
A Branch on the Mainline: Hayek's Analysis of Complex Adaptive Systems

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I cannot imagine any serious scholar who will not come away enlightened from Peter J. Boettke's *F. A. Hayek: Economics, Political Economy and Social Philosophy*. It is an impressive feat: Boettke weaves together biography, a close examination of the history of critical economic controversies with contemporary debates, fundamental reflections on the nature of economic thinking, the critical importance of information in the market order, a statement of the liberal program—and a guide to Hayek's system of ideas. A great strength of Boettke's book is his distinctive toolkit: he knows the history, the texts, and is a highly accomplished economist. He knows not only mainstream economics but what he describes as “mainline” political economy—the body of thinking about social and economic order extending from Adam Smith, through Hayek, Coase, North, Buchanan and Ostrom (Boettke, Haeffele-Balch and Storr 2016). It is rare that an author has this wide array of competencies and interests, making Boettke's contribution uniquely valuable.

Of course even a perspective such as Boettke's, including such a wide range of knowledge and tools, has its limits. By its very nature, a perspective categorizes and frames problems and solutions—that is how it enlightens us. That, though, also entails that it will fail to pick up on issues that do not fit well with its categorizations and background models. Although, as an economist, his perspective is extraordinarily broad and complex, Boettke nevertheless understands Hayek's system through the lens of economics. An alternative perspective, which I shall investigate here, stresses Hayek's indebtedness to the biological sciences, both directly in the form of his evolutionary thought, and methodologically. As Bruce Caldwell (2004, p. 299) tells us, in the early 1950s Hayek conducted a seminar at the University of Chicago—which he called “one the greatest experiences of my life”—on levels of organization in the sciences, in which Sewell Wright, a leading group selectionist, par-

ticipated. In the 1950s and 1960s Hayek developed his theories of complex systems and social evolution which, as I see it, deeply informed all his later work, most obviously *Rules and Order* (1973), the *Fatal Conceit* (1988) and, I believe his Nobel lecture of the “Pretense of Knowledge” ([1975] 2014). On this view, aspects of Hayek's thought that are rather peripheral to Boettke's analysis—such as the theories of cultural evolution and complex phenomena—move to center stage. The upshot of following out this second line of interpretation, I shall argue, is a somewhat different view than (though generally compatible with) the analysis of Hayekian economic methodology presented by Boettke. However, it suggests a more sharply contrasting understanding of Hayek's place in mainline political economy, a place that is obscured when we view his work primarily through the lens of economic thinking.

IT USUALLY BEGINS WITH ADAM SMITH

Boettke's idea of mainline economics begins, of course, with Adam Smith. Boettke (2018, p. 134, emphasis added) writes:

Even in the world of *knave* men, Smith demonstrated that economic liberalism enabled peaceful social cooperation that leads to increases in productivity. Indeed, he pointed out that *liberalism could not only deal with a world of selfish individuals, but actually harnessed man's self-interested motivation for the benefit of everyone*. Under liberalism, *self-interested and rapacious* man is “led by an invisible hand to promote an end that was no part of his intention”—to the interest of society.

I have two hesitations about this important passage: (1) the apparent claim that markets can successfully function

with a majority of truly selfish individuals, or even rapacious ones, and (2) the implication that the heart of Smithian liberalism is the invisible hand. I believe these two worries are reinforcing.

Reciprocity Rather Than Selfishness

As Boettke (Ibid., p. 227) acknowledges, self-interest is not the same as selfishness. Yet in the above passage he rather slides between them (“liberalism could not only deal with a world of selfish individuals, but actually harnessed man’s self-interested motivation for the benefit of everyone”). I infer that Boettke thinks that, while they are different, a largely selfish population could populate functional market orders. Thus he (Ibid., p. 172) repeats James Buchanan’s dictum: “same players, different rules, produce different games.” The difference between Hobbes and Smith, it would seem, is simply the institutional framework, not the underlying motivational structure. Put selfish, rapacious folks in the normless state of nature and they pillage; put them in the market and they trade (Ibid., p. 159).

On my reading of the evidence, I’m skeptical. Despite the best efforts of economists (say, drawing on direct reciprocity and the folk theorem in iterated games) to show that such individuals can cooperate, the results are not robust: as soon as opportunistic cheating is profitable, selfish or “rapacious” individuals will defect.¹ In contrast, evolutionary theorists explaining the rise of cooperation have focused on humans as “strong reciprocators.”² While we do not cooperate out of benevolence or altruism—our *aim* is not typically to help non-kin others—we willingly return benefit for benefit in lieu of the threat of punishment. We thus tend to stably play cooperative games, and so exchange flourishes.

Exchange Rather than the Invisible Hand

This brings me to my second concern. Although many insist that the invisible hand is the heart of Smith’s economics or his liberalism, we must remember that the phrase appears only once in *The Wealth of Nations*, and then only in Book IV, in the case against restrictions on imports in the second chapter of his relentless criticism of Mercantilism (Smith 1976, vol. 1, p. 477). What Smith himself clearly stresses in the first three chapters of *The Wealth of Nations* is that the tendency to *exchange* is at the core of markets and the resulting division of labor. Let us consider the famous passage more fully:

This division of labour, from which so many advantages are derived, is not originally the effect of any human wisdom, which foresees and intends that general opulence to which it gives occasion. It is the necessary, though very slow and gradual, consequence of a certain propensity in human nature which has in view no such extensive utility; the propensity to truck, barter, and exchange one thing for another. ... [M]an has almost constant occasion for the help of his brethren, and it is in vain for him to expect it from their benevolence only. He will be more likely to prevail if he can interest their self-love in his favour, and shew them that it is for their own advantage to do for him what he requires of them. Whoever offers to another a bargain of any kind, proposes to do this: Give me that which I want, and you shall have this which you want, is the meaning of every such offer; and it is in this manner that we obtain from one another the far greater part of those good offices which we stand in need of. It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest. We address ourselves, not to their humanity but to their self-love, and never talk to them of our own necessities but of their advantages (Ibid., pp. 17-18).

Now as I read it, nothing in this canonical passage entails that individuals are selfish, or even allows selfishness, much less possible rapaciousness. Smith’s individuals are *reciprocators* playing cooperative games—“Give me that which I want, and you shall have this which you want.” This is not a promise selfish players can reliably make. Selfish individuals get caught in Prisoner’s Dilemmas, in which they each seek to defect on each other’s cooperation, and so their contractual promises³ are notoriously worthless: “Give me that which I want, and if I can’t get away with cheating, you shall have this which you want.” As Hobbes recognized, only by keeping the selfish in “awe” can they be sufficiently intimidated to play according to the rules. But reciprocators naturally and easily play the exchange game. There is, I think, no greater mistake in interpreting Smith than to think that the absence of benevolent motivation implies simple selfish motivation. There is a large space between being willing to be a sucker (benevolence) and preferring to play others for a sucker (selfishness). Smith denies that the market supposes the former but never says it embraces the latter.

Given Smith's assumption that individuals are reciprocators (natural exchangers), the stage is set for the division of labor (not the invisible hand) and its great expansion of markets. By far, most of us are reliable reciprocators, so exchange (rather than cheating and theft) is a natural way of meeting our needs. But, as Smith (1976, vol. 1, Bk. I, chap. 3) goes on to argue, the resulting division of labor becomes increasingly refined and specialized as the market expands. Smith seems to have viewed the expansion of the market and the division of labor as primarily driven by the *exogenous* variables of transportation and communication costs. As these costs go down, the number of people who gain by exchange increases, and so the division of labor becomes more minute (cf. Boettke 2018, p. 162). Jobs that could not exist in a small town become common in a large city. However, as the physicist complexity theorist Stuart Kauffman has recently argued, in both biological evolution and in the market this growth is, critically, *endogenous*. Each new service or good produces a new niche for yet other new services or goods, which themselves create more new niches that can be exploited. "The process is broadly self-accelerating. Thus, the growing economic web explodes in a diversity of complements and substitutes from perhaps a thousand or ten thousand goods 50,000 years ago to billions today!" (Kauffman 2018, p. 137).

Adam Smith's simple analysis of the exchange producing the division of labor is thus the core insight of a complexity analysis (Boettke 2018, p. 180ff.): individuals are constantly creating new niches, with new information about niche-contexts, as they go about trading (Kauffman 2018, p. 112). The market is thus constantly creating the conditions for its own expansion, constantly amplifying its own complexity (Ibid., p. 117). This insight is lost when we blur the analyses of exchange and the division of labor with Smith's account of the invisible hand. The invisible hand is a self-organization-equilibrating analysis: on the most common interpretation, it is about the system's tendency to produce a certain emergent property such as equilibrium. While this is important (though, we shall see in section III, not necessarily basic), it is different from the self-sustaining growth of the division of labor. How wealth and the market grow is the critical subject of Book I of *The Wealth of Nations*; we should not read into it the analysis of system self-organization (the invisible hand) from Book IV.

HAYEK'S COMPLEXITY ANALYSIS AND THE BIOLOGICAL TURN

In my view, Hayek's great contribution in the later part of his career was to develop the complexity insight implicit in Smith's mainline economics.⁴ Highly heterogeneous actors with distinctive plans constantly adjust their actions to the previous adjustments of others. And as they adjust they are constantly creating new economic niches, with attendant new possibilities for interactions and yet new reflexive adjustments (see Beinhocker 2013). What is especially noteworthy is that as Hayek develops this complexity insight he was increasingly drawn to understanding economics as an evolutionary discipline that shares a methodology with biology rather than physics. As Boettke nicely stresses, much of Hayek's work was a criticism of the methodology of mainstream economics, which sought to attain a physics-like analytic and predictive rigor. Recall Jevons's (1965, p. 3) claim at the outset of his *Theory of Political Economy*: "It is clear that Economics, if it is to be a science at all, must be a mathematical science." But, Hayek ([1964] 2014) argued, evolutionary sciences cannot generate deterministic mathematical models predicting outcomes: even if one assumed complete information, there is no possible set of equations that can predict the course of evolution. We can say that some developments are possible or impossible, but the course of an evolutionary phenomenon cannot be predicted.

Thus in his Nobel Prize lecture, Hayek ([1967] 2014, p. 365) insisted that "the social sciences, like much of biology but unlike most fields of the physical sciences, have to deal with structures of essential complexity, i.e., with structures whose characteristic properties can be exhibited only by models made up of relatively large numbers of variables." This is a fundamentally different objection to over-ambitious mathematical social science than that which Boettke (2018, pp. 182-185) rightly stresses, viz., the subjective and intentional nature of the data in the social sciences and so their essentially interpretive, narrative, character. This latter criticism of over-ambitious mathematical social science was, of course, important to Hayek's abuse of reason project (Hayek 2010). The line here is between the natural and moral sciences. In the Nobel Prize lecture, however, Hayek ([1975] 2014, p. 365) insists that he does not reject mathematical modelling, but stresses its limitations when confronted by complexity. Economics can model possible system states—"patterns"—but a deterministic set of equations

is quite impossible. This new line separates the complex from the non-complex sciences.

Kauffman (2018, p. x) has recently argued much the same: “what evolves cannot be said ahead of time.” And, very much in the spirit of Hayek, Kauffman insists that mathematics tells us little about where the evolutionary process may go. On Kauffman’s (Ibid., pp. 107, 110, 124) analysis evolutionary sciences—and here, like Hayek, he includes parts of biology and economics—concern “adjacent possible new niches.” We can only identify ahead of time *possible* adjacent new niches: evolution enables new developments but, Kauffman (Ibid., p. 116-7) stresses, evolutionary dynamics do not cause them to be occupied. Moreover, such developments are path dependent: the niches that are created and so are possible to occupy at time t_2 depend on those occupied at t_1 . Evolved systems are open, and so at any point exogenous factors may radically alter the possibility space. We cannot even know the possibility space (the boundary conditions of the system), so we cannot identify the probability that the system will occupy any specific space: “not only do we not know what will happen, we do not even know what can happen” (Ibid., 117).

TWO ACCOUNTS OF ADAPTIVENESS: SELF-ORGANIZATION AND MACRO-SELECTION

Why is the Self-Organizing Framework Itself Adaptive? Second-level Self-Organizat

Thus far I have been stressing a mainline track from Smith’s analysis of the division of labor to complexity and evolution—a line of development that Boettke (2018, pp. 179-181) also perceives, though it is not especially prominent in his book. Hayek’s reliance on complexity and evolution, and ultimately his “biological turn,” are all natural, but highly sophisticated, developments of the core Smithian focus on market exchange and the division of labor. Boettke (Ibid., p. 3) is certainly right: Hayek is a theorist of the twenty-first, not the twentieth, century.

We now come to what Boettke (2018, p. 174) calls “[t]he crucial step in the Hayekian analysis”—“to argue that not only was the pattern of social interaction within the *framework* a result of spontaneous order, but the very *framework* itself was the product of another spontaneous ordering process.” If we think in more evolutionary terms, the Hayekian claim ([1967] 2014; Mack 2006) is that not only does ac-

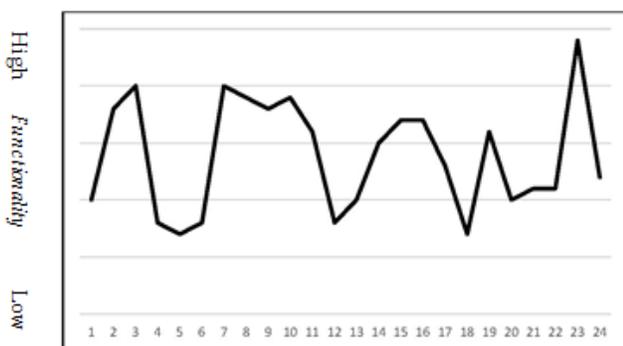
tion within a liberal institