
Rules of Spontaneous Order

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Bio-sketch: Jason Potts has written three books and dozens of articles on the theory of economic evolution. His work focuses on how entrepreneurship and innovation drive economic growth and development. His books include *The New Evolutionary Microeconomics: Complexity, Competence and Adaptive Behaviour* (2001, Elgar) a co-recipient of the Schumpeter Prize. He also co-wrote the *The General Theory of Economic Evolution* (2007, Routledge). His latest book is *Evolutionary Economics and Creative Industries* (2011, Elgar).

Abstract: This paper is a reply to Gus diZerega's essay on the nature, scope and ambition of spontaneous order studies. I am in broad agreement with diZerega's claims and so I will seek neither rebuttal, nor restatement. Instead, I want to argue some different points of emphasis in the spontaneous order research program. Specifically, I argue that emergent social order should be studied as an application and indeed exemplar of the evolutionary theory of rule-based co-operation.

Keywords: Spontaneous order; complexity; economic evolution; Hayek; rules

1: INTRODUCTION

This essay is a response to Gus diZerega's engaging, thoughtful and wide-ranging survey of the subject domain of spontaneous order studies and of the various analytic and methodological approaches within its ambit. The launch of a new scholarly outlet for the study of emergent social phenomena is an ideal opportunity to engage in such purpose and reflections. I want to pick up some themes and challenges that diZerega has posed, and push them along a little further. This essay will develop the analytic framework that diZerega has proposed, but I will seek to steer these arguments in a particular direction, namely toward a study of evolving rule-systems for distributed co-operation. Specifically, I argue that the most overarching source of spontaneous order in any social system is imitation, or the copying of rules. This produces co-operation and evolution, which in the social sciences are the proper focal points for the study of spontaneous order.

Like any relatively new science¹ spontaneous order studies is still very much in the 'collecting' phase of gathering together instances of spontaneous orders, and of gathering and

auditioning methods and tools for their study. Its research program is still advancing through the following templates—'X is (also) a spontaneous-order domain'; and 'Y is (also) a spontaneous-order theorist'. My purpose in this essay is not to add another X or Y—for I do that elsewhere, with X = Innovation and Y = Elinor Ostrom and Deirdre McCloskey (Potts, 2012). Instead, I seek here to build on diZerega's survey with some particular refinements and points of emphasis.

Many sciences develop by the differential contributions of 'lumpers and splitters'.² Lumpers see in advance the bringing of things together that may appear different, so that overarching patterns and similarities may be revealed. Spontaneous-order theory, it would seem, is dominated by lumpers. Splitters seek to make sub-classifications to highlight different mechanisms and to make sense of new data. Mature sciences tend to be dominated by splitters. I want to do both some lumping and some splitting.

The lumping is in respect of the theory of *co-operation*: I want to lump spontaneous order studies—and the study of emergent social phenomena generally—with the study of co-operation. This often sits below the surface. Yet the study

of spontaneous orders can benefit from having this in plain view. It also helps reveal intriguing questions that are otherwise ill-framed: such as why spontaneous orders are often so hard to see, or why we so readily attribute design or intention to the complex order they produce when there is none. This also helps frame the classical ‘Scottish Enlightenment’ sense of spontaneous orders as a species of what we might think of as unintended co-operation.

The splitting is in respect of the mechanisms of spontaneous orders. I want to make the case that there are two broad and distinct mechanisms at work in a spontaneous order—complex networks (adaptation) and evolution (copying)—and while they are often seen together, they are in fact different mechanisms and processes. The research program of spontaneous order studies benefits from splitting them. On the one hand there are spontaneous orders made of complex information networks that facilitate the use of distributed information and knowledge through signals and adaptation. A classic example is F. A. Hayek’s (1945) essay on the price mechanism ‘The use of knowledge in society’. On the other hand, there are spontaneous orders that emerge through differential rule copying, as through an evolutionary process that results in the change of population structures. A classic example is F. A. Hayek’s (1973) theory of cultural evolution, which might well have been called ‘the use of society in knowledge’. There are several reasons to emphasize this split. One is that they draw on different theoretical and analytic foundations (*viz.* complexity and network theory versus evolutionary theory). Another is that while networks are essentially about information dynamics, evolution is about rule dynamics.

This lumping and splitting helps us to see the relation between spontaneous orders and civil societies, which is the theme of Part III of diZerega’s essay, where he argues that Jane Jacobs’ work is more in the manner of civil society rather than of spontaneous order, and that civil societies are analogous to social ecosystems. I want to step back from the social ecosystem metaphor and argue that civil society is what happens when we have both sorts of dynamics: namely, information networks and the emergence and evolution of rules.³ But these differences in emphasis should not detract from the overarching agreement.

Gus diZerega has proposed a broad map of the elements of the study of spontaneous order and the range of its applications (see also diZerega, 2008). Studies of spontaneous order have a wide compass. There are multiple definitions and meanings, many accepted methods, and an inclusive attitude to membership. But to progress much beyond a

broad-church concept it will need to refine its definitions and sharpen its focus. This new journal is an instrument in the effort to do that. Toward that end, I want to make the case that spontaneous-order studies can be usefully framed as the study of the rules by which co-operation evolves.

2: INVISIBLE HANDS & EVOLVED MINDS

But before we get to that, consider a basic reason why the study of spontaneous orders is hard, namely that we seem instinctively predisposed not to see emergent unintentional order. We tend to overwrite it with intention and design.

The concept of an emergent or spontaneous order has been a part of inquiries into the human, natural and social sciences at least since the writings of the Scottish moral philosophers (Barry 1982). In 1714 we find in Bernard Mandeville’s *Fable of the Bees* a story of ‘private vices and public virtues’. The concept of ‘the invisible hand’ is in Adam Smith’s *History of Astronomy* (1749), in his *Theory of Moral Sentiments* (1756) and in the *Wealth of Nations* (1776). In 1782, Adam Ferguson wrote in *History of Civil Society* of social order as ‘the result of human action, but not the execution of any human design’. The abstract idea of a spontaneous order has long been recognized as central to the study of human society, the growth of knowledge, and the economy.

These deep eighteenth-century insights catalysed further recognition of the domain of spontaneous orders as alternative explanations of the appearance of design. Perhaps most famously this occurred in Charles Darwin’s theory of evolution by natural selection—still a classic argument against design—but eventually leading to the modern science of complex adaptive systems and of emergent order. Nevertheless, the core of the analytic idea of a spontaneous order that developed through the nineteenth and twentieth centuries can be claimed to have centred on the concept of a market or institutional price mechanism (as in the work of Carl Menger, for example) as an information-processing system that co-ordinates the distributed actions of individuals, and which results in an overall pattern of order or *cosmos*, a term that Hayek (1979) highlighted in Chapter 2 of *Law, Legislation and Liberty*. This spontaneous order emerged from a parallel process of mutual feedback and local adaptation, co-ordinated through price signals.

The study of the spontaneous order of culture, economy and society has developed across a number of domains: specifically, through what Ludwig von Mises called a *catallaxy* in relation to the economic order; what Hayek called ‘the Great Society’ and ‘the extended order’;⁴ what Karl Popper

called ‘the Open Society’ in relation to the classical liberal polity; what Michael Polanyi called the spontaneous order of the enterprise of science; and in the study of the equilibrating tendencies of the price system (e.g. in the work of Leonid Hurwicz, although not in that of Kenneth Arrow). These advances have helped us to see the range of where spontaneous orders exist and provide insight into the mechanisms and processes by which they work. Gus diZerega, in his opening essay, proposes several other key contributors and domains, including Jane Jacobs on cities, Thomas Kuhn on scientific revolutions and Evelyn Fox Keller on slime moulds. A register of additional domains of spontaneous-order studies extends well beyond market economies and reaches into the study of, for example: law (Hayek, 1967); language (Pinker, 1995; Habermas, 1998); democracy (Scott, 1998; diZerega, 1989); religion (Andersson, 2010); the family (Horwitz, 2005); and arts and literary production (Camplin, 2010; Cantor and Cox, 2010).

It is noteworthy that spontaneous orders are both very common⁵—they are in an important sense all about us, as the above list illustrates—and yet are nevertheless very difficult to see, in the sense that we must overcome a ‘nativist’ perception that these are the result of a designed order. Specifically, it is difficult to see complex structures and systems—such as families, cities, science, economies and so on—as not being designed or planned, both because of their apparent complexity and because they are seemingly co-operative systems or outcomes. It is hard to see them as spontaneous orders.

Consider why this is. First, you can’t see them directly. They have to be statistically constructed so that the ordered patterns become apparent. But there is a further difficulty that acts against the grain of any analytic exploration. The problem is that our brains seem wired as if to actively filter out or misconstrue spontaneous orders. This is not simply a problem of rational ignorance about how economic systems work (Caplan, 2006). Instead, it would seem to be the case that the human perceptual and classificatory apparatus has evolved in such a way as to instinctively misconstrue spontaneous orders as either purely *natural*—as exogenous or unintended—or as entirely *artificial*—as endogenous and intentional. Under this hypothesis, we have a cognitive blind spot in respect of order that is both endogenous (caused by human action) and unintentional (not by human design).

The human brain (and probably other organisms too) has trouble with endogenous forces and processes in the social realm that are unintentional. Endogenous-Intentional covers the range of artificial or rational operations (see

Figure 1 below). Exogenous-Unintentional is the realm of the natural. Exogenous-Intentional is the mystical. But Endogenous-Unintentional is problematic: we more or less filter it out. But that invisible world is the realm of spontaneous orders.

