency and unity in his thought running through time and subject matter. In volume 15 of the *Collected Works of F. A. Hayek* (Hayek 2014), entitled 'The Market and other Orders', editor Bruce Caldwell has selected papers that range in date of publication from Hayek's pivotal 1937 paper on 'Economics and Knowledge' ([1937] 2014) to his 1975 Nobel Memorial prize lecture on 'The Pretence of Knowledge' ([1975] 2014). The selected papers illustrate this unity in a very instructive way. Throughout his professional career Hayek wrestled with issues related to the coordination of interrelated human actions, positing from early on that there was some kind of 'ordering' or 'coordinating' set of properties to the market process. This theme of 'spontaneous order' is the connecting thread that runs through all of his work, not just in economics but also in theoretical psychology and political philosophy. In this volume we can trace the development of Hayek's ideas on this topic through his career, relating it in particular to his emerging view of the economy as a complex system.

We begin in the next section with a discussion of Hayek's crucial 'early years' (the 1930s and 1940s at the London School of Economics). The articles published in this peri-

od—still frequently cited today—contain penetrating analyses of the nature of equilibrium, knowledge and the market process. In writing these early papers, Hayek was coming to grips with the themes that were to define the rest of his long career. In the third section of the paper, we discuss Hayek's treatment of complexity in the social world. We bring out in particular the fact, often unappreciated, that on Hayek's account the coordinative power of the market is an emergent property of the free market system that is formed when people's interactions are structured by certain kinds of formal and informal rules. We also highlight the point, also insufficiently widely acknowledged, that Hayek provides a satisfactory explanation of how order is possible in decentralized market economies only in his later work, which is ostensibly on political philosophy rather than economics. In the fourth section we discuss Hayek's vision of the world as consisting of many different (hierarchically organized) complex orders, of which the market is only one. Far from being an ontological reductionist, as he is sometimes (mis-)portrayed, Hayek subscribes to a view of the world as consisting of a series of ontologically distinct, and irreducible, layers of phenomena. We explore this further in the fifth section, examining the implications of Hayek's views for the possibility of multi-level interaction, arguing–contrary to some readings of his work–that Hayek's approach admits the possibility that emergent properties possessed by social systems include the capacity to shape, via downward causation, human agency. In the sixth section we turn to the question of how different societies come to be characterized by different sets of orders and thus different levels of economic success. Hayek posited a group selection evolutionary process that has been the subject of some criticism. We examine this and find Hayek's story to be more plausible than the critics have suggested. In the seventh and eigth sections we examine Hayek's perception of the market as a dynamic process occurring in real time. We focus on two questions in particular: how do real-world economic actors cope with radical uncertainty; and what is the nature of any tendency towards plan coordination? We argue in particular that Hayek's analysis implies that, even in the absence of external shocks, the question of whether the market system tends to produce greater plan coordination cannot be answered on the basis of *a priori* arguments alone. The final section concludes with an examination of Hayek's ideas in relation to modern complexity theory.

2 EQUILIBRIUM, PRICES, RULES AND SOCIAL ORDER

It was in a lecture delivered in 1936 to the London Economics Club that Hayek first grappled with some of the enduring themes that were to shape the remainder of his career. This paper is clearly a major departure for him:

> It was really the beginning of my looking at things in a new light. If you asked me, I would say that up until that moment I was developing conventional ideas. With the '37 lecture … I started my own way of thinking. (Hayek 1983, quoted by Caldwell 2014: 3)

In this lecture Hayek explored for the first time the concept of equilibrium from a subjectivist perspective, a route which took him immediately to questions about action, time, knowledge and expectations. Hayek realized that, unlike its counterpart in the physical world, the notion of equilibrium in economics must refer to the views of individuals as they act in the social world. Hence Hayek defined equilibrium as a situation in which 'the different plans which the individuals composing [a society] have made for action in time are mutually compatible' (Hayek [1937] 2014: 64). Equilibrium is here conceived as a situation in which individual knowledge and expectations, and the actions based on them, are compatible with the 'data,' where the 'data' for one individual include the plans and actions of other individuals. Hayek wonders how people's plans are in fact synchronized and coordinated. All successful human action is based on perceived and reliable causal connections between those actions and their effects. Disparate expectations, implying the inevitability of widespread errors and plan failures, would appear to preclude successful action. Having been pushed by the logic of equilibrium in a changing world to consider this question, it became a preoccupation of Hayek's throughout his career, even as he moved beyond economics narrowly understood. But it was also the beginning of his penetrating critique of some aspects of accepted theory and practice, most notably the meaning of competition and the market process, that are the themes of the other three articles that comprise Part 1 of the volume under review, entitled *The Early Years*. In retrospect, these papers can be seen to have laid the basis for his later work on the nature of the rules and practices that facilitate successful human action in dynamically changing societies, societies that are essentially complex phenomena.

In what is his most cited article, Hayek ([1945] 2014) posits that the high degree of coordination observed in economic life reflects the pivotal role of prices as both signals and incentives. Price movements signal changes to which individuals are motivated to adapt even in the absence of any knowledge as to their causes. His example of a sudden scarcity in the supply of tin, which results in a rise in its price that provokes individuals to economize on it, and to seek to produce substitutes, is justly famous as a canonical statement on the role of prices as 'knowledge surrogates' that communicate much of the information people need in order to coordinate their plans. As Hayek noted in 'Economics and Knowledge', in an economy characterized by an elaborate division of labour, knowledge—about people's tastes, about the availability of resources, about the technology that might be employed to produce goods—is inevitably dispersed throughout the population ([1937] 2014: 72). However, as he went on to argue in 'The Use of Knowledge in Society,' when one set of individuals implements plans formulated on the basis of their local (dispersed and also often tacit) knowledge[1], their actions generate changes in relative prices which summarize in a publicly available form the significance of that knowledge for the scarcity of various resources.[2] And those price changes both enable and encourage other people to adjust their own plans so as to dovetail with those of the first group, without the former in fact knowing anything about the details of the local knowledge that informed the latter's actions ([1945] 2014: 99-100).[3]

This is the second of the two famous 'knowledge' articles—published eight years apart (1937 and 1945)—that set the tone for so much that was to follow. Interestingly, there is potentially a tension between them. In 'Economics and Knowledge' Hayek emphasizes the subjective nature of knowledge and expectations ([1937] 2014: 60). The 'data' upon which we base our actions are to a large extent composed of our expectations of the actions of others upon whom we depend in order to bring our plans to fruition. More generally, as Hayek shows beautifully in an article written just a few years later, the very 'facts' of any given social situation are themselves really the interpretations we make of events and things in order to classify them by analogy to what we already know into categories useful for action and understanding (Hayek [1943] 2014). Thus, any social event, including a price change, must be interpreted if it is to be of any use. Yet, in 'The Use of Knowledge in Society' Hayek seems to come close to attributing an 'objective' status to price changes in the sense that, at times, he seems almost to suggest that they provide unambiguous signals to people about what needs to be done.

