

Toward an Interdisciplinary Paradigm of Spontaneous Order

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1. Introduction

The notion of spontaneous order has been developed in a large number of different fields, yet no general paradigm exists through which findings in these fields could be integrated with and elaborated by one another. The reason for this, I would argue, is that all of the existing conceptions of spontaneous order—in economics, biology, law, and other disciplines—remain too much rooted in the concrete features of the fields from which they emerged to be of anything more than metaphorical use in other fields. When economists and social scientists talk about "spontaneous order," when chaos theorists talk about "complex adaptive systems," and when biologists talk about "self-organizing processes" in evolution and development, it is clear that all of them are talking about the same kind of thing, and each of them can explain what that thing is within the framework of their discipline; but what such a thing would be outside of any concrete framework—as a purely abstract paradigm, defined on its own terms and equally applicable to any field in which spontaneous order plays a role—remains unstated. Thus, while we know how to *identify* spontaneous orders when we see them, we cannot strictly *define* them, and it is the absence of such an independent definition that makes communication among the different fields that invoke the idea of spontaneous order so problematic.

In this paper, I would like to attempt to formulate such a general and abstract definition—what might be called a purely philosophical definition—that would permit results from different disciplines that study spontaneous orders to be integrated with one another.

What all writers on spontaneous order concur in is that spontaneous orders consist of complexly self-reinforcing processes, that they are complicated arrangements of what are effectively positive and negative feedback loops. At the same time, all spontaneous orders are evolutionary processes—indeed, Hayek himself repeatedly referred to "the twin ideas of

evolution and spontaneous order"¹—and therefore processes of adaptation and change. It is these two fundamental features of spontaneous orders—self-reinforcement, on the one hand, and change, on the other—that give rise to the essential paradox that they embody: How can a process of continual change be made up entirely of various forms of self-reinforcement? In other words, the history of any spontaneous order can be told either as a story of endurance or as a story of transformation. How can both be true?

The different notions of spontaneous order that have emerged from the different disciplines explain how both can be true by pointing to those features of spontaneous orders which are conserved and those which adaptively change over the course of their histories. But this merely gets us back to the crux of the problem, because the conserved features of spontaneous orders that are singled out in each discipline are typically specific to that discipline, and hence of little use in shedding light on the conserved features of spontaneous orders in other disciplines. Hence the difficulty of interdisciplinary communication and integration.

I would like to propose a model of spontaneous order that describes how a self-reinforcing process can amount to a process of constant change. This model involves putting the parameter of time back at the center of the concept of spontaneous order. Indeed, when Hayek elaborated his notion of the economy as a spontaneous order in "Economics and Knowledge" in the 1930s, he was in the middle of developing a theory of capital that posited time—the interplay between different periods of time for which resources were invested and the relationships between resources invested at different time scales—as *the* central fact about the market process. The key question that his theory was meant to call attention to and to answer was how the economic mechanisms that governed capital and interest made possible the *intertemporal* coordination of labor and the *intertemporal* allocation of resources.

In fact, if one compares Hayek's works from the first half of his career—up to *The Sensory Order*—with those from the second half, one discovers a much greater emphasis on this dynamic dimension of spontaneous order in the former and a much more static vision of things in the latter. These are, of course, merely differences in emphasis, and Hayek himself remained fully aware of the evolving nature of all of the spontaneously self-organizing processes that he wrote about, whether in economics, law, epistemology, or other fields. But differences in emphasis matter.

Following Hayek's emphasis in his theory of capital, and abstracting from it, I would like to conceive of spontaneous orders as self-reinforcing processes of a peculiar kind, whose distinctive feature consists in the fact that they scale with time. In other words, I propose to think of spontaneous orders

as consisting of self-reinforcing processes at multiple different time scales that mutually reinforce each other.

Consider that a process can be self-reinforcing in two ways. First, it can be a matter of simple feedback. Second, mutual reinforcement can also exist between processes that take place at different time scales. A short-term feedback process can reinforce the conditions that make possible a long-term feedback process, which in turn can create the conditions that enable the short-term feedback process in the first place. It is such a temporally scaling feedback loop system—consisting not just of a short-term and a long-term component, but of multiple self-reinforcing elements at multiple different time scales—that I have in mind as a model for the phenomenon of spontaneous order.

Below, I will describe how this highly abstract model can be applied to the concrete problems of economics, law, and biology, thus providing an illustration of how results from disparate fields may be fruitfully integrated within a single paradigm. In anticipation, I should like to point out that such a model of self-reinforcement resolves the paradox of conservation and change alluded to earlier. A temporally scaling self-reinforcing process in fact possesses more degrees of freedom than a simple feedback loop. A simple feedback loop cannot change: it consists of a self-replicating sequence of events, and if the sequence changes, then it is no longer clear what is being replicated. But a temporally scaling self-reinforcing process admits of change as new self-reinforcing components appear and disappear in it, as long as their appearances and disappearances are constrained by the fact that they must enter into mutually reinforcing relationships with all the other self-reinforcing processes that constitute the spontaneous order at any given time.

Thus, a self-reinforcing process that scales in time can indeed be a process of constant change that is yet made up entirely of self-reinforcing components. Such a model, in my view, can be applied to biological evolution, to legal history, to the market process, and indeed to any situation in which the characteristic features of spontaneous order emerge.

2. The English Janus

Because the model of spontaneous order that I want to present has two parts—self-reinforcement, on the one hand, and temporal scaling, on the other—it will be convenient to approach it historically by looking at two traditions of thinking about spontaneous order that emphasized one or the other of these two aspects. The first of these traditions emerged from British legal theory, which was concerned with explaining the evolution of the common law. The evolution of the common law was a process that unfolded over the long term and could be observed in detail, since much of it was

documented in written records. It might be argued that it was due to these two aspects of the particular spontaneous order that they were studying that the British legal theorists were led to raise questions about time and in general to develop a habit of thinking about spontaneous order in terms of the relations between different time scales. The second tradition grew out of economic concerns and attempts to explain the market process. Unlike the common law, the market process unfolded in “real time,” as it were: it was a form of evolution that took place in the short term and it left behind no extensive documentation through which the strands of its unfolding could be easily traced and analyzed. Thus, writers such as Mandeville and Smith focused not so much on the relation of this spontaneous order to time—on its adaptive capacity for memory and anticipation—as on its recursive or self-reinforcing features. The writers of the period recognized that the long-term evolution of the law and the short-term evolution of the market were similar kinds of processes—that both were, in fact, forms of spontaneous order—but they created different sets of conceptual tools for elucidating their salient properties.

I will begin by looking at the older of these two traditions, British legal theory, and the concept of evolution that it developed. In fact, the British legal theorists already confronted the question with which I began this discussion: how can evolution be both a form of endurance and a form of change? The classic description of this controversy was given by J. G. A. Pocock (1987: 173-174) in *The Ancient Constitution and the Feudal Law* when he addressed alternative conceptions of the common law that were elaborated during the sixteenth and seventeenth centuries: “the idea of custom was twofold—men might treat it primarily as that which was continually adapted, or as that which was constantly preserved. The former emphasis would lead... to the idea that law was the ever-changing product of a historical process; the latter to the idea that law was fixed, unchanging, immemorial.”

The point at issue was this: is custom-based law a law that never changes or a law that never ceases to change? For Pocock, the former position was represented by Edward Coke and the latter by Matthew Hale. More precisely, both Coke and Hale were concerned with showing that (1) the law lay outside the hands of any sovereign, and that (2) the reason embodied in the law lay outside the realm of any natural or universal reason but was what Coke called “artificial reason.” Both of their arguments—Coke’s claim that the common law stemmed from a time immemorial and Hale’s claim that it captured the flux of custom—gave support to these conclusions in different ways. That is how they deflected the arguments of their adversaries, who *were* interested in grounding the law in either (1) an act of sovereign will or (2) the dictates of natural reason.

What both Coke and Hale endeavored to show, in other words, was that the common law is precisely what later writers would call a spontaneous order. But what they failed to resolve between them was the question that underlies all spontaneous orders: how do they bring together endurance and change? As Pocock (1987: 36-37) puts it:

If the idea that law is custom implies anything, it is that law is in constant change and adaptation, altered to meet each new experience in the life of the people; and it might seem that there was no theory more likely to lead to a historical conception of the nature of law. Yet the fact is that the common lawyers, holding that law was custom, came to believe that the common law, and with it the constitution, had always been exactly what they were now, that they were immemorial....The clue to the paradox lies in the fact that the concept of custom is ambiguous; Selden was never more suggestive than when he called the common law the English Janus. We may regard it as that which is in constant adaptation, and to do so will give rise to ideas that are unmistakably historical. But it is equally possible to regard it as that which has been retained throughout the centuries and derives its authority from its having survived unchanged all changes of circumstances; and once we begin to think of custom as unchanging, we must remember that it is also immemorial, for if it were known to be the work of some founder it would be written or statute law and not custom at all.

3. Time Scale Thinking

Although the paradox of the English Janus remained unresolved, the British legal theorists did formulate an unambiguous description of the common law as a spontaneous order—neither organized by any single individual nor based on any universal reason—positioning it conceptually between positive law, on the one hand, and natural law, on the other. Their arguments for this vision of the common law were explicitly based on observations about its peculiar relation to time. In all legal traditions, of course, people who make legal decisions are trained to think about their decisions in terms of multiple different time scales. A legal decision has one meaning in the short term, a different kind of meaning in the medium term, and yet another kind of meaning in the long term. And if the “interpretation of [a] rule can be regarded merely as a use of a clear rule for a purpose other than that originally intended,” (Stein 2001: 7) then the entire judicial process may be regarded as the art of using already existing rules for a purpose other than that originally

intended and the art of formulating new decisions in light of the fact that they themselves will necessarily be used for a purpose other than that originally intended.

Running ahead, I should like to point out that this notion that the origins of something might be completely dissociated from its eventual functions—a notion that first appeared in the context of legal thinking—became a key insight in thinking about spontaneous orders in general. Thus, it entered biology through Darwin’s concept of the “functional shift”—“in considering transitions of organs,” Darwin wrote, “it is so important to bear in mind the probability of conversion from one function to another”—and was subsequently given prominence by Stephen Jay Gould through his concept of exaptation.² But it also reappeared in economic ideas about the dissociation between the self-interested goals of the producer and the interests of society at large, in which the same activity on the part of the producer serves two unrelated purposes, one of which the producer pursues deliberately and one of which he is completely ignorant of. Just how this disconnect in legal or biological evolution corresponds to the disconnect in the market process may not be immediately obvious. It will be one of my aims in this paper to show the common structure that both share.

But let me return to the law. The British legal theorists, who studied not how the law structured human life, but how the law itself was structured, explicitly recognized the fact that thinking about the law meant thinking in terms of multiple time scales. And just as the importance of taking into account the immediate future as well as the distant future was inculcated into lawyers’ minds in practice, so the theorists and historians of the law noted the presence of multiple time scales when looking at the law’s past. “There are many things especially in Laws and Governments,” wrote Hale,

that mediately, Remotely and Consequentially are reasonable to be approved, though the reason of the party doth not presently or immediately and distinctly See its reasonableness. For instance, it is reasonable for me to preferre a Law made by a hundred or two hundred persons of age wisdom Experience and Interest before a Law excogitated by my Selfe... though I discern better the reason of that Law that I have thought of then the reason of the Law of those wise men. (Pokock 1987: 172).

The difference between old and new here is not a difference between what came first and what came second, so much as a difference between what has been around for a long time and what has been around only briefly. It is a difference, in other words, between two times scales—one seen “mediately, remotely, and consequentially,” the other “presently, immediately, and distinctly”—and the forms of knowledge associated with each. Hale, again:

It is a thing of greatest difficulty, So to Contrive and Order any Lawe that while it remedies or provides against one Inconvenience, it introduceth not worse or an equall. A Man that hath a prospect at one, or a few thinges may with ease enough fitt a Lawe to that, or those thinges. Qui ad pauca respicit facile pronuntiat. But the texture of Humane affaires is not unlike the Texture of a diseased bodey labouring under Maladies, it may be of so various natures that such Phisique as may be proper for the Cure of one of the maladies may be destructive in relation to the other, and the Cure of one disease may be the death of the patient. (Pokock 1987: 171).

The contrast, again, is between the ease with which a legal decision can be fitted to a small number of cases and the difficulty of fitting it to a large number of cases. The tension between these two alternatives is the salient tension in the law, and the challenge for the jurist is to formulate decisions that can, as it were, scale with time. One more quote:

Long Experience makes more discoveries touching conveniences or Inconveniences of Laws then is possible for the wisest Councill of Men att first to foresee. And that those amendments and supplements that through the various Experiences of wise and knowing men have been applyed to any Law must needs be better suited to the Convenience of Laws then the best Invention of the most pregnant witts not ayded by such a series and tract of Experience. (Pokock 1987: 172).

The implication in all this is that legal decisions which are buttressed by multiple precedents are shaped by constraints that have endured over many different time scales, some longer and some shorter. And as a process that has been shaped by factors at different time scales, the common law has a shape that corresponds to no factors that exist at any single time scale at all. The rules that it contains thus constitute a kind of intratemporal knowledge, neither the knowledge of the ages nor the knowledge of the moment. Such an approach to the law is an instance of what I would like to describe as “time scale thinking.” Time scale thinking means thinking about processes not in terms of sequences of events and step-by-step changes, but rather as outcomes of interactions between unchanging constraints that endure over different time scales.

This was the habit of thought that writers like Coke and Hale cultivated, and with it came a living awareness of the limitations of what could be accomplished by any person or indeed any process operating at a single time scale. Ultimately, one might argue, it was from this awareness that their criticisms of both positive and natural conceptions of law derived. The problem with a law that proceeds from a sovereign is that such a law must be

framed in terms of a single time scale, the time scale of the individual will. The problem with a law that proceeds from natural reason is similar in character: it is, again, a conception of law framed within a single time scale. It is perhaps peculiar to associate natural law with a time scale at all, since its whole premise is that it exists outside of time. But the point is that it is not framed in terms of *differences* between multiple time scales. The common law, by contrast, gets people in the habit of thinking in terms of multiple time scales and of seeing how the same thing can sit simultaneously within multiple temporal frames.

The common law coordinated rules from “time out of mind” with decisions that applied to events taking place in the present, and it was the attempt to explain how the gap between such vastly different time scales could be bridged that led the British legal theorists to the idea of spontaneous order. Such coordination, they concluded, could not be accomplished at any time scale individually, but had to penetrate multiple time scales at once. This is what led them to attribute the origins of the common law neither to will (human or divine) nor to reason, but to tradition. And this is what led them to recognize that the advantage of the rules contained in the common law was that they tell people how to operate on a rich spectrum of different time scales.

To repeat, what is crucial for the theory of spontaneous order in all this is that the events in such an order are simultaneously governed by multiple constraints that endure at different time scales. This is the peculiar form of memory which a spontaneous order preserves and it is this form of memory that enables a spontaneous order to prepare for future possibilities, as it were, and to adapt to alternative developments by anticipating them in advance.

4. Feedback Feedback

Time scale thinking, as described here, constitutes one of the key attributes of the interdisciplinary model of spontaneous order that I am going to propose. Its other key attribute is one whose study is perhaps even more closely linked historically with the study of spontaneous order, namely, feedback. Interestingly, the theorists of the common law did not put significant emphasis on this aspect of legal evolution. Perhaps the fact that the law was self-reinforcing—in that precedents set earlier constantly acquired new life by being invoked in decisions that set new precedents for the future—was too self-evident to merit critical attention. A tradition is something that feeds on itself, and to define the law as a tradition may have been tantamount to describing it as self-sustaining. Whatever the case, we see here a significant example of the general tendency mentioned at the beginning of this paper: each discipline that has studied spontaneous order has focused on those aspects of spontaneous order that are of greatest relevance to its particular subject matter.

British legal theory was interested in how the common law coordinated decisions and actions across vast stretches of time, and hence it explored the relation between spontaneous order and time, while seemingly taking for granted its self-reinforcing nature.

The other great British tradition of thinking about spontaneous order, however, did precisely the opposite. This was the tradition that famously emerged from the economic insights of Bernard Mandeville and was picked up and elaborated by such writers as Hume and Smith. Watching the economy and other self-organizing social phenomena, these writers observed a distinctive and recurring pattern of self-reinforcement. Namely, they saw that a market participant's actions were self-reinforcing in two different ways at once, directly and indirectly. Thus, the producer of goods was motivated to produce and sell goods by self-interest, and his reward fueled his motivation: this was the direct feedback process that he was involved in, a process that he himself was fully aware of. But he was also involved in an indirect feedback process, of which he remained largely unaware, by contributing not to his own immediate interest but to the general interest of society at large, which, due in part to his contribution, provided him with the general conditions that made it possible for him to pursue his particular activity and his immediate interest in the first place. Consequently, the market participant was encouraged to continue doing what he did because (1) he made money from it, and (2) the society in which he did what he did functioned and made doing what he did possible. The first form of encouragement was direct, the second indirect.

The critical insight here was that there existed situations in which a process could be involved in two feedback loops at once—one operating directly and one indirectly—in such a way that each reinforced the other. In other words, the idea that Mandeville hinted at in his parable about the bees and that Smith articulated explicitly in *The Wealth of Nations* was that there could be *relations of feedback between feedback processes*—that there could be situations in which one self-reinforcing process and another self-reinforcing process additionally reinforced each other. This insight spilled out, for example, into the complicated discussion of self-interest in eighteenth century ethics and economics. On the one hand, when people wrote about the market process, they eulogized the unexpected repercussions of self-interested activity, depicting it as the force that sustained all wellbeing. On the other hand, when they turned their attention to the law, they criticized the “narrowness of soul which makes [men] prefer the present to the remote” (Hume 1978: III.ii.7) and praised legal and ethical norms as that which curbs short-sighted self-interest in order to promote more indirect interests of which people are not immediately aware. Taken together, these two perspectives on self-interest result in an image of society in which self-interested activity constitutes a direct form of feedback,

which is apparent to the producer, while the specific form that it assumes owing to legal constraints contributes to an indirect form of feedback, which the producer cannot know in principle but recognizes in practice simply by following the rules of the marketplace. Note how the two forms of feedback support and sustain one another: on the one hand, the form given to self-interested activity by legal constraints gives rise to general conditions without which the pursuit of the producer's specific goals would be impossible; on the other hand, conversely, without the immediate motive of self-interest, the general conditions to which it indirectly gives rise would not be able to endure.

This tradition of thinking about spontaneous order, which appeared later than the theorizing about the common law, developed alongside of it, and was undoubtedly largely inspired by it, saw spontaneous order in the peculiar phenomenon of social processes that reinforced themselves simultaneously in direct and indirect ways. Initially, the most striking observation here was that a person could do things that reinforced his own activity in ways that he himself was ignorant of. This fact furnished the motivation for thinking about self-organizing social processes as "spontaneous" and for characterizing the "hand" that leads a producer to "promote an end which was no part of his intention" as "invisible." But no less striking here is the insight that there are situations in which many layers of feedback operate at once; that if a process is self-sustaining, it does not necessarily have to be self-sustaining only in a single way, but may be self-sustaining in multiple different and unrelated ways simultaneously; and that by sustaining and being sustained by the same process, these different and unrelated feedback loops can therefore be seen to reinforce each other.

Time was evidently a factor in the economic model that Smith elaborated, yet it was not one that he chose to foreground. More concretely, like the legal theorists, he saw spontaneous order as resolving a knowledge problem; yet while for them the knowledge problem arises from separation in time and the inability of decision-makers to know what effects their decisions will have in the distant future, for Smith separation in time is not a prominent obstacle that stands in the way of the transmission of knowledge. The market participant knows only how to satisfy his own immediate interests and little beyond that, yet his actions somehow end up satisfying the interests of a lot of other people as well. How does he do what he does without knowing that he is doing it? This is the knowledge problem for Smith, and it is this problem that the complicated feedback mechanism described above is called upon to resolve.

Here again we see how the specifics of the subject matter have led to a vision of spontaneous order that is addressed to those specifics. For the market process is indeed not stretched out in time like the history of the common law. Rather, it is a form of adaptation that takes place over a short time scale, and if

it may be called an evolution, then it is a continuous, short-term evolution by comparison with the discontinuous and long-term evolution of the legal process. This short-term evolution and this long-term evolution, while structurally analogous, evidently required different conceptual tools for their elucidation. And the conceptual tools developed to explain the short-term evolution of the market process did not involve what I described above as time scale thinking, but rather directed attention to the reciprocal causal connections between “the seen and the unseen,” as it were, existing in society at any given point in time.

5. The Temporally Scaling Feedback Loop

To be sure, the writers of the period recognized that the two types of institutions that they were describing were similar kinds of phenomena, and a number of them—above all, David Hume—made deep contributions to both traditions of thinking about spontaneous order. Both the long-term evolution of the law and the short-term adaptation of the market were understood to be, in the formula later popularized by Hayek, “the results of human action but not of human design”—although when Hume presented an epistemology that was virtually modeled on the pattern of the common law, and when in the nineteenth century biology began identifying its own spontaneous orders, the relevance of this formula diminished, for neither human action nor human design had any role to play in biological evolution, and yet biological evolution was unambiguously a process that gave rise to and was governed by a spontaneous order as well.

Later writers continued to make the links between different kinds of spontaneous order progressively more explicit. In an essay entitled precisely “The Results of Human Action but not of Human Design,” for example, Hayek (1967: 101) equates various spontaneous orders himself and singles out Menger as the first person to have articulated such a connection:

The point... which was long not fully understood until at last Carl Menger explained it clearly, was that the problem of the origin or formation [i.e. the long-term evolution of the law] and that of the manner of functioning of social institutions [i.e. the short-term evolution of the market] was essentially the same: the institutions did develop in a particular way because the coordination of the actions of the parts which they secured proved more effective than the alternative institutions with which they had competed and which they had displaced.

Note, however, that the general category of evolutionary phenomena is defined here only in a negative way, in opposition to less successful alternatives:

Menger tells us what it was that various forms of spontaneous order were able to achieve by contrast with the alternatives, but he does not explain the actual mechanism that allowed them to do this. Thus, his explanation of the common features of such spontaneous orders as the law and the market remains within definite limits. In the same essay, Hayek (Ibid) also quotes a suggestive passage from the biologist Ludwig von Bertalanffy: “What are called structures are slow processes of long duration, functions are quick processes of short duration. If we say that a function such as a contraction of a muscle is performed by a structure, it means that a quick and short process-wave is superimposed on a long-lasting and slowly running wave.” Although this image remains within the realm of metaphor, it illustrates an explicit awareness of the structural similarity between evolutionary processes that unfold at different speeds or at different time scales.

All of these insights that establish links between different kinds of spontaneous orders may be seen as significant moments for the theory of spontaneous order in general. All of them serve to define an abstract category of spontaneous order per se—which includes both phenomena that we would tend to describe as spontaneous orders in the strict sense of the term, such as the market, and phenomena that we would more likely call evolutions, such as the history of law or indeed biological evolution—and thus contribute to the development of a paradigm of spontaneous order that can be genuinely and efficaciously interdisciplinary. The recognition of the fact that the phenomena studied by the British legal theorists, on the one hand, and the writers on economics, on the other, were in fact fundamentally identical in nature was a key step in this development.

What I would like to propose, however, is that it is not enough to see the similarity between the two different kinds of objects that formed the focus of these disciplines. Rather, the key concept for an interdisciplinary paradigm of spontaneous order comes from bringing together the two different traditions of thought that developed around them and from *uniting the two different sets of conceptual tools* to which they gave rise. Specifically, the idea of spontaneous order as consisting of multiple simultaneous direct and indirect self-reinforcing processes can be given substantive content by being infused with the idea of temporal scaling. That is, degrees of indirectness in feedback processes can be interpreted in temporal terms, as feedback processes taking place over greater or lesser time scales. In this way, Smith’s economics-based notion of spontaneous order and the history-based notion of the legal theorists can be united within a single model. Below, I will discuss the general advantages of such an approach. But first, I would like to consider how it applies concretely to the long-term evolution of the law and the short-term evolution of the market.

6. The Law as a Temporally Scaling Feedback Loop

To begin with the law, a legal decision will adapt to new conditions by relying on a number of precedents of varying degrees of antiquity and of varying degrees of generality. By doing so, it will augment the relative weights of the precedents and principles that it invokes, both by reinforcing their validity in the present moment, in application to conditions which could not have been foreseen when the precedents were originally set; and by increasing their chances of being invoked again in the future, since it itself now becomes a precedent on which future decisions can rely, and any decision that relies on it will therefore by extension, implicitly or explicitly, also rely on all the precedents on which it itself relies. It is through this kind of process, in which new decisions constantly change the relative weights and scopes of the precedents that already exist, that the common law evolves. Indeed, any conflict that raises the need for a new legal decision might be seen, from the point of view of the law, as an opportunity to weigh against each other the relative values of the various alternative precedents and principles on which a decision regarding the case at hand might be based. The law can adapt to new conditions because it is such an ongoing weighing process in which the value attributed to rules and principles of different levels of generality constantly shifts. The relative importance of more recent or more specific precedents changes more rapidly, while at deeper levels of antiquity or generality, the ranking becomes increasingly more stable, and the effects of new decisions that might change this ranking take a longer time to pile up and, as it were, a longer time to penetrate down to the less specific rules. This is a rather idealized picture of the law, of course, and in practice the legal process may be somewhat different; yet since what we are interested in describing is a purely abstract model of spontaneous order, divorced from any practical context, such an idealized sketch is well suited to our purposes.

Consider, then, how the system described above might be said to constitute a system of feedback loops, in which the feedback takes place at many different time scales, and in which the feedback loops mutually reinforce one another. A legal decision that relies on many precedents at once enters into mutually reinforcing relations with each of them individually, since it points to each of them and each of them in turns points back to it. Since these precedents will be of different degrees of antiquity and generality, the mutually reinforcing relations that will arise between them and the present decision may effectively be said to exist at different time scales. The older precedents will be given new weight and thus extend their effectiveness to a greater time scale (with implications for their potential future effectiveness as well); the more

recent precedents will likewise be given new weight, but their effectiveness will have endured over shorter time scales. This, then, is the temporally scaling feedback that characterizes the legal process. In addition, and crucially, all of these layers of feedback will support and depend on one another, since it is only due to the more recent precedents that the older ones will be able to manifest their continued relevance, and conversely, it is only due to the older precedents that the more recent ones will have come into being at all. This essentially describes the rationale for characterizing the spontaneous order of the law as a *temporally scaling feedback loop*.

Every legal decision, of course, invokes a different set of precedents and thus brings a different combination of precedents into a mutually reinforcing relation. It is in this way that principles might acquire new meanings—or that precedents might, over great stretches of time, acquire functions that are completely disconnected from their origins. This is the phenomenon that reappears in evolutionary biology under the name of functional shift or exaptation, mentioned earlier. In the history of a temporally scaling feedback loop, such functional shifts are not an exception, but a universal rule.

7. The Economy as a Temporally Scaling Feedback Loop

Let us now consider how this same model may be applied to economics and what effects its application has on the vision of the market process as a spontaneous order presented by Adam Smith. Smith, as we have seen, conceived of the economy as a system of mutually reinforcing direct and indirect feedback loops. Direct reinforcement comes to the producer of goods explicitly, from the profits that he reaps for his production. Indirect reinforcement arrives in a diffuse and attenuated form, as a result of the indirect contributions that his production makes to other producers' plans, which bring about the conditions under which he can operate. It is not difficult to see how "direct" and "indirect" reinforcement may be reconceived, in broad terms, as fast and slow feedback. Some market responses to a producer's actions arrive immediately, while others reach him after too long a delay for him to be able to make a causal connection between his actions and their eventual outcomes, and still others might come even later, when his own personal activity has ceased but the conditions that made it possible must still be maintained for others who take his place. Thus, the Smithean notion of spontaneous order lends itself to a temporally scaling interpretation readily enough. But the resulting image remains very broad and not especially substantive in economic terms.

Yet economics was the first field of study in which the temporally scaling feedback loop model was formulated explicitly and concretely. This is

what happened, I would argue, in Hayek's theory of capital and interest. Hayek was not trying to merge together the two traditions of thinking about spontaneous order that I have been describing here. He was just looking at the market and trying to explain how its complex interactions get coordinated in time. Yet while remaining in the economic context and addressing himself exclusively to economic concerns, he arrived at a vision of capital that embodies the model of spontaneous order that I want to present and generalize in this paper, and that indeed serves as the inspiration for this abstract model.

As is well known, Hayek conceived of the capital-intensive economy as consisting of multiple production processes of different durations. In his model, what he called producers' goods—goods purchased by producers of other goods—enter into a process in which they contribute to the production of a series of other producers' goods, until eventually this process reaches its outcome in the production of a consumers' good—a good purchased by consumers—which provides the ultimate reason for the production of the producers' goods and constitutes the ultimate source of profit for investments in their production. Thus, each producers' good is separated from the consumers' goods to which it eventually leads by a period of production of a specific duration. Similarly, capital invested in different stages of the production process is thus invested at different time scales, measuring from the moment of investment to the moment when it begins to bear fruit.

By singling out the differences between the time scales at which investments are made as a salient feature of the market process, Hayek effectively introduced into economics what I characterized above as time scale thinking—a habit of thought that had been typical of the British legal tradition, yet was quite slow to penetrate into other disciplines concerned with spontaneous orders. Crucial in this respect was his insistence on the fact that there is no such thing as an “average period of production.” By analogy, the fact that legal decisions are separated from the precedents on which they rely by different amounts of time—that it would have been absurd to talk about a single average time-span that separated decisions from related precedents—was evident to the historically-oriented minds of the common law jurists. The law established relations between decisions at a whole spectrum of different time scales, and this was why, ultimately, it could neither have been designed by man nor been based on any atemporal or ahistorical reason. The fact that capital was invested over a similar multiplicity of time scales, and that this was similarly crucial to economics, was a central proposition of Hayek's theory of capital. It made clear the nature of the coordination problem that a theory of capital had to solve: namely, how did the market achieve a coordination between different periods of production and how did it coordinate the intertemporal allocation of capital?

In *Prices and Production*, Hayek laid out an elaborate picture of the feedback mechanisms that allow such coordination to happen. Roughly, they fall into two general categories. On the one hand, demand for consumers' goods gradually penetrates upstream in the process of production and translates into demand for the producers' goods that are involved in making them. This is the feedback mechanism of derived demand, which operates more quickly on downstream products and more slowly on upstream products, and hence in itself constitutes a temporally scaling self-reinforcing process. However, the process of production is long and if producers of upstream goods relied exclusively on derived demand to learn how to modify their production, consumers' needs could never be satisfied in a timely manner. Therefore, Hayek proposed a more fundamental feedback mechanism that guided capital to different stages of production in anticipation of changes in consumers' demand that have yet to take place: this is the mechanism which operates through the rate of interest, which reflects consumers' preferences for saving over current consumption. The interest rate, which facilitates the allocation of investments over different time scales, is thus likewise involved in a self-reinforcing process that scales with time. A good introduction to how this complicated model of the intertemporal allocation of capital works is given by Roger Garrison (2005):

The difference in the value of the output of one stage and the value of output of the next stage reflects, among other things, the general terms of intertemporal exchange, expressed summarily as the market rate of interest. With a given rate of interest, excessive stage-to-stage value differentials would present themselves as profit opportunities which could be exploited only by reallocating resources toward the earlier stages of production. In the limit, when all such profit opportunities have been competed away, the relative prices of inputs used in the various stages are brought into line with the equilibrium rate of interest.

Thus, with the temporally scaling feedback loop of derived demand operating in the late stages of production, and the temporally scaling feedback loop of interest operating in the earlier stages of production, and with both of them acting additionally as constraints on or signals to one another, Hayek showed how the intertemporal allocation of capital could be effectively coordinated in the market.

In *The Pure Theory of Capital*, he went on to develop this landscape of temporally scaling feedback further by showing the numerous ways in which the value of any investment constantly depended on the particular state of the structure of the process of production which it entered. For our purposes, in terms of formulating an interdisciplinary paradigm of spontaneous order,

Hayek's model of the capital-intensive economy, with its multiple roundabout processes of production, embodies two key insights.

First, it shows not just why the concept of an "average period of production" is misguided, as indicated above, but why the convenient habit of seeing spontaneous orders in terms of merely two time scales—the short and the long—is ultimately misleading as well. Such a habit has a fair amount of tradition behind it. When eighteenth century philosophers discussed the differences between the effects of people's actions or the limitations of their knowledge at different time scales, they abstractly contrasted the "proximate" with the "remote," and this ready-made opposition was no doubt justifiable on the grounds that it facilitated the presentation of the basic idea of spontaneous order. But when the same dichotomy began to be taken up by the more quantitative discipline of economics in the nineteenth and twentieth centuries, it became less defensible. Hayek's illustration of its untenability in economics demonstrates why it must ultimately be discarded by any more abstract theory of spontaneous order as well. There is not just a short term and a long term in the processes that constitute spontaneous orders, but a densely packed gradation of different terms, resulting in what might be thought of as a kind of depth—rather than simple opposition—in the self-reinforcing relations between processes taking place at different time scales.

And this fact points to the second and even more important insight that can be drawn from Hayek's model, which has to do with the unique capacity of spontaneous orders to adapt to new conditions by sustaining the memory of old conditions at many different time scales simultaneously—and in this way anticipating and preparing for possible future changes at many different time scales in advance as well. We see a vivid example of this phenomenon in the economy, in the way in which the market is able to steer investments into production long before consumer demand for the goods to which this production will eventually give rise appears. But such a property is characteristic of any temporally scaling feedback loop as it moves forward in time and encounters the changes that time brings.

Essentially, changes in surrounding conditions will immediately interrupt the short-term feedback loops in the process and bring about a selection of new short-term feedback loops to take their place. But since the short-term feedback loops are constrained not only by surrounding conditions, but also by the longer-term feedback loops with which they endure in mutually reinforcing relationships, only those new short-term feedback loops will be selected that reinforce and are reinforced by some of the longer-term feedback loops as well. The selection of new short-term feedback loops will thus have repercussions on the various feedback loops taking place at longer time scales, selectively reinforcing the influence of some and inhibiting the influence of others.

Accordingly, the resulting adjustment in the overall self-reinforcing process will alter the field of possible short-term responses to the next change in surrounding conditions that the process will confront. In this way, many of the transformations that must occur in the process if it is to adapt to changing conditions happen before the changes in conditions take place. And the older a spontaneous order is and the more temporally scaling feedback loops it encompasses, the more forward-looking its capacity for adaptation will be. Thus, an immediate change in the present—in response to a change in consumer demand or the interest rate, for example, or in response to a legal conflict that requires immediate resolution—anticipates and prepares for a whole series of possible changes at multiple stages in the future.

The precise way in which self-reinforcing processes will sustain a temporally scaling memory of past conditions, and the precise way in which the selection of new short-term feedback loops will be constrained by both surrounding conditions and the longer-term feedback loops that are already part of the process, will vary from one spontaneous order to another. But the structure of the process of adaptation described here will, I submit, remain essentially the same. Put more briefly, the capacity for adaptation at any time scale presupposes the capacity for adaptation at every time scale that is smaller than it; therefore, adaptation, which is accomplished through positive and negative feedback, must be a temporally scaling process and must rely on a temporally scaling memory.

8. Memory and Anticipation

This image of adaptation represents one of the signal advantages of the temporally scaling feedback loop model of spontaneous order over the simpler model offered by Adam Smith. Through it, we see not just how a spontaneous order endures, but how it changes in order to endure, and what the relationship in it of change to endurance must be. Of particular interest is the light this sheds on the role of history in a spontaneous order and the effect that its age has on its adaptive capacity. As already mentioned above, the longer a spontaneous order endures, the greater will be the number of time scales at which its self-reinforcing processes will operate. Hence, as the age of a spontaneous order grows, the meaning of any immediate changes that take place in response to changing conditions will change, as will the role played by such immediate changes within the spontaneous order as a whole. Specifically, they will come to have more and more repercussions on the longer-term layers of the self-reinforcing process—resulting in preparations for future changes, rather than any direct change—until eventually the longer-term significance of these repercussions will outweigh the immediate impact of the effect that gives

rise to them. Indeed, Hayek described precisely such a scenario when he turned his attention away from the economy and directed it toward yet another example of a spontaneous order, namely, the nervous system and the brain.

In *The Sensory Order*, working outside his field of expertise, Hayek gave perhaps his purest formulation of the kind of model of the evolutionary process that I have tried to develop here. I find it extremely fruitful to read this text not from a neurobiological or cognitive science perspective, but as a work of pure philosophy, so to speak, aimed at articulating an abstract model of a certain kind of process or system—of which the brain may be one instance, among others. Whether or not this model matches the concrete case of the brain—and it appears that it does—it is of great interest in and of itself for developing an interdisciplinary paradigm of spontaneous order.

Hayek describes the brain and the nervous system as a network of relations that “classifies” and “reclassifies” impulses received as input from the senses in increasingly abstract ways by translating them into further impulses that are more and more removed from the senses and increasingly internal to the network itself. Eventually, multiple sets of impulses at many levels of abstraction converge to determine a specific motor response to the input received. But the relation between stimulus and response can become increasingly mediated by the intervening layers of “reclassifications,” so that the time scale that separates a concrete sensory input from the various concrete motor outputs to which it will ultimately contribute can become indefinitely large.

The passage in which Hayek (1952: 112) describes the effects of such increasing mediation, although somewhat encumbered by his technical terminology, is nonetheless suggestive enough for our purposes to deserve quoting at length:

As any afferent impulse is passed on to higher levels, it will send out more and more branches which will potentially be capable of reinforcing or inhibiting an ever-increasing range of other impulses. This increasing ramification of every chain of impulses, as it ascends through successive relays to higher levels, will mean that at any moment the general excitatory state of the whole nervous system will depend less and less on the new stimuli currently received, and more and more on the continued course of chains of impulses set up by stimuli which were received during some period of the past. In consequence, an ever-increasing part of the forces determining the response will consist of the pre-existing distribution of impulses throughout the whole system of connected fibers, while the newly arriving impulses will play a correspondingly smaller part.

It is a corollary of this steadily increasing influence of the pre-existing excitatory state that the main significance of any new stimulus will be that it will alter the general disposition for responding in particular ways to further stimuli, and that less and less of its effect will consist in producing a specific response. In other words, a greater and greater part of the effects of impulses set up by any new stimuli will go to create a 'set' controlling future responses, and a smaller part directly to influence current responses.

In this way, changes in the present will be selected within any spontaneous order less and less for their immediate effects, and more and more for their future ramifications; and similarly, changes in the present will take place less and less due to changes in surrounding conditions, and more and more due to changes that have taken place in the past and that will have increasingly prepared, as it were, the changes happening now. Internalist factors will increasingly outweigh externalist ones. Thus, as the law ages, precedents play an increasing role in determining present decisions, and present decisions become increasingly important for their repercussions on future decisions, rather than for their effects on the situation at hand. As the market process ages, the historically determined structure of production and allocation of capital carry greater and greater weight in determining present choices, and present choices again become more and more important for the future capital and production landscape that they help to shape. Likewise, as the history of biological evolution ages, the changes that occur in the present become increasingly determined by the history of changes that have occurred in the past, rather than by immediate factors, and the selection of changes in the present becomes increasingly constrained by the way in which they will shape the field of possible changes in the future. This list of parallels can be continued indefinitely, as long as we can name more spontaneous orders to add to it. It points to a basic fact about the behavior of all spontaneous orders and their relation to past, present, and future. The great advantage of the temporally scaling feedback loop model is that it describes a consistent mechanism that explains such behavior.

As I noted earlier, after *The Sensory Order* Hayek retreated somewhat from this emphasis of what might be called the diachronic dimension of complex adaptive systems and began to focus on their synchronic parameters—in writing about "the twin ideas of evolution and spontaneous order," his attention shifted, as it were, from the first to the second of these two terms. Hayek may have had good reasons for wanting to simplify things and reduce the idea of spontaneous order to its essentials. Yet I believe that failure to underscore the concrete nature of its temporal component hinders the

formation of an efficacious interdisciplinary paradigm, confining generalizations about spontaneous order to the realm of metaphor.

9. Temporally Scaling Feedback as a Principle of Selection

To reiterate, then, I conceive of spontaneous order schematically as a complex self-reinforcing process that can be broken down into component processes such that (1) each of these component processes constitutes a feedback loop in itself, (2) each of them operates at a different time scale, and (3) each of them reinforces and is reinforced by all the others, by contributing to the conditions that make the others possible and by being possible itself due to the conditions to which the others give rise. A self-reinforcing process has a certain repeating structure in itself, but also depends on certain constant surrounding conditions that allow this structure to endure. In a temporally scaling feedback loop, the conditions in which each feedback loop operates are constituted by other feedback loops. Thus, feedback loops reinforce other feedback loops indirectly, at different time scales, by creating mutually beneficial conditions, in addition to each of them constituting a more direct process of self-reinforcement at its own time scale. In the unfolding of the overall sequence of events that forms a spontaneous order, different feedback loops are constantly being selected at different time scales, appearing and disappearing, on the basis of whether or not they reinforce and are reinforced by feedback loops at other time scales that are currently part of the self-reinforcing process.

As I mentioned earlier, a feedback relationship between processes at different time scales is an interesting phenomenon because it possesses a degree of freedom that a simple feedback loop, taking place at a single time scale, lacks. A simple feedback loop either remains the same or else disappears entirely: it is difficult to conceive of such a feedback loop changing over time, since that would beg the question of what it is that constitutes the feedback loop in the first place. But a temporally scaling feedback loop, although it is entirely composed of feedback components and depends on the existence of such components, has no essential part that it cannot do without. In other words, it can change entirely over the course of its existence: none of the simple feedback loops composing it at one time and another have to remain the same.

A temporally scaling feedback loop amounts to a process of constant selection of simple feedback loops at different time scales, such that they match certain criteria, namely, such that they stand in a mutually reinforcing relation to the system of feedback loops which already exists at that given moment. In this way, the whole system can continually change: no specific feedback loop is

a constraint on its variability. What *is* a constraint on its variability is the manner in which it can change from one point to the next. Every transition that it makes and every change that it passes through has to be of a specific kind, namely, it has to involve the disappearance of component feedback loops that no longer reinforce and are no longer reinforced by the other component feedback loops; or the appearance of new component feedback loops that reinforce and are reinforced by the other component feedback loops. Thus, while a spontaneous order need not have any invariant components whatsoever, there is an invariant rule which governs the way in which it can change over time.

The temporally scaling feedback loop, then, is a model of spontaneous order that resolves the paradox of endurance and change mentioned at the beginning of this paper. It is a model that identifies a type of endurance which allows for, may be constituted by, and indeed often depends on constant change. It is a model that shows how evolution can be seen as a process of incessant transformations—a highly complex and never-repeated sequence of events—and yet remain entirely self-reinforcing at the same time.

It is worth emphasizing that, as a process that subsists on self-reinforcing relations *between* self-reinforcing processes, the temporally scaling feedback loop constitutes a very special kind of selection mechanism. Specifically, within the realm of various possible self-reinforcing processes, it constantly selects those that enter into mutually reinforcing relationships with one another, distinguishing them from those that do not. Which particular feedback loops will be capable of entering into such relationships is a factor that will change as conditions change and thus vary over time. What will not vary is the principle of selection that will lead to the discovery of those among them that fit this profile at any particular moment.

This profile is indeed the profile of spontaneous order. I believe that it is sufficiently broad to characterize not just the two phenomena that we have discussed so far—the law and the market—but that it applies equally well to any biological process that involves trial and error, to the development of any body of scientific knowledge (and, perhaps surprisingly, art as well), and to any other process that can be described as an evolution. The abstractness of this model, and hence its interdisciplinary promise, is due to the fact that it is formulated in terms of self-reinforcement and time scales—concepts that are not specific to any field, but refer to the properties of processes in general. At the same time, the model is concrete enough to stipulate the necessary and sufficient conditions that define spontaneous orders wherever they appear.

10. The Pyramid of Life

To illustrate the broad applicability of this approach, let me conclude by considering how it relates to the field that studies evolution in the most concrete meaning of this term, namely, biology and the evolution of the genome. The story of genetic evolution is commonly told as a story of changes, diagrammatically represented as bifurcations in the image of the tree of life, which was popularized by Darwin. However, as the authors of a recent book on evolution, Marc Kirschner (2005: 45-70) and John Gerhart, point out, the same story may be told with equal justice as a story of conservation. If we look at the genome of any individual organism, we will be able to identify features in it that it shares with every other organism in the biosphere. These features may be thought of as a layer of the genome that has been conserved since life began on earth. On top of this layer will be another layer of features that the individual organism shares with every other organism in its kingdom, another layer of features distinctive to its phylum, class, order, and so on, all the way up to the last set of features, which are unique to the individual organism itself. The genome might thus be represented diagrammatically as a kind of pyramid, whose bottom layer is universally shared by all life forms and is thus its oldest component, and whose top layer is unique to an individual organism and is thus its youngest component. Accordingly, every layer within the pyramid has been conserved, in the course of evolution, at a different time scale, ranging from the time scale of life on earth to the time scale of the life of a single organism.

The genome as a whole, of course, is involved in the self-reinforcing process of reproduction and natural selection. But the different layers of the pyramid are involved in this process in different ways. For those features which are unique to the organism, only its own reproductive success will tell whether or not they will endure for another generation. But if we look at the features that all of life shares, then the fate of any single organism is largely irrelevant to their endurance. They are dependent on the population of the biosphere as a whole and its reproduction. This suggests a time scale considerably greater than that of the reproductive lifespan of a single organism. The reproductive success of the biosphere as a whole is determined much more slowly. In other words, changing conditions that will favor or inhibit reproduction will act rapidly on single organisms, and thus on the features that are theirs alone, but much more slowly on populations—and the more slowly, the larger the population is. Consequently, the ramifications of a change in conditions on the top layer of the genetic pyramid will be quickly discovered, but the ramifications of the same change on its lower and lower layers will take longer and longer to play out. In this way, the pyramid image of the genome illustrates how genetic evolution may also be thought of as a temporally scaling feedback process. Each layer in the genetic pyramid is involved in a feedback loop at a different

time scale; and in addition, within every organism, all the layers must interact, constraining and reinforcing one another.

Since Darwin added biological evolution to the list of phenomena that can be characterized as spontaneous orders, biologists have identified several other major areas in their discipline that fit the same description. In addition to neurobiology, already alluded to above, the most prominent among these have been development and metabolism.³ Both embryological development and cellular and intracellular metabolism have been seen to operate on the same trial-and-error principles as genetic evolution—just at much shorter time scales, somewhat like the economy operating at much shorter time scales than the law.⁴ While lack of space prevents me from doing it here, I believe that both of these phenomena could also be described in accordance with the temporally scaling feedback loop model. In each case, older self-reinforcing processes will serve as selective constraints on newer ones, which will in turn selectively reinforce or inhibit the former, thus creating the same pattern of mutual reinforcement between feedback processes taking place at different time scales.

11. Conclusion

It may be argued that, in the history of life, different kinds of biological spontaneous orders have emerged when new conditions for temporally scaling feedback have appeared. This implies that those who study such orders can use the temporally scaling feedback loop model as an experimental tool, whether they are cognitive scientists interested in modeling cognition algorithmically, researchers exploring the behavior of cellular automata, or biologists using evolutionary selection techniques in conducting experiments. In all such cases, the temporally scaling feedback loop model specifies the conditions that would have to be reproduced or modeled in order for spontaneous order to emerge. What I want to emphasize in particular is that this model, which I have elaborated above using examples drawn from the social sciences, suggests a quite concrete research program for the natural sciences as well. It is in this way that it may be capable of serving as an interdisciplinary bridge that would allow all fields that study spontaneous orders—regardless of whether they involve human action or not—to communicate with one another.

As for the social sciences themselves, the greatest benefit of this model in my view is that it can promote what I referred to above as time scale thinking. The history of genetic evolution is not the only history that can be told either as a story of endurance or a story of change. The history of every spontaneous order is open to these two alternative approaches. Since spontaneous orders appear as processes of constant change, there is an abiding tendency across many disciplines—and among people in general—to talk about

them as if they were stories of change and nothing more. This is what all relativistic, historicist, and positivistic approaches to the history of social institutions and the history of bodies of knowledge ultimately amount to: they tell these histories—which can just as well be told exclusively as stories of endurance—exclusively as stories of change.

A great number of misconceptions have sprung up as a result of people looking at spontaneous orders and seeing only change. This is even true of explanations of genetic evolution in biology, but especially disciplines that study such phenomena as the law or the economy have suffered from the tendency to view historical processes as just one unrelated event followed by another. Such an approach is no doubt justified with regard to some historical phenomena, but in the case of others, it captures just one side of the story and the impression that it captures the whole story is an illusion.

The idea of spontaneous order has always served as an antidote or a counterweight to that view. It showed that certain phenomena which appear as forms of flux are actually invariant in the sense of being subject to invariant constraints. Yet this idea has often remained so abstract or metaphorical that bridging the gap in a concrete way between it and the change that people actually observe when they look at historical events has tended to be an unpopular undertaking. And those who were not interested in spontaneous order in the first place, but had an ideological commitment to interpreting phenomena as meaningless series of accidents, could freely ignore it.

The model of spontaneous order proposed here, I believe, makes the gap between the abstract paradigm and the concrete reality somewhat easier to bridge. It describes a particular form of endurance that presupposes constant change. Appreciating the enduring aspect of spontaneous orders—legal, economic, biological, and others—involves thinking of them less as sequences of events and more as interactions between conserved phenomena that endure at different time scales. Such a shift in perspective calls attention to various forms of memory—and the concomitant capacity to anticipate future contingencies—and raises questions about the specific conditions that make such memory and anticipation possible. It spells out the narrow constraints in which all of the apparent changes in spontaneous orders take place and must take place, namely, they must enter as self-reinforcing processes into a system of self-reinforcing processes. And crucially, it raises awareness of the limitations on changes that can be introduced into such a process. By conceiving of every change that takes place within a spontaneous order as a form of endurance, we effectively identify a very special category of changes that spontaneous orders can accommodate without breaking down. Any change that does not constitute a form of endurance in the narrow sense defined above cannot be a part of the process.

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Notes

¹ For example, “Notes on the Evolution of Systems of Rules of Conduct” in Hayek (1967: 77)

² See Gould (1979). Darwin quoted in Gould (1985).

³ See, for example, Kirschner and Gerhart (2005).

⁴ Indeed, there is a deeper parallel to be drawn between the relationships between the long-term and short-term processes in both cases: in much the same way that the long-term evolution of the law creates the abiding constraints within which the short-term evolution of the market can operate, the long-term evolution of the genome lays down the rules and parameters within which the much shorter-term evolutions of development and metabolism unfold. There is a whole area here to explore with regard to how long-term and short-term spontaneous orders interact, in light of the fact that both of them can be seen individually as temporally scaling feedback processes. See also the section on “the map and the model” in Hayek (1952).

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