Figure 1: System-agency in attribution of order

	<i>Intentional</i>	<i>Unintentional</i>
<i>Exogenous</i>	Mystical	Natural
<i>Endogenous</i>	Artificial/Rational	Spontaneous Order

The invisibility of spontaneous order has the perverse effect of generating demand for hierarchically imposed forces to defeat the latent anarchy of the Hobbesian social ‘state of nature’ with the artificial creation of centralized governance. The tendency to see a mystical basis of society is perhaps deep in the human psyche and instinct, and the modern mind has developed to replace this with an attribution that oscillates instead between natural and artificial. But it would appear that there is a similar tendency to neglect the possibility of spontaneous order. They may simply not see it, or they may see it but find in it quasi-mystical properties that may appear dogmatic or ideological. Hayek observes that

[m]any of the greatest things man has achieved are not the result of consciously directed thought, and still less the product of deliberately coordinated effort of many individuals, but of a process in which the individual plays a part which he can never fully understand. They are greater than any individual precisely because they result from the combination of knowledge more extensive than any single mind can master (Hayek, 1952, 149-50).

That millions of people pursuing their own purposes and plans without central direction could result in anything other than utter chaos seems implausible: no design without a designer; large-scale order must thus be the result of large-scale planning. That chaos does not generally result, and that societies and market economies not only function without detailed centralized direction, but for the most part function best without it, is testament to the supreme importance of this idea as a foundational insight into the nature of modern society and economic systems.

The human mind seems to have evolved to attribute any perceived order to the guiding intention of an ordering hand or mind, and thus to seek causal explanations or stories (Boyd, 2009). So there may be opportunity to develop a minor research program at the intersection of evolutionary psychology and behavioural economics to explore this systematic ‘anomaly’ (*à la* Kahneman, 2011). Call this ‘behavioural microeconomics of spontaneous orders’; it may then underpin various attribution biases, systematic overconfidence in entrepreneurial judgments, expectation formation, and many other choice anomalies.

3: CO-OPERATION

The reason we care about spontaneous orders at all—which is to say the reason why we seek to better understand how they work and their range of application—is because of what they are not: namely, a spontaneous order is not the consequence of coercive force. It is not an expression of individual power over others. A spontaneous order is a state of co-ordination that is achieved through mechanisms that are, in law, nature and game theory, co-operative. A spontaneous order is the outcome of a mutual co-operative strategy, that is, as diZerega notes, ‘based on certain broadly shared values that are simpler than the values actually motivating many people’.

A spontaneous order is an unintentional co-operative solution that arises from agreement about rules, not outcomes. It is a solution to a co-ordination problem that arises without recourse to force of command or acts of coercion. The price mechanism is both an efficient and a peaceful mechanism. There are also other efficient and peaceful ways to achieve order. Co-ordinated outcomes can also be realized through rule-governed voluntary collectives, such as when clubs or civil societies create public goods. Or it can occur when many people adopt the same behaviour, technology, institution or idea. In these instances, the order essentially exists in the correlated population of rules that agents carry. It exists dynamically in the institutional space of order provided by those rules.⁶

The concept of a spontaneous order has long been associated with the order of the market, in which price signals co-ordinate economic activity without the need for central planning. It has also been noted that this spontaneous order seemingly relies on institutional arrangements such as property rights that are provided by government, and therefore rely on its coercive powers. But as Ostrom (1990), Greif (1993), Anderson and Hill (2004), and Leeson (2008; 2010)

among others show, there is considerable scope for the development and enforcement of rules to govern co-operative behaviour without recourse to the state. This connection between the mechanisms of co-operation and spontaneous orders is at the forefront of modern science and is having a particularly strong impact in the reframing of the social sciences (Nowak, 2010; Wilson, 2012).

Theoretical, experimental and empirical findings are converging on a set of conditions that appear to be necessary for the emergence of co-operation in ‘collective-action’ or ‘social-dilemma’ situations. These are: (1) low discount rates, patience, or long time horizons; (2) low information-sharing or communication costs; (3) equally strong agents; and (4) shared ideas about defection and how it should be punished (Leeson, 2008: 70). In the absence of these conditions, mutual co-operation is not expected to emerge spontaneously. diZerega makes a similar observation, noting that ‘all spontaneous orders possess certain abstract features in common’—‘all participants have equal status. All are equally subject to whatever rules must be followed. All are free to apply those rules to any project of their choosing’. He also recognizes that ‘these rules facilitate co-operation among strangers’. There is obvious overlap between these approaches as well as room for cross-fertilization: for example, in the understanding of decentralized enforcement (or what is called ‘altruistic punishment’ in the evolutionary-games literature).

There are two main concepts of *orders* in the literature: first, that based on command incentive (for example, power or coercion); and second, that based on non-command incentive (for example, markets or other spontaneous orders). And there are two main concepts of *spontaneous* orders in the literature: that which is based on information (or complexity); and that which is based on rules (or evolution). Spontaneous orders are co-operative orders. These are valuable in themselves because they are not coercive orders. Spontaneous orders are in several ways voluntary and non-coercive. But they are also invariably rule-governed, rather than command-governed. They are better understood as rule systems than as communication systems; but in both cases they are co-operative systems.

4: INFORMATION & RULES

Hayek’s most well-known paper, and by several accounts one of the most important papers in economics (Arrow *et al.*, 2011), is his 1945 essay—‘The use of knowledge in society’. It explains how the information contained in price signals enables vast numbers of economic agents to continuously

adapt not only to changes in the relative scarcity of different commodities, both locally and globally, but also to changes in the preferences and plans of others, all through mutual adaptation and without central direction. The result is the coordination of millions of individuals' plans without anyone doing the planning, a result also known as the spontaneous order of the market through the mechanism of the price system. Hayek (1945: 527) notes in passing that '[i]f it were the result of deliberate human design ... this mechanism would have been acclaimed as one of the greatest triumphs of the human mind'. His point is that we don't tend to value things, such as spontaneous orders, that can't be traced to rational planning or individual construction.

Hayek unpacks the spontaneous orders in the market-price system by focusing on distributed information or knowledge. The centrepiece of Hayek's (1945: 520) argument lies in recognizing that the economic problem is ultimately 'the utilization of knowledge not given to anyone in its totality' and, crucially, that there are 'different kinds of knowledge'. There is scientific or technological knowledge – 'which occupies now so prominent a place in public imagination that we tend to forget that it is not the only kind that is relevant' – and there is local distributed 'knowledge of particular circumstances of time and place'. For Hayek this second type of 'very important but unorganized knowledge' about local conditions and opportunities is key to understanding why the decentralized price system is superior to central planning. Following von Mises' information-and-calculation-based critique of socialism (1922/1951), Hayek argues that the price system enables a society to make effective use of distributed knowledge of the particular circumstances of time and place, something that is not just difficult but impossible in a centrally organized system.

Hayek and the Austrian school of economics (along with certain strands of post-Keynesian macroeconomics⁷) have emphasized that the fundamental economic problem is not so much an *allocation problem* (the textbook shibboleth 'the allocation of scarce resources') but is properly understood as a *co-ordination problem* as regards the co-ordination of distributed knowledge and individual plans. Prices carry information that embodies widely distributed knowledge as information that enables agents to adapt their own actions in response. A system of markets with variable prices is thus a kind of many-to-many communication network or system:

The most significant fact about this system is the economy of knowledge with which it operates, or how little the individual participants need to know in order

to be able to take the right action. ... It is more than a metaphor to describe the price system as a kind of machinery for registering change, or *a system of telecommunications* which enables individual producers to watch merely the movement of a few pointers in order to adjust their activities to changes of which they never know more than is reflected in the price movement (Hayek, 1945: 527; italics added).

The allocation-coordination distinction is important because if the economic problem is defined as an allocation problem *and* if the role of prices is to define the general equilibrium solution to this problem—as in textbook neo-classical economics—then the socialists would have a point. Specifically, what economists such as Oskar Lange (1936; 1937), Henry Dickenson (1933) and Abba Lerner (1937; 1938) noted in the 1930s was that if we can compute those prices by some other means, then we don't actually need the market-generated *process*; we can just go straight to the optimal allocation using 'shadow prices' and the implementation of an optimal central plan. Hayek's 'The use of knowledge in society' was a rebuttal to this claim by reasoning that there is no way the planners can get that information to compute those prices in the first place because most of it – 'the particular circumstances of time and place' – is distributed and subjective and cannot be centralized. This is why a market society co-ordinated by the price mechanism will work, and why any large complex society based on central planning will eventually fail (Boettke, 2000).

The price mechanism is a massively parallel communication system that produces (or computes) the spontaneous order of the market. As Steve Horwitz explains:

Because so much of our knowledge is tentative, fragmented and tacit, we require the use of spontaneously evolved social institutions to generate social order. Spontaneous ordering processes are *communication procedures* that enable us to overcome our very narrow and partial views of the world and to make use of the differently partial and narrow knowledge that others possess (Horwitz, 2001: 91, italics added).

It enables the efficient and effective utilization of distributed knowledge through its embodiment in prices and the adaptive behaviour that price changes induce. This account that focuses on distributed and partially tacit knowledge, on prices as information signals, and on the communications system metaphor has become the dominant theoretic-

cal account of the efficacy of the price mechanism and the market system. Peter Boettke (1990, italics added) explains that ‘early Hayek, as well as later Hayek, is concerned with *the communicative function* of social institutions in general, whether they are money prices within the economic system or the rules of behavior within social interaction. Exploring this communicative function is what motivates his research’.

This is not only in the development of work on mechanism design (see for example Hurwicz, 1969; Myerson, 2009) but also as evidenced by the research program on information asymmetries and bounded rationality, all of which proceeds from a computational and information-centred view of markets.

Most definitions of spontaneous order are in the Smith-von Mises-Hayek tradition of decentralized information communication networks without a central co-ordinator. The price-mechanism model of co-ordination via information feedback is almost canonical in the study of spontaneous orders. A related model emphasizes a different aspect of the process of spontaneous order emergence: the role of rule use, rule creation and rule copying (Dopfer, 2004; Dopfer and Potts 2008; 2013). Rule-use and rule-copying also produce a spontaneous order. This is ‘the use of society in knowledge’.

This approach is more explicitly evolutionary in the Darwinian sense of centring on the differential replication (variation and selection) of units of knowledge such as genes, technologies or rules (Nelson and Winter, 1982; Aldrich *et al.*, 2008; Hodgson and Knudsen, 2011). It is also more explicitly modelled on theories of cultural and technological evolution (Hayek, 1973; Boyd and Richerson, 1985; Rogers, 1995; Ziman, 2001; Mesoudi, 2011).

We may understand rules as the units of knowledge that compose a cultural, technological or economic order, in the sense of rules as the ordering instructions that govern individual choice, action and behaviour (rules of choice, behavioural heuristics), as well as rules that govern how people interact in organizations or shared or common rules that define institutions. We may also think of technology as rules for ordering matter-energy into particular forms to generate particular capabilities (Arthur, 2009). By rules, then, we refer to the knowledge that composes an economic, social, technological or cultural order and specifically to the idea that these rules have an origin, a point at which they are developed, and a trajectory by which they are adopted into a relevant *carrier population* that may potentially stabilize at some level to form an institution. In the language of Dopfer *et al.* (2004) and Dopfer and Potts (2008), this ‘generic rule and its

carrier population’ forms a ‘meso unit’: a macro-economy is an order of meso-units (Wagner, 2012). The order of a macro-economy is an order of rules fitting together, both in the connectionist or complex-systems sense of the rules fitting with other rules (Potts, 2000) and also in the Darwinian-population sense of a population of rules coming into order. Rules are what evolve in the process of economic evolution and the order of the ‘market ecology’ is an order of rules.

From this perspective, then, the spontaneous order of the market can be viewed from an evolutionary perspective that is centred on not only a given population and structure of rules. It is also centred on the process by which new rules originate and enter into the economic order, and on the evolutionary trajectory through which they are adopted by a carrier population, as well as on the effect of that process on existing rules, a process that Joseph Schumpeter (1945) famously characterized as ‘creative destruction’. The point of this emphasis on rules and the evolutionary process is to make clear the difference between a process of adaptation within a given set of rules or knowledge and a process of the adoption of new rules. In the first case, exemplified by Hayek’s ‘use of knowledge in society’, we are dealing with the outcome of a many-to-many communication network operating through price signals that are processing distributed knowledge. In the second case, exemplified by Schumpeter’s creative destruction model of economic evolution, we are dealing with a process in which new ideas, rules or knowledge enters into and transforms a system as the rule is originated, adopted and retained by a carrier population. It will often be the case that these two co-ordination processes occur simultaneously, but they are nevertheless different types of spontaneous order. Any endeavour to develop the theory of spontaneous order needs to make this distinction clear.

Yet these ideas are often run together in the spontaneous-order tradition, where there is a tendency to think of distributed knowledge and changes as being caused by exogenous shocks, as well as to think of the re-coordination that the price mechanism provides as carrying over to the ‘exogenous shocks’ of new technology or new ideas.⁸ There is a tendency to think of these things (new information, new knowledge and new ideas) as more or less the same concept at the limit, but there is a crucial difference. In short, the first requires *adaptation* (doing something different, requiring reaction); the second requires *adoption* (doing something new, requiring learning). With novelty, the problem is not with whether something has changed and what to do about it; the problem is about how to act in a situation never before

encountered, a situation in which learning is required about how to act at all.

There are broadly two solutions to the challenge of learning how to act in a new situation: (1) develop a new strategy; or (2) copy someone else. As if to parallel Hayek's argument regarding knowledge as technical knowledge and knowledge of time and place (where the common premise was that all knowledge was technical knowledge), the basic problem with modern economics is that it assumes that any situation involving novelty necessarily involves developing a new strategy, and moreover that this is a costless process. That is, it presumes that the challenge of learning is met by the agent acting rationally, and without reference to the actions or the examples of others. But while economists tend to model rational behaviour this way, it is actually far from obvious that this is itself a model of rational behaviour. Specifically, once we account for the opportunity costs involved, the frequency with which novel situations or commodities are met, and the common situation that some other agents have already invested time and resources in figuring out what to do, imitation or copying can be, in the language of Vernon Smith, an ecologically rational strategy (see also Banerjee, 1992; Bikhchandani *et al.*, 1992; Potts *et al.*, 2008; Ormerod, 2012). This is the use of society in knowledge, which is an idea that Hayek himself wrote about in terms of cultural group selection in which 'successful practices get passed on through tradition, learning and imitation' (Caldwell, 2000: 6).

Under certain conditions copying is an effective strategy, both individually and globally, and results in a grown order that through differential adoption effectively co-ordinates new rules into the economic order. This is of course not a novel argument; copying mechanisms underpins most theories of cultural evolution. However, the concept has not yet been properly integrated into studies of spontaneous order, and nor has the full implications of this generalization from information to knowledge been fully elaborated in terms of subject matter, empiricism, theory, and analysis. There are many definitions of spontaneous order but these are largely in terms of information and systems co-ordination. I argue that a more general approach should be based on rules and on a comprehensive rule classification. It should also be centred on rule-copying. This explains how spontaneous orders are grown, and accounts for this in the presence of novelty. A special case is then when there is no rule-copying or rule dynamics, and just decentralized co-ordination through positive and negative feedback, such as through the price mechanism.

5: TWO DEFINITIONS OF SPONTANEOUS ORDER

From Adam Smith to Vernon Smith the standard account of a spontaneous order is of a process of mutual adaptation that is facilitated by the information economy of the price mechanism. The price mechanism is herein understood as a communication system that can efficiently process widely distributed knowledge and information (Hayek, 1945). Agents can co-ordinate their individual plans by paying attention to price movements alone, and without the requirement of any central controlling agency. In this account, spontaneous order means 'order without design', but specifically refers to an outcome produced by the price system. The price system is said to be a complex evolutionary mechanism that co-ordinates the production of the economic order.

Several partially overlapping yet analytically distinct approaches to the study of spontaneous orders are embedded in this definition. There is a communication-network definition that emphasizes the solution to the distributed-knowledge problem and the role of price signals as a co-ordination mechanism. This emphasizes information feedback processes among individual agents and the limited knowledge of each agent. A different emphasis is in complexity-based approaches to the study of spontaneous orders, which tend to focus on the systems properties of the connections and interactions between the agents, and on the emergent properties of the system because of these structures of interactions. This also includes agent-based computational approaches, using rule-based agents interacting on complex networks. Further along this path is the evolutionary and institutional approach that pushes the agents and information further into the background and brings the population dynamics of rules or knowledge into the foreground.

As such there are two standard approaches to spontaneous order, broadly in terms of whether the focus is on the outcomes (i.e. the order *per se*, or the state of co-ordination or equilibrium), or on the processes, mechanisms and institutions that generate or constitute those outcomes. This difference is in practice hard to separate, and indeed James Buchanan⁹ has explained that it doesn't even make sense to speak of an order separated from the process by which it is arrived at or discovered. In a brilliant short note entitled 'Order defined in the process of its emergence' he explains:

I want to argue that the "order" of the market emerges only from the *process* of voluntary exchange among

the participating individuals. The “order” is, itself, defined as the outcome of the *process* that generates it. The “it,” the allocation-distribution result, does not, and cannot, exist independently of the trading process. Absent this process, there is and can be no “order” (Buchanan, 1986b: 73-4; italics in original).

That the outcome and the process are in a sense the same phenomenon has meant that definitions of spontaneous orders can shift back and forth between the mechanism or process and the outcome. A line of thinking from Adam Smith through John Stuart Mill, Carl Menger, Frank Knight and F. A. Hayek centres on the price mechanism—and the study of markets and market-like situations that compute and communicate price or price-like information—as the core of the study of spontaneous order. In the modern form, this is then associated with the workings of a complex system (Wagner, 2008). Vriend (2002), Lavoie (1989) and Potts (2000) associate Hayek’s view with complexity, and Barkley Rosser (2012: 125) explains that ‘[i]n Hayek’s view, emergence and complexity are essentially the same thing, given his linking of the concept of complexity to the emergentist tradition of Mill, Lewes and Morgan’.

But a wider definition views the spontaneous order of the market economy as the product of an *evolutionary process* operating broadly over organizations, institutions and technologies (Schumpeter, 1942; Nelson and Winter, 1982; Dopfer and Potts, 2008; Hodgson and Knudsen, 2010). Here the price mechanism is just one of several mechanisms involved in this evolutionary rule-based process. Steven Horwitz explains that spontaneous orders

comprise practices, rules, institutions, and so forth that have developed not because human actors rationally foresaw their likely benefits and deliberately, consciously constructed them, but rather because they are unintended consequences of various human actors’ pursuit of their own purposes and plans (Horwitz, 2001: 82).

Despite this, the concept of a spontaneous order has come to be synonymous with that of a co-ordinating rule or convention that has emerged through use, salience and selection, rather than being deliberately designed. A spontaneous order is associated with the *co-ordinating rule* that generates the spontaneous order. This is the meaning of spontaneous order in evolutionary game theory, such as Thomas Schelling’s focal points (Schelling 1960), or the no-

tion of *conventions* or *institutions* as equilibrium solution concepts in a game, such as an evolutionary stable strategy (Maynard Smith and Price, 1973; Sugden, 1989; Young, 1993; Aoki, 2007).

A related meaning of spontaneous order is as an evolutionary process, and specifically a variation-and-selection mechanism, that blindly produces an ordered outcome though the twin mechanisms of variety generation and selection against variants that do not meet some minimum fitness criterion. The order here is attributed not to the individual elements and their interactions, but to the population as a whole and its associations with other populations. This ‘ecological’ or ‘macro’ ordering represents a state of order and co-ordination that is not attributable to design or intention but comes about through distributed interactions. Schumpeterian creative destruction is an example, as is the Austrian (liquidationist) theory of the business cycle.

A spontaneous order in the more classical sense refers to a broad phenomenal outcome of a state of co-ordination between many independent agents or parts such that they fit together. The order of the market, in the sense of Adam Smith’s invisible-hand metaphor, fits this meaning, and more generally this refers to Hayek’s notion of the ‘Great Society’, or the ‘extended order’, or of Popper’s (1945) ‘Open Society’. This includes not only a co-ordination of actions but also of plans and therefore of expectations:¹⁰

Living as members of society and dependent for the satisfaction of most of our needs on various forms of cooperation with others, we depend for the effective pursuit of our aims clearly on the correspondence of the expectations concerning the actions of others on which our plans are based with what they really do (Hayek, 1973: 36).

Hayek (1978) updated Smith’s invisible hand with the concept of a spontaneous order. In the past few decades Hayek has himself been updated with the concepts of self-organization or the theory of *complex adaptive systems* (CAS). While the CAS framework has developed from a number of lines including non-linear dynamics, agent-based modelling, computational simulation, network theory, and other analytic domains, there is an acknowledged debt to the work of Hayek and others in introducing the idea of emergent order as a unifying concept. This is evident in neuroscience (Hayek, 1952), markets (Hayek, 1945) and the extended order of society (Hayek, 1973; see also Andersson, 2008).

Complex systems theory offers a sharper conception of analytic concepts, including agent, rule, interactions payoff and networks (or spaces of interactions, see Potts, 2000), and also descriptors such as the notion of self-organized criticality (Bak, 1999), emergence and the ubiquity of *power laws* as a signature of self-organization. Complex systems theory has also furnished a suite of off-the-shelf models for the study of CAS, such as cellular automata, Boolean networks, random graphs, and, more recently, increasingly sophisticated and easy-to-use simulation platforms and analysis packages. These factors have sharpened up the analytic conception, modelling approaches and empirical research into the study of spontaneous orders understood as belonging to the class of CAS.

A central insight, which also can be traced to Hayek, concerns what it means to describe a spontaneous order as complex. For Hayek and others, the main distinction was between a complex and a simple system, whereupon a hierarchical order (such as an organization) was actually a simple system because it could be described and understood. As Steve Horwitz explains, referencing Hayek's (1973) discussion of made versus spontaneous orders:

Organisations are fairly simple structures, with a degree of complexity that the maker of the order can survey. In addition, organisations are usually directly perceivable by inspection and serve the specific purpose(s) of those who constructed them. Spontaneous orders, such as the market, are, by contrast, capable of any degree of complexity, they are rule based and their structures may not be obvious, plus they serve no particular purpose; rather, they serve the multitudinous purposes of those who participate in them (Horwitz, 2005: 671).

CAS theory has provided a deeper understanding of what it actually means to describe a spontaneous order as complex. In particular, complex systems theories distinguish complex not from simple but from complicated. A complicated system will have many parts or elements composing it. It is informationally complicated because there is a lot to know. However, a system with only a few parts could be a complex system. The crucial factor determining complexity concerns the interactions (not the number of parts). A complex system is complex because of feedback, and that feedback is a property or structure of the rules that govern the system. Complex systems are complex because they set up rule systems that drive information feedback between the

elements (and whether there are a few or millions doesn't really matter).

It should also be clear that the study of spontaneous orders, and equally that of complex adaptive systems, is ultimately a study of rules and rule systems, and it is this ontology and method that distinguishes the spontaneous order approach from that of constructivist rationalism. An 'extended order' is a rule system. All spontaneous orders are rule systems because their governance structure is a process of rules rather than of hierarchic organization. For Hayek:

it is only as a result of individuals observing certain common rules that a group of men can live together in those orderly relations which we call society (1973: 95).

Boettke elaborates:

all we need are rules or social institutions (conventions, symbols) that produce mutually reinforcing sets of expectations to maintain a degree of social order, and these rules or institutions must serve as guides to individuals so they may orient their actions (Boettke, 1990: 76).

The spontaneous-order literature (for example the journal *Studies in Emergent Order*) does two things that differ from the above. First, it draws a somewhat different emphasis on the properties of a spontaneous order that focus on the properties of the elements as human agents with moral dimensions (a focus that Adam Smith also made). Specifically, it emphasizes the properties of the agents as independent, in the sense of pursuing their own plans without regard to those of others (and vice versa), except to the extent that other people's plans will impact on their own (and vice versa), thus recognizing that there is a co-ordination problem that needs to be solved. It has to be solved in such a way that it minimizes the extent to which each individual needs to concern themselves with the plans of others. Institutional solutions that maximize individual autonomy and minimize public sharing of information and coercion are to be preferred.

6: PRIVATE CHOICE AND PUBLIC INFORMATION

The genius of Hayek's (1937; 1945) contribution to the theory of the market order was to see clearly how it worked with *distributed private information*:

The peculiar character of the problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess (Hayek, 1945: 519).

This became a critique of central planning when it was shown that planning required all information to be known in its entirety to one central mind. Hayek's point was that information does not need to be *centralized*, but rather that market mechanisms work to co-ordinate *decentralized* information and knowledge into a single variable of price. Market prices aggregate distributed information and knowledge and reflect the relative scarcity and value of a good. Based on this market information (either its level or its changes), the distributed actions of agents throughout the system can be continuously re-coordinated without central planning:

It is the source of the superiority of the market order, and the reason why it regularly displaces other types of order, that in the resulting allocation of resources more of the knowledge of particular facts will be utilized which exists only dispersed among uncounted persons, than any one person can possess (Hayek, 1989: 4).

The decentralized model triggered a second observation – closely bound up with the ‘Austrian’ subjectivism of human action – that knowledge could remain entirely *private*, with the only public information being the emergent market price. Again, this was a powerful insight because it showed that the minimal information conditions (private subjective knowledge, public price) were also sufficient conditions: nothing else was required for the market mechanism to co-ordinate the efficient allocation of resources. In the Hayekian framework, private (or local) choice and action explains emergent market order by its effect on ‘public’ (or global) price (Hirshleifer, 1971).

The key point is that no agent need observe other agents’ actual choices and actions—that is, they attain no benefit from doing so—as it is sufficient to observe only the price, which, as an aggregator of distributed knowledge and information, enables an agent to observe in a single piece of information the choices and actions of a great number of other agents (Angeletos and Pavanm, 2007). The economics of market co-ordination are thus, as a principle of sufficiency, wholly separate from the public or social context

of choice and action: that other agents’ choices can or might be observed is immaterial to the mechanics of the emergent market order.

In turn, the economics of ‘observing other peoples’ choices’ has gone in a different set of directions. The seminal theory on choice observation concerned the economics and sociology of consumption and the use of observed (public) choice in *competitive social signalling* (Veblen, 1899; Leibenstein, 1950; 1976). Here, the information was carried directly in publicly revealed or displayed choice (via public consumption); price information was thereby inverted. The concern here is *social competition*.

A second game-theoretic line concerned observation of others’ choices in order to extract private information about their *strategic intentions*: in its simplest form, about the strategic ‘type’ of the observed agent (for example co-operator or defector). This does not concern the effects of distributed choice, but specific observation of other agents or agent populations and it is thus concerned with information-signalling. Prices enter parametrically via the pay-off matrix rather than being key information. The concern is *social co-operation*.

A third line of choice observation concerned *social learning* in which direct observation of others’ choices revealed information about the costs and benefits of adoption of new ideas and technologies. This is neither essentially competitive nor co-operative but evolutionary in that it relates to the public externalities associated with the benefits of learning by observation and imitation (Dosi *et al.*, 2005; Apesteguia *et al.*, 2007; Rendell, 2010). This concerns *social evolution*.

These three lines of economic analysis of observed choice have all been extensively developed. They have contributed much to our understanding of economic co-ordination and dynamics. However, none of these lines explicitly seeks to generalize to Hayek’s seminal formulation of private choice over a distributed space beyond its minimal sufficiency conditions; that is, to examine the implications of observation of other peoples’ choices *and* prices working in parallel. I want to argue that this is the logical direction for spontaneous-order studies to go because this enables us to develop a unified approach to the study of spontaneous orders that integrates both the distributed knowledge problem (and the role of the price mechanism in solving the co-ordination problem) and also the new knowledge problem (and the role of the copying mechanism in solving *that* co-ordination problem).

The reason that the copying mechanism is a logical extension of the price mechanism is simply because there is information in other people's choices, and when copying the rules used by other people to make choices over novel circumstances, the copier gets access to that information without even necessarily knowing what it is. That information can remain private, while only the choice rule is publically copied.

NOTES

- 1 Although, as we will see below, the origins of this idea date back to the early 18th century (Barry, 1982).
- 2 A phrase first used by Charles Darwin.
- 3 This is the reason that I do not follow so readily in the direction of Habermas, or in the accommodation of Hayek and Marx. Rather I see this going in a different direction that is more toward Michael Oakeshott, John Rawls and James Buchanan; for example, in respect of emergent constitutional orders.
- 4 Peter Boettke (1990: 61) suggests the overarching theme of Hayek's research program is: 'how do social institutions work, through the filter of the human mind, to co-ordinate human affairs?'
- 5 Although Buchanan (1986) argues for the restriction of the concept of spontaneous orders to price systems.
- 6 Arthur (2009) makes a similar claim about technology.
- 7 In particular, see the work of Bob Clower, Axel Leijonhufvud, George Shackle, Brian Loasby and Peter Earl (Lachmann, 1976).
- 8 This is most clearly apparent in, for example, so-called 'endogenous growth theory' (Romer, 1990).
- 9 Buchanan also usefully explained why we should prefer the term emergent order to spontaneous order, but we will not take that up here.
- 10 See the work of Austrian/Post-Keynesians such as G. L. S. Shackle, Robert Clower, Axel Leijonhufvud and Brian Loasby on macro co-ordination, epistemics and complex systems (see Potts, 2000).

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