One way of resolving this tension is to interpret the later article as taking the success of the market process as a given, as confirmed by our shared experience, and proceeding then to describe the implications of this success, and the pitfalls of failing to understand it. This leaves aside the question of how, and under what circumstances, people are able to extract from price signals knowledge that is accurate enough to permit the system to function as we know it can and does. But for sure this is not a question that Hayek ignored in any way. Hayek hints at an answer in 'The Use of Knowledge in Society,' when he refers to the way in which people 'make constant use of formulas, symbols and rules whose meaning we do not understand and through the use of which we avail ourselves of the assistance of knowledge which individually we do not possess' ([1945] 2014: 101). But a fuller answer came only later, in Hayek's later writings on political philosophy and the law, where he argued systematically and explicitly that the dissemination of knowledge required for plan coordination is facilitated not only by price signals but also by a set of intersubjectively shared rules and norms, including both formal legal rules and also informal norms of honesty and promise-keeping. The fact that people act in accordance with the same general guidelines about how to interpret and act in various kinds of situation makes it possible for them to form reasonably accurate expectations of each other's future conduct, thereby enabling them to formulate plans that have a reasonable chance of coming to fruition (Fleetwood 1995; Lewin 1997; Vaughn 1999a). As Hayek puts it:

> What makes men members of the same civilization and enables them to live and work together in peace is that in the pursuit of their individual ends the particular monetary impulses which impel their efforts towards concrete results are guided and restrained by the same abstract rules. If emotion or impulse tells them what they want, the conventional rules tell them how they will be able and be allowed to achieve it. (Hayek 1976: 12)

Perhaps most notably, by facilitating enforceable contracts, the set of rules in question enables people to formulate and embark upon plans of action in the confident expectation that the contributions from their fellow men required to implement those plans will actually be forthcoming.[4] In the

present volume, one can see early formulations of this idea in Hayek's Cairo Lectures on 'The Political Ideal of the Rule of Law,' where Hayek states that 'if a multitude of individual elements obey certain general laws, this may … produce a definite order of the whole mass without the interference of an outside force' (Hayek [1955a] 2014: 160). This possibility 'applies to the laws obeyed by men no less than to the laws of nature.' It is, Hayek tells us, an example of 'what Michael Polanyi has described as the spontaneous formation of a polycentric order; an order which is not the result of all factors being taken into account by a single centre, but which is produced by the responses of the individual elements to their respective surroundings' ([1955a] 2014: 160-61).[5]

The outcome that is generated when people's (inter)actions are structured by an appropriate set of rules is orderly in the following sense:

> By 'order' we shall … describe a state of affairs in which a multiplicity of elements of various kinds are so related to each other that we may learn from our acquaintance with some spatial or temporal part of the whole to form correct expectations concerning the rest, or at least expectations which have a good chance of proving correct. (Hayek 1973: 36; emphasis removed)

The orderliness of free market activity manifests itself in the fact that people can usually predict the behaviour of their fellows well enough to implement successfully the plans they make in the course of going about their daily lives and meeting their most basic needs (Hayek 1973: 36). As we shall see in section 7 below, this notion of 'order' differs in significant ways from the standard notion of general equilibrium.

What all this suggests, as Caldwell (2014: 12-14) notes in his 'Introduction', is that Hayek's post-1937 research in economics and his later investigations in social theory and political philosophy form a more coherent body of work than might at first glance appear to be the case.[6] That is so not simply because, as is widely recognized, Hayek's insight that the problem of order is primarily an epistemic one informed his writings on political philosophy and social theory. The coherence also reflects the fact, less commonly acknowledged, that it was only in this later work, ostensibly on political philosophy, that Hayek was finally able to provide a convincing answer to the question, first posed in his narrow technical work on economics, of how socio-economic order is possible in decentralized market economies. As Hayek himself put it, in retrospective reflections on the development of his research penned in his essay on 'Kinds of Rationalism':

> [T]hough at one time a very pure and narrow economic theorist, I was led from technical economics into all kinds of questions usually regarded as philosophical. When I look back, it seems all to have begun, nearly thirty years ago, with an essay on 'Economics and Knowledge' in which I examined what seemed to me some of the central difficulties of pure economic theory. Its main conclusion was that the task of economic theory was to explain how an overall order of economic activity was achieved which utilized a large amount of knowledge which was not concentrated in any one mind but existed only as the separate knowledge of thousands or millions of different individuals. But it was still a long way from this to an adequate insight into the relations between the abstract rules which the individual follows in his actions, and the abstract overall order which is formed as a result of his responding, within the limits imposed upon him by those abstract rules, to the concrete particular circumstances which he encounters. It was only through a re-examination of the age-old concept of freedom under the law, the basic conception of traditional liberalism, and of the problems of the philosophy of the law which this raises, that I have reached what now seems to me a tolerably clear picture of the nature of the spontaneous order of which liberal economists have so long been talking. (Hayek [1965] 2014: 49-50)

In emphasising the importance of rules as well as prices, Hayek can in his later work be thought of as attempting to devise an interdisciplinary, social-theoretic—as opposed to narrowly economic—approach to the explanation of plan coordination (Fleetwood 1995; Vaughn 1999a). We can elaborate on the nature of this account by exploring another development in Hayek's post-war thinking that is apparent in the essays collected in this volume, namely his increasing emphasis on viewing society as a complex system.

3 COMPLEXITY AND THE COORDINATING POWER OF THE MARKET AS AN EMERGENT PROPERTY

Responding to criticisms of his efforts in *The Counter-Revolution of Science* (Hayek [1952] 2010] to draw a sharp distinction between the methods of the natural and the social sciences made, amongst others, by the philosopher Ernst Nagel and the mathematician Warren Weaver, Hayek began

from the mid-1950s to distinguish between those sciences that study relatively simple phenomena and those whose subject matter is relatively complex (Hayek [1955b] 2014; see Caldwell 2014: 14-15). For Hayek, a complex system consists of a set of parts or elements which are related to each another, and so interact with one another, in a particular way. The set of relations that must obtain between a set of elements if they are to constitute a particular kind of complex system is the system's structure. As Hayek writes in a unpublished paper that complements those reprinted in this collection, '[t]he term system will … be used here in the sense in which it is used in von Bertalanffy's "General System Theory,"' that is 'in the sense of a coherent structure of causally connected physical parts' (Hayek n.d.: 4).

While not completely pellucid (Fiori 2009, Rosser 2010), Hayek's explicit account of complexity appears to suggest that it has two defining features. The first is that complexity involves 'structures whose characteristic properties can be exhibited only by models made up of relatively large numbers of variables' (Hayek [1975] 2014: 365; see also Hayek [1955] 2014: 195-96, 200 and Hayek [1964] 2014: 260-61). The second is that complex systems display what are known as emergent properties. The term 'emergence' refers to situations where, when certain elements stand in particular relations to one another, the system that is formed has properties that are not possessed by its constituent parts taken in isolation or as an unstructured aggregate. As Hayek puts it in his essay on 'The Theory of Complex Phenomena,' the hallmark of emergence is that 'a certain combination of ... structures produces an overall structure possessing distinct characteristic properties':

> The "emergence" of "new" patterns as a result of the increase in the number of elements between which simple relations exist, means that this larger structure will possess certain general or abstract features which will recur independently of the particular values of the individual data, so long as the general structure (as described, e.g., by an algebraic equation) is preserved. Such "wholes", defined in terms of certain general properties of their structure, will constitute distinctive objects of explanation for a theory, even though such a theory may be merely a particular way of fitting together statements about the relations between individual elements. (Hayek [1964] 2014: 261-62)

Emergent properties are structural or relational in the sense that their existence depends not only on the presence of their ('lower-level') constituent parts but also on those parts being organized into a particular ('higher-level') structure that involves them standing in specific relations to one another. More specifically, emergent properties arise in systems that are characterized by what Hayek terms *organized complexity*:

> Organised complexity here means that the character of the structures showing it depends not only on the properties of the individual elements of which they are composed, and the relative frequency with which they occur but also on the manner in which the individual elements are connected with each other. (Hayek [1975] 2014: 365)

Emergent properties are ontologically and causally irreducible to the properties of the lower-level elements of which the emergent or higher-level whole is formed. Where emergent properties arise, therefore, there is not merely a quantitative but a qualitative difference made to the world. New categories, irreducible to those required to understand the lower-level elements, are needed in order to conceptualize adequately the nature and causal impact of the emergent whole (Lewin 2014: 179-82; Lewis 2012, 2015a; Turner 2014).

For Hayek, one notable example of a complex system is, of course, the market economy. In particular, as Hayek came to see it, the ability of the price mechanism to coordinate people's plans is an emergent property of the complex (market) system that is formed when people's (inter)actions are governed both by the formal rules of contract, property and tort law, and also by informal moral norms of honesty and promise-keeping. In an essay entitled *Notes on the Evolution of Systems of Rules of Conduct*, Hayek christens the coordinative power in question as 'the overall order of actions' (Hayek [1967] 2014: 282). It is an emergent property because it is possessed only by a particular whole, namely the free market system that is constituted by a group of people whose interactions are structured by a set of rules like that mentioned above. In Hayek's words, it is 'more than the totality of regularities observable in the actions of the individuals and cannot be reduced to them ... It is more than the mere sum of its parts but presupposes also that those elements are related to each other in a particular manner' (Hayek [1967a] 2014: 282).[7]

The epistemological implication of complexity is that the outcomes that result from the operation of complex systems do not lend themselves to precise quantitative predictions.

Instead, they are intelligible in that we are able to understand the *kinds* of outcomes—defined in terms of their general attributes rather than in terms of the properties of any individual component—that are possible. Thus *patterns* rather than point values are what can be predicted. Of course, the inability to make specific predictions makes it harder to falsify theories (Hayek [1955] 2014: 207, 210; Hayek [1964] 2014: 264). However, as Hayek is anxious to point out, this does not preclude altogether the possibility of an important type of (Popperian) falsification or refutation. Certain resulting patterns are ruled out by this type of investigation; the observation of a pattern of results outside the range predicted by a model of some complex phenomenon would refute that model. For example, confirmed observations of inherited traits acquired in a Lamarckian manner would refute the Darwinian version of evolution (Hayek [1964] 2014: 259-60, 263-71; Hayek [1975] 2014: 365-71). Moreover, as we shall see below, pattern prediction is not the sole preserve of (social) scientists; it is also something that businesspeople must rely on in attempting to navigate their way through a complex economic system.

4 HAYEK, OTHER 'ORDERS' AND THE STRATIFIED NATURE OF REALITY

As Caldwell (2014: 24-25) notes in his excellent 'Introduction' to the volume, Hayek contends that the notion of 'order'—understood as referring to a situation in which the actions of various members of a group are coordinated or brought into mutual adjustment, so that they stand in certain relations to one another—is applicable not only to the market economy but also to other natural and social phenomena. While it is possible for some simple kinds of order to be created through the deliberate arrangement of the relevant parts, Hayek's main focus is, of course, on those complex orders which—like the market order or catallaxy—arise spontaneously (that is, as the unintended consequence of the rule-guided behaviour of their individual parts, without any conscious direction) (Hayek [1967b] 2014). Prominent amongst such orders is the human mind, and it will be helpful for drawing out some important aspects of Hayek's thought to explore in more detail his account of the mind as a spontaneous, rule-governed order.

Hayek's theoretical psychology is set out in full in his 1952 book *The Sensory Order* (Hayek 1952). The volume under review here contains two essays in particular that draw on and develop some of the ideas advanced in that work, namely 'Rules, Perception and Intelligibility' and 'The Primacy of the Abstract.' Hayek views the mind as consisting of a structured hierarchy of interconnected nerve fibres, which acts as a rule-governed system of classification that discriminates between different physical stimuli in such a way as to give rise to the pattern of sensations—the sensory order, in Hayek's terminology—that people actually experience. 'What we call "mind"', Hayek (1952: 16) writes, 'is thus a particular order of a set of events taking place in some organism and in some manner related to but not identical with the physical order of events in the environment.' The neuronal structures in question are—as we shall elaborate in the next section of this paper—the material embodiment of a set of abstract social rules that not only govern perception but also regulate all of the other activities of our minds and indeed much of human action. As Hayek puts it, '[w]e ought to regard what we call mind as a system of abstract rules' (Hayek [1969] 2014: 43). These rule-governed neural structures create in people dispositions both to perceive certain classes of external stimuli as constituting particular types of situation, and also ultimately to respond to those circumstances in certain ways. On Hayek's account, therefore, there is no orchestrating Cartesian 'self' that oversees and directs the function of the neurons in the brain. Rather, our mental life is a spontaneous order, the unintended (emergent) outcome of the rule-governed interactions of a myriad of neurons (Hayek [1962] 2014: 232-36; Hayek [1969] 2014: 317-21, 326-27; see also Dempsey 1996: 25-27, 33).

As Hayek's use of the term 'order' suggests, he views the human mind as relational in nature. The capacity of the human mind to generate the phenomenal world of sense experience, and also to imbue events with meaning and to initiate purposeful action, is possessed only by a particular whole—namely the structured arrangement of neurons found in the human brain—and not by those neurons taken in isolation (Hayek [1967] 2014: 284-85; Hayek 1952: 35, 46-47, 53). In other words, those capacities are emergent properties of the structured array of neurons found in the human brain and central nervous system (Butos and Koppl 2006: 40-43; McQuade 2006: 59; Lewis 2012: 370-73). Their bearer is the higher-level or emergent entity, namely the human mind, which is formed when nerve fibres are arranged into the type of structure required to facilitate the classification of external stimuli and to respond to those stimuli in the complex, rule-governed way described by Hayek. On this emergent causal powers materialist account, the mind is viewed, not as consisting of distinctive 'mental stuff' that exists independently of the physical and biological world, but rather as

an emergent property of the structured array of neurons that is found in the human brain (Hayek 1952: 177-79; also see Bunge 1980: 6-9, 21-25; Lewis 2014).

For Hayek, then, both the mind and the market are complex systems. In both cases, they consist of parts (neurons and people respectively) whose behaviour, when their interactions are structured by an appropriate set of rules, generates emergent properties (such as, respectively, the capacity to generate the sensory qualities we experience and the capacity to coordinate people's plans). More generally, the picture to which this kind of emergentist position gives rise is one that portrays the world as stratified in the sense that there is a hierarchical structure of ontologically distinct 'levels' of emergent entities, each of which has its own distinctive and irreducible properties. These range from the physical, chemical, and biological to the mental (psychological), individual, and social. The existence of entities in the higher strata always depends upon their constituent lower-level components; people could not exist without lower-level physical and biological processes, and society would not exist in the absence of human action. However, at the higher levels there are emergent properties—such as the meaning associated with human action and the increased productivity associated with an elaborate division of labour—that arise only as a result of the relations that obtain between lower-level entities and which are qualitatively novel in the sense of being irreducible to the properties of those lower-level entities taken in isolation (Blitz 1992).

Two other pieces of evidence can be adduced in support of the claim that Hayek subscribed to such a layered ontology. The first comes in the form of teaching notes Hayek produced for a seminar class entitled 'Scientific Method and the Study of Society', held at the University of Chicago in late 1952. The notes include a chart listing phenomena at different 'levels of organization', ranging from the gene to the cell to individuals to society, along with the corresponding fields of study (genetics, physiology, etc.) (Caldwell 2004: 298-99). As used in the notes, the term 'organization' refers here to the way in which emergent properties arise only when certain (lower-level) parts or elements are arranged—'organized'—so as to form particular kinds of (higher-level) structure (Hayek 1952: 46-47; Hayek 1973: 27, 37; also see Lewis 2014).[8] The reference to 'levels of organization' can be taken, therefore, to indicate that Hayek views the world as consisting of a nested set of emergent entities, with lower-level entities existing within the context of higher-level ones in a hierarchy of organizational levels. Hence Hayek's remark that '[s]ocieties differ from simpler complex structures by the fact that their elements are themselves complex structures' (Hayek [1967] 2014: 288). This interpretation receives additional support from a second piece of evidence, namely the way in which, in some of the essays collected in the volume under review, Hayek describes phenomena such as the coordinative powers of the market as 'higher level regularities' or 'higher level generalities' (Hayek [1961] 2014: 381-82; also see Hayek [1964] 2014: 264). The higher-level regularities are 'wholly different … [from any] regularity in the behaviour of the elements,' and 'cannot be wholly reduced to the regularities of the parts,' indicating once more Hayek's commitment to the notion of emergence and a layered ontology (Hayek [1967] 2014: 289, 286).[9]

We move on now to consider two important implications of Hayek's emphasis on emergent properties and a layered ontology: the first concerns the nature of the interaction between entities located at different levels; the second relates to the possibility of group selection on the basis of the emergent property that is the overall order of actions.

5 INTERACTION BETWEEN LEVELS

One question to which this stratified account of reality gives rise concerns how entities at different levels interact with one another. So far as this issue is concerned, as was hinted above, Hayek's theory implies that the social rules structuring people's interaction so that they form a functioning market system can quite literally get inside people's heads and shape the dispositions governing their actions. The process through which the internalization of social rules happens centres on the way in which repeated action in conformity with a social rule can—via social-psychological processes of habituation, imitation, and conformism—cause neurological changes that lead to the formation of new neural structures and, therefore, to people having new dispositions to conceptualize and respond to their circumstances in certain ways.
Consider, for example, how new drivers learn the rules of the highway code. Those rules set out how people who drive cars on the public highway should interact with each another. Novice drivers have to make a conscious effort to learn the rules, so that the act of following them involves impulses travelling along nerve fibres in parts of the brain associated with higher-order thought. Over time, however, as the external stimulus provided, say, by a red traffic light becomes associated with a particular type of action—namely, bringing the car to a halt—connections form between the neurons stimulated by that external event and the motor fi-

bres that fire when the appropriate response is taken, so that the neurons that previously had taken the stimulus into the higher-order nerve centres need not fire for the appropriate action to be forthcoming. In the case of an experienced driver, therefore, the impulses emanating from the receptors stimulated by the red light simply cause the motor neurons associated with the act of stopping the car to fire, without the fibres associated with conscious thought coming into play. The upshot is that the appropriate action will be taken 'automatically,' so that the rule will no longer be followed consciously (Hayek [1967] 2014: 285-86; Hayek [1969] 2014: 317-21, 326-27).

In this way, the alteration in the neural structures of the brain leads to the formation of a new disposition—or 'abstraction', as Hayek also terms it—for the person to interpret and respond appropriately to an aspect of their social environment without having to make a conscious decision to do so on each separate occasion. As Hayek puts it:

> [T]he formation of abstractions ought to be regarded not as actions of the human mind but rather as something which happens to the mind, or that alters the structure of relationships which we call the mind, and which consists of the system of abstract rules which govern its operation. In other words we ought to regard what we call mind as a system of abstract rules of action (each 'rule' defining a class of actions) which determines each action by a combination of several such rules; while every appearance of a new rule constitutes a change in that system, something which its own operations cannot produce but which is brought about by extraneous forces. (Hayek [1969] 2014: 322)

Because the neuro-physiological structure of the human brain is sensitive to people's experiences, and because those experiences are shaped by the social rules that structure how people interact with each other, the human mind must also be sensitive to, and causally influenced by, those social rules and relations. In Hayek's words, '[i]ndividual reason is the product of inter-individual relationships' (Hayek 1952: 160). For Hayek, therefore, social rules can—quite literally—become physically embodied in people's brains. And by moulding people's neural networks, social rules also shape the dispositions that govern how people perceive, think and act. In short, social rules, and the systems to which they give rise, possess the emergent causal power to shape human agency (Lewis 2012: 374-76).[10] One important implication of this view, as we shall see, is that it will help us to mount a defence of Hayek's much-maligned theory of cultural evolution, to which we now turn.

6 GROUP SELECTION AND CULTURAL EVOLUTION

One question raised by Hayek's emergentist perspective on the market concerns the origin of the rules that shape people's interactions so as to gives rise to the overall order of action (Potts 2013: 35-36; Lewis 2015a: section 3.3). One answer is provided by Hayek's controversial theory of cultural evolution and group selection, which is most clearly outlined in this collection in his essay 'Notes on the Evolution of Systems of Rules of Conduct' (Hayek [1967a] 2014). While undoubtedly controversial and problematic, recent developments in social theory have shown that Hayek's account is perhaps not as flawed as some of his critics have argued.

Hayek's reference to the importance of 'the twin ideas of evolution and spontaneous order' is telling in this regard (Hayek [1967] 2014: 289; see also Chaumont-Chancelier 1999; Gauss 2006). For in Hayek's view, it is through an evolutionary process that the set of rules required to generate the overall order of actions comes to be established.[11] According to Hayek's theory, human societies develop through a process of competition between groups of people, where the groups in question are defined by reference to the sets of rules to which their members subscribe. The trait that forms the basis for the competition between those groups is in fact an emergent property, namely the ability of the sets of rules in question to generate the overall order of actions: 'what may be called the natural *selection* of rules,' Hayek ([1967] 2014: 279) avers, 'will operate on the basis of the greater or lesser efficiency of the resulting *order of the group*':

> It is the resulting overall order of actions but not the regularity of the actions of the separate individuals as such which is important for the preservation of the group … [and] the selection process of evolution will operate on the order as a whole. (Hayek [1967] 2014: 280, 283)

Those groups whose activities were structured by a set of rules that gives rise to the relevant emergent property were able to generate the wealth required to sustain higher populations, while those groups that did not adhere to such rules declined in size and ultimately were eliminated, leading eventually to an outcome in which groups that exhibit

the emergent power in question came to predominate. In Hayek's scheme of thought, therefore, the notions of emergence, spontaneous order and evolution are intimately bound together, because it is in virtue of their capacity to generate the emergent causal power to coordinate people's actions without centralized direction that groups—and, more specifically, the sets of rules that characterize them—are selected in the process of social evolution (Gaus 2006; Lewis 2015a).[12]

A noteworthy feature of Hayek's account of cultural evolution is that the emergent property upon which the process of group selection acts is the outcome of the interplay between several different rules rather than being simply the aggregation of their separate effects. Hence Hayek's remark that 'systems of rules of conduct will develop as wholes' (Hayek [1967] 2014: 283):

> The evolutionary selection of different rules of individual conduct operates through the viability of the order it will produce, and any given rules of individual conduct may prove beneficial as part of one set of such rules, or in one set of external circumstances, and harmful as part of another set of rules or in another set of external circumstances. (Hayek [1967] 2014: 280)

There is, in other words, an intricate institutional structure, whereby certain rules complement each other in the sense that, taken together, they give rise to capacities that are not possessed by any of them taken alone. For example, as Hayek makes abundantly clear, the existence of the emergent causal power to coordinate people's actions requires not only formal legal rules but also informal moral rules of promise-keeping and truth-telling. One of those types of rules alone will not suffice to generate the overall order of actions (Hayek 1960: 36, 62, 158).

Group-selection arguments of the kind advanced by Hayek have been criticized on the grounds that they depend on the members of the group in question following the relevant set of rules, not because doing so benefits the individuals themselves, but because it is advantageous for the group as a whole. The problem with such self-sacrificing behaviour, the critics argue, is that such groups will be undermined by the growing presence amongst their membership of free-riders who benefit from being part of the group without incurring the costs of conforming to the rules in question. While such groups might enjoy a 'between-group advantage' in the process of competition with other collections of people, the critics contend that they will ultimately be undermined from within, because the selfish free-riders will enjoy the benefits of group membership without incurring any of the costs of sustaining it. As a result, they will enjoy a 'within-group advantage' over the more altruistic group members who adhere to the relevant rules, being able to out-compete the latter and eventually coming to dominate the group (Vanberg 1986: 85-89).

However, the interpretation of Hayek's work provided above, taken together with recent developments in experimental economics and behavioural game theory, suggests that such criticisms need not be fatal for group-selection arguments of the kind advanced by Hayek. The evidence collected by experimental economists and behavioural game theorists suggests that people often possess so-called *prosocial preferences*. The latter encourage people both to cooperate even with anonymous others with whom it is known that there will be no future interaction and also to punish people who violate social rules even though doing so involves the person carrying out the punishment incurring a personal cost. Such behaviour is said to involve people exhibiting *strong reciprocity* or acting as *rule-following punishers* (Gintis *et al*. 2005; Henrich *et al*. [eds.] 2004; Gintis and Bowles 2014).

The punishment meted out by rule-following altruists is important because it indicates how group selection arguments of the kind postulated by Hayek can be defended against their critics. The presence within a group of even a small minority of altruistic punishers means that other members of the group face a realistic prospect of being penalized if they fail to follow the relevant social rules. The prospect of such punishment can ensure that it is in the interest even of those group members who are not naturally inclined to adhere to the rules in question actually to do so, thereby deterring free-riding and ensuring that the rules that underpin the group's 'between-group advantage' are followed. On this view, altruistic punishment (also known as *second-order cooperation* and involving people enforcing rules) can help to ensure that behaviour in conformity with group-benefitting rules (so-called *first-order cooperation*) is also in the individual's own self-interest. And the realization that a second-order disposition altruistically to enforce the social rules that underpin cooperative group behaviour can help to sustain the set of rules that defines the group and underwrites its emergent causal power to coordinate its members' actions shows how group-selection arguments of the kind advanced by Hayek can be rescued the from their critics (Zywicki 2000; Gaus and Thrasher 2013: 645, 652-53).

This argument is strengthened by the possibility, noted in the previous section, that people's dispositions can be shaped by the social rules governing the society in which they live. If we include within the category of 'dispositions' people's preferences—which seems reasonable, because preferences dispose people to behave in certain ways—then what Hayek's theoretical psychology offers is an account of the cognitive processes through which people's preferences are shaped by the rules that characterize the group of which they are a member. The point is that repeated action in conformity with the rules that underpin the social order of actions may ultimately cause people to internalize those rules, so that they acquire a pro-social preference or disposition for adhering to them. And if people come to value intrinsically behaviour that is in conformity with those rules, then they will be less likely to engage in opportunistic free-riding of the kind that might undermine the emergent properties that give their group its 'between-group advantage' (Gaus 2006: 242).

7 NOVELTY, UNCERTAINTY AND ORDER VERSUS EQUILIBRIUM

It is worth reflecting on how variety is introduced in the evolutionary process. Hayek focuses on two possibilities: accident and purposeful rule-breaking. New rules may arise for 'purely accidental reasons' (Hayek 1979: 155), the accidents in question being concerned with the way in which knowledge, skills, attitudes and habits are combined (Hayek 1960: 29-33). In that case the variation that is introduced into the evolutionary process is random. Second, however, and more significantly for Hayek, new rules can arise because there are times when, in the light of their personal circumstances and views, an individual makes a conscious decision to 'brave general opinion and to disregard a particular rule which he regards as wrong' (Hayek 1979: 171). While in his explicit comments on these matters, Hayek typically focuses on moral rules, the scope for introducing variety into social systems also encompasses the rules governing how work is organized and how physical and human capital are combined in the course of producing goods and services. Thinking about this aspect of novelty is useful because it will enable us to connect our discussion of the introduction of variety to our earlier accounts of the notions of emergence and order in Hayek's work.

Evolutionary and Austrian economists such as Hodgson (1997, 2000), Dosi *et al*. (2003), Dopfer and Potts (2004, 2008), and Harper and Endres (2012) have argued that when entrepreneurs combine human capital, physical capital, and social rules in novel ways, they give rise to emergent properties. New combinations of the intra-organizational rules that govern production can give rise to new, emergent properties at the level of the firm, such as cheaper production processes and an enhanced capacity to innovate (Potts 2000). New combinations of capital goods generate emergent capacities absent from any of the individual components taken in isolation, as for instance when the correct assembly of the parts of an iPhone yields a product that has *sui generis* communicative and data-transmitting capabilities (Harper and Endres 2012). The idea that new combinations of capital goods can give rise to emergent properties, and thereby introduce novelty into the economic system, is of course central to the Hayekian account of capital and, in particular, the idea that there exists complementarities between different kinds of capital goods (Lachmann 1956; Lewin 2011; Harper and Endres 2012).

Significantly, while these new combinations of capital and rules are composed of familiar elements, the emergent properties to which they give rise typically cannot be deduced from, and so cannot be predicted on the basis of, a priori knowledge of their individual component parts. The properties exhibited by such systems are novel in the sense that it is hard, if not impossible, to predict them from our prior knowledge of the elements. In such cases, decision-makers must deal with radical uncertainty; they are unable to assign sharp numerical probabilities to the consequences of their actions and so cannot act in the expected-utility maximizing fashion postulated by rational choice theory (Shackle 1972; Lachmann 1976; Arthur 2013). The answer to how people cope with such uncertainty is found, once again, in social rules. Perhaps most notably, the long-term contracts facilitated by the rules of the legal system enable people to secure a degree of control over their future income and expenditure (in the case of households) and revenues and costs (in the case of firms). Such contracts do not tie down the future completely (unforeseen events may arise, which are not covered by the contract, and one or more parties may unexpectedly renege on their contractual commitments). But they do circumscribe the range of possible outcomes sufficiently for people to be able to orient themselves towards the future in a sensible way. In a complex world, the rules of the legal system play a similar role to that which Hayek attributes to scientific theories in the case of the natural world. While such rules 'do[.] not tell us precisely what to expect, [they] will still make the world around us a more familiar world in which we can move with greater confidence that we shall

not be disappointed because we can at least exclude certain eventualities':

> It makes it a more orderly world in which … we can at least say in general terms how [events] hang together … Though not in a position to specify precisely what to expect, or even to list all possibilities … it limits the possibilities of what else may occur … [thereby] help[ing] us to make our action more effective. (Hayek [1955] 2014: 209-10; also see Hayek 1976: 130).

In this way, such rules enable people to act in a purposeful, goal-driven fashion.[13]

This returns us to the conception of order to which Hayek subscribes. As noted in section 2 above, Hayek defines 'order' as a situation in which a multiplicity of elements are related to one other in such a way that it is possible to learn from an acquaintance of part of the whole to form correct expectations concerning the rest. Over the course of his career, Hayek gradually came to believe that this notion of order was more suitable than the traditional notion of equilibrium for conceptualizing the outcomes produced by the market process, writing in 'Competition as a Discovery procedure' that '[e]conomists usually ascribe the order which competition produces as an equilibrium—a somewhat unfortunate term, because such an equilibrium presupposes that the facts have already been discovered and competition has therefore ceased'. Hayek ultimately rejects the notion of equilibrium on the grounds that it cannot capture the dynamic, open-ended, evolutionary, novelty-generating features of the market process. The advantage possessed by the notion of order is that 'we can meaningfully speak of an order being approached to various degrees, and that order can be preserved throughout a process of change' (Hayek [1968] 2014: 184).[14] For Hayek, therefore, the notion of order is better able to do justice to the nature of the market as an open-ended, evolutionary process of discovery in which, notwithstanding the emergence of novel goods and methods of production, people are still usually able to predict the behaviour of others well enough to devise plans that have a decent chance of coming to fruition.

Hayek advances a *transformational conception of socio-economic order* (Fleetwood 1995: 135-55; Lewis 2015a).[15] For Hayek the continued existence of the inherited stock of social rules that facilitate purposeful, coordinated human agency at any given point in time depends on current human action (Hayek [1967] 2014: 284-89). In drawing upon the inherited rules in order to act, people reproduce—or, if individuals transgress and engage in new forms of conduct which others subsequently imitate, transform—those rules. What this suggests is that social rules may be seen at one point in time as relatively stable points while at others as features of the economic systems that are subject to change. Commercial law is necessary for the conduct of economic life and indeed facilitates the emergence of unpredictable novelty in economic life, but economic and technological changes of certain types put a strain on aspects of the law that prompt it to change. For example, the emergence of electronic communications has suggested the acceptance of facsimile signatures and has raised difficult legal questions relating to copyright and privacy on the internet. However, so long as the extant set of rules continues to generate the emergent causal power to coordinate people's plans, an outcome that is orderly in the sense defined above will still be generated. On this view, social order is the (continual, never-ending) process whereby people draw on (pre-existing, historically given) social rules and norms in order to act and, in so doing, subsequently either reproduce or transform the rules in question.

8 THE NATURE OF THE TENDENCY TOWARDS PLAN COORDINATION

It was argued above that, for Hayek, the capacity of the market to coordinate people's plans is an emergent property of the set of rules that characterises the liberal market system. Put slightly differently, those rules constitute a generative mechanism that, when set in motion by the behaviour of the people whose (inter)actions they shape and structure, gives rise to the emergent causal power to coordinate people's plans even in the absence of centralized direction. The fact that the mechanism underpinning the overall order of action is animated only by human agency is significant because it implies that outcomes in the market are the product of the interplay between two ontologically distinct and relatively autonomous causal powers, namely the overall order of actions and the power of people to engage in purposeful, creative decision-making. It is for this reason, of course, that Hayek describes the working of the market system as involving the interplay of causal powers—or 'regularities', as Hayek terms them—'on ... two levels' and involving the 'interaction between the regularity of the conduct of the elements [people] and the regularity of the resulting structure' (Hayek [1967] 2014: 286, 288-89; also see Hayek 1979: 158).

On this view, the actual outcome produced by the market is the result of the interplay between two ontologically distinct, and relatively autonomous, levels, 'the individual and the social,' each of which possesses its own distinct (emergent) causal powers. But then there arises the possibility that the capacity of the market to bring people's plans into conformity with one another might be offset by the capacity of human agents to respond so autonomously, so creatively—and, therefore, so unexpectedly—to their circumstances that they surprise one another and as a result develop plans that are less, not more, compatible. The creative powers of human agents may be such that, to use the terminology employed by subsequent generations of Austrian economists, discoordinating forces are generated endogenously, as part of the market process. Moreover, the tendency to endogenous dis-coordination produced by creative human agency may even outweigh the capacity of the liberal market economy to bring plans into greater conformity with each other, so that the operation of the market process leads to less, not more, plan coordination (Lachmann 1976: 129; Rizzo 1996: xvii-xxi; cf. Beinhocker 2006: 109-14; Arthur 2013).[16]

Ultimately, therefore, as Hayek himself clearly recognized, even in the absence of external disturbances the question of whether the market system tends to produce greater plan coordination cannot be answered on the basis of *a priori* argument alone. As Hayek remarked in 1983, 'while the analysis of individual planning is in a way an *a priori* system of logic, the empirical element enters in people learning about what other people do … [Y]ou can't claim, as Mises does, that the whole theory of the market is an *a priori* system, because of the empirical factor which comes in that one person learns about what another person does' (Hayek, quoted in Caldwell 2004: 221; also see Hayek [1937] 2014: 68-70). Of course, the evidence indicates *ex posteriori* that the coordinative powers tend to prevail. However, as Hayek himself clearly recognized, there are no guarantees that they will always and invariably do so.

9 CONCLUSION: HAYEK AND COMPLEXITY THEORY

We end by considering the extent to which Hayek's ideas anticipate the work of modern complexity theorists (Vaughn 1999b; Vriend 2002; Rosser 2010). While there are many different definitions of complexity, none of which command universal ascent (Horgan 1997), complex systems are commonly said to possess the following attributes.

- First, they are composed of a set of elements which are related to one another in a particular way, forming a structure that governs how they interact and that displays emergent properties (Holland 1998: 2-6, 14, 225; Miller and Page 2007: 9-10, 48-50; Page 2011: 25-26).
- Second, they are hierarchical, in the sense that systems obtaining at one level of organization (the physical, say, or the individual) form the building blocks (sub-systems) out of which systems obtaining at higher levels (the chemical or the social respectively) are composed (Holland 1988: 6-9; Miller and Page 2007: 40-42, 50-51).
- Third, the emergent properties that obtain at each level of the system are the product of a process of self-organization, arising as a result of the rule-guided responses of the individual elements to their local environment (rather than from directions issued by a central controller possessing an over-arching, synoptic view of the entire situation) (Holland 1998: 141-42; Beinhocker 2006: 167-68).
- Fourth, these properties are often novel in the sense that it is hard, if not impossible, to predict them from our prior knowledge of the elements. On this view, novelty is generated endogenously, via the operation of the system itself, as well as through exogenous shocks (Holland 1998: 4, 229-30; Beinhocker 2006: 97; Arthur 2013).
- Fifth, the systems obtaining at each level are adaptive in the sense that they adjust to the broader environment in which they are situated via an evolutionary process involving variation, selection, and (differential rates of) reproduction (Beinhocker 2006: 18-19; Page 2011: 25).
- Sixth, the outcomes produced by such systems do not lend themselves to being understood using standard notions of (economic) equilibrium, but rather in terms of alternative notions of 'order' (Beinhocker 2006: 17-19, 76-75; Miller and Page 2007: 222; Page 2011: 27; Arthur 2013).

Hayek's explicit definition of complexity tends—as we have seen—to focus on the number of variables required to represent a system and on the presence of emergent properties (section 3 above). However, Hayek's writings, as showcased in the volume under review here, also refer to most if not all of the other aspects of complexity listed above, so that his own use of what would now be regarded as complexity-related ideas often outstrips his explicit definitions of complex systems. For, as we have seen, Hayek attributes to mind, and to society, many of the other features commonly said to be hallmarks of complex systems: in each case, order arises spontaneously as a result of rule-governed interactions between the system's parts rather than through conscious con-

trol (see the second and fourth sections above); both systems are adaptive, evolving so as to become better fitted to their environment via a process of group selection (see the sixth section); the two systems form part of a larger hierarchy of structures (see the fourth and fifth sections); while the patterns produced in such systems are best conceptualized not in terms of 'equilibrium' but of 'order' (see the seventh section).

It is important not to exaggerate the extent to which Hayek anticipated modern complexity theory. His understanding of some of the concepts listed above was of course different in certain key respects from that of modern complexity theorists. For instance, it is hard to argue convincingly that in his notion of 'order' Hayek had an (implicit) understanding of technical concepts in modern complexity theory such as 'basins of attraction' and 'strange attractors'. Moreover, there are also important respects in which Hayek's account of complex systems diverges notably from modern complexity theory. For instance, Hayek's account of the economy as a complex system tends to emphasize negative rather than positive feedback (Hayek [1968] 2014: 309), whereas contemporary complexity theory sets great store by increasing returns to scale and positive feedback (Miller and Page 2007: 50-52; Witt 2013: 123; Arthur 2013). Also, Hayek's ideas about complexity tend to be presented discursively, in marked contrast to the present-day emphasis on mathematical and computer modelling. However, it seems safe to conclude, following Rosser (1999: 185-86), Caldwell (2004: 363) and Gaus (2006: 254 n. 5), that, while Hayek never developed what contemporary complexity theorists would regard as a fully-fledged theory of complexity (in the sense of articulating a completely integrated, formal account of all the features listed above), his writings display many of the ideas that were later crystallized into complexity theory.[17]

What is clear enough, though, as this essay has hopefully demonstrated, is 'the gradual emergence of and, indeed, the underlying *order* to be discovered in Hayek's ideas' (Caldwell 2014: 1). As editor Bruce Caldwell (2014: 35) writes: 'The title of this volume is *The Market and Other Orders*. The title is meant to highlight Hayek's own path: he began with the market order, then became aware of the existence of orders in many other areas.' Caldwell has succeeded admirably in his aim of bringing out the unity in Hayek's thinking across a wide range of topics that might appear at first glance to be rather disparate. Scholars have reason to be grateful for the care and good judgment with which he has curated this volume.

NOTES

1 By 'dispersed knowledge' Hayek ([1945] 2014: 95) means, in his famous phrase, 'the particular circumstances of time and place.' This encompasses knowledge of 'local conditions and of special circumstances' rather than of 'general rules.' Examples include knowledge of 'a machine not fully employed, or [of] somebody's skills which could be better utilised, or ... of a surplus stock [of some good].' As these examples attest, local knowledge is often explicit, propositional knowledge (that is, knowledge that such-and-such is the case). In the case of 'tacit knowledge', however, people have the capacity to act according to (general) rules without necessarily being able to state those rules explicitly (Hayek [1962] 233; [1969] 2014: 317-18). An example of such 'know-how' is provided by a person's ability to speak and write grammatically correct English without being able to articulate the rules of English grammar. Herein then lies the distinction between these two kinds of knowledge: dispersed knowledge is explicit and has as its object particular facts; tacit knowledge is not propositional and has as its object general rules. Of course, notwithstanding the possibility of drawing such analytical distinctions, Hayek also notes that in practice two forms of knowledge may come into contact with each other. For example, in 'Competition as a Discovery Procedure,' Hayek argues that one example of tacit knowledge is provided by an entrepreneur's 'capacity to find out particular circumstances.' That is to say, according to Hayek, while entrepreneurs possess the capacity to discover local, propositional knowledge, they may be unable to 'list the principles that underlie their ability to do so' ([1968] 2014: 306).

2 As Caldwell rightly notes in his Introduction, Hayek's emphasis is on the role of disequilibrium, as distinct from equilibrium, prices (2014: 9-11; also see Thomsen 1992 and Kirzner 1997).

3 In a series of lectures delivered at the University of Virginia in 1961, entitled 'A New Look at Economic Theory' and published for the first time as Appendix A of this volume, Hayek offers a similar account of 'The Communication Function of the Market,' couched not in terms of tin but of sisal and jute (Hayek [1961] 2014: 415-22).

4 As Hayek puts it elsewhere, the information provided by market prices enables people to form reasonably accu-

rate expectations of one another's plans only if it arises against 'a fairly constant framework of known facts,' as provided by social rules and norms (Hayek 1976: 125). Thus, stability and predictability in one sphere, namely that of institutions, is a necessary ingredient for coping with its absence (unpredictable novelty) in another sphere (Lewin 2014: 187-88).

5 In addition to being the first place where Hayek used the term 'spontaneous order,' the Cairo lectures also saw him elaborate on several issues in political theory, the history of political thought, and jurisprudence—such as the notions of 'equality before the law' and the 'rule of law,' as well as the history of liberalism—that would form part of the core of *The Constitution of Liberty* (Hayek 1960; see Caldwell 2014: 12-14).

6 The reason why the claim about coherence concerns Hayek's post-1937 work in economics is that, as Hayek notes in the long passage from 'Kinds of Rationalism' quoted in the main text, and as Caldwell (2014: 3-5) explains in his Introduction, Hayek's 1937 paper on 'Economics and Knowledge' marks a major shift in his approach to economic analysis. Prior to that paper, Hayek was an exponent of the standard approach to economics, namely equilibrium analysis. Indeed, before 1937, Hayek virtually defined economics as equilibrium analysis, maintaining that any legitimate *economic* explanation must employ some notion of equilibrium. However, due principally to the experience of participating in the socialist calculation debate of the 1930s, Hayek came to question the merits of the equilibrium concept. The use of general equilibrium theory to justify market socialism led Hayek to revise his understanding of his own approach to economics and to begin to distance himself from that mode of analysis. For in responding to the arguments of the market socialists—arguments that were couched in terms of the equilibrium framework by which he himself had set such store in the past—Hayek came to realize that his emergent understanding of the market as a dynamic process of adjustment was one to which equilibrium analysis could not do justice. The reason, of course, is that by confining itself to situations in which people's plans are already coordinated, equilibrium analysis ignores the most important question that must be answered both in explaining how market economies work, and also in evaluating the feasibility of central planning, namely that of how (if at all) people acquire the information they need to coordinate their plans and thereby achieve an orderly allocation of resources (Kirzner ([1988] 1992; Caldwell 2004: 155-62, 209-220, 409-22).

7 Hayek makes a similar point in *The Errors of Constructivism*, writing that '[t]he order of society is therefore a factual state of affairs which must be distinguished from the regularity of the conduct of individuals' (Hayek [1970] 2014: 344).

8 Hayek was of course aware of the fact that the 'organized' wholes to which he referred were not consciously designed. In this context, the term 'organization' was, of course, being used in a sense different to that intended by Hayek in his criticisms of constructive rationalism. As Hayek put it in the first volume of *Law, Legislation and Liberty*, '[t]he biologist will generally speak without hesitation of "organization" without implying design … [B]iology has from its beginnings been concerned with that special kind of spontaneous order which we call an organism' (Hayek 1973: 27, 37).

9 Given that, on Hayek's account, both the mind and the market—and, indeed, other facets of social life, such as the law—are complex systems in which order arises spontaneously, the question arises of whether there is a common, underlying account of 'system' and of 'spontaneous order.' It is noteworthy in this regard that the theoretical biologist Ludwig von Bertalanffy, upon whose notion of 'system' Hayek draws (see Hayek n.d.: 4; Hayek [1961] 2014: 381-82), sought to develop a trans-disciplinary framework—couched in terms of concepts such as 'organization', 'level,' and 'emergence'—that was applicable to all phenomena of organized complexity, independent of their substance or spatio-temporal sphere of existence (Bertalanffy 1950: 164-65; Bertalanffy 1952: 11). Bertalanffy termed his framework general system theory and it would seem to be one candidate for the unifying account in question. For more on Bertalanffy's influence on Hayek's thinking, see Lewis (2014, 2015c). And for interesting efforts to find an abstract account of 'spontaneous order' common to all the particular examples considered by Hayek, see Bernstein (2008) and diZerega (2013).

10 In this regard, Hayek's work is compatible with the ideas of various evolutionary, old institutionalist, and modern complexity economists, all of whom emphasize the scope for social rules to help constitute human agents and, therefore, human agency (Hodgson 2004: 184-86, 2007; Gintis and Bowles 2014; Gintis and Helbing 2015; Harper and Lewis 2012: 1-3; Lewis 2015b).

11 The foil against which Hayek develops his evolutionary account of the emergence of the set of rules in question is provided by those approaches, such as contractarian political philosophy and legal positivism, which portray rules as the deliberate creation of conscious reason. Hayek contends that, while the roots of this 'constructivist rationalist' approach are ultimately to be found in Greek philosophy, its modern influence begins in the sixteenth and seventeenth centuries with the works of Francis Bacon, Thomas Hobbes, and in particular René Descartes. Hayek traces the influence of their ideas through the works of French thinkers such as Rousseau and Comte and of English legal positivists such as Bentham and Austin, via Hegel and Marx, and ultimately to the market socialists and Fabian reformers of the twentieth century. From the current collection, see in particular the essays entitled 'Kinds of Rationalism' (Hayek [1965] 2014), 'The Results of Human Action but not of Human Design' (Hayek [1967] 2014), and 'The Errors of Constructivism' (Hayek [1970] 2014). These essays also contain Hayek's account of the evolutionary tradition of thought to whose revival he saw himself as contributing, and whose leading exponents included the Scottish Enlightenment thinkers Hume, Smith, and Ferguson, the Spanish Schoolmen, the conservative political philosopher Edmund Burke, and the founder of the Austrian school of economics Carl Menger.

12 It is also worth noting in this context that, according to Hayek, the mind develops via a process of selection through which neural structures are reinforced or whither, according to how successful they are in promoting behaviour that is well adapted to the prevailing context in the sense of enabling a person to achieve his or her goals. Hayek's account is one in which structured groups of neurons are selected by virtue of their emergent capacity to classify the world in a way that enables people successfully to navigate their environment (Hayek 1952: 74). This process of neuronal group selection on the basis of the emergent properties of the group of neurons is, of course, analogous to the process of group selection that Hayek believes accounts for the development of rule-governed social systems such as the market economy.

13 What this suggests, of course, is that it is not only social scientists who engage in pattern prediction; the occupants of complex systems also have to rely on pattern prediction in attempting to devise plans that have a decent chance of being brought to a successful conclusion. For more on the nature of plan coordination, and on different kinds of knowledge that can sustain it (including the kinds of knowledge possible in complex systems), see Lewin (1997: 251-53; 2011: chapter 3).

14 As Caldwell notes elsewhere, in a lecture delivered in 1981 Hayek was unequivocal in his dissatisfaction with the equilibrium concept as a means of capturing the market process. Using the metaphor of a stream to articulate his ideas about the way in which the price mechanism coordinates the capital stock to continuously changing economic conditions, Hayek comments as follows: 'It is tempting to describe as an "equilibrium" an ideal state of affairs in which the intentions of all participants precisely match and each will find a partner willing to enter into the intended transaction. But because for all capitalistic production there must exist a considerable interval of time between the beginning of the process and its various later stages, the achievement of an equilibrium is strictly impossible. Indeed, in a literal sense, a stream can never be in equilibrium, because it is disequilibrium which keeps it flowing and determining its direction' (Hayek, quoted in Caldwell 2004: 226-27).

15 The same is arguably also true of another Austrian economist, Ludwig Lachmann. See Lachmann (1970), Lewis and Runde (2007), Lewis (2011) and Lewin (2014).

16 On this view, the emergent causal power of the market to coordinate people's actions is best viewed as giving rise to a non-empirical or transfactual tendency towards the dovetailing of people's plans, whose impact on the outcomes that actually arise may be offset by the impact of other, countervailing tendencies, most notably those produced by creative human agency (Lewis 2011).

17 This is unsurprising once it is remembered that Hayek was developing his ideas at a time when the scientific problems and concepts that were the precursors to modern complexity theory were being discussed and developed (Vaughn 1999b; Lewis 2014). If it is indeed the case, as Colander and Kupers (2014) argue, that there is no unified theory of complexity that incorporates all of the features of complex system listed in the main text, then Hayek's 'failure' to develop such a theory looks like less of a shortcoming than it otherwise might.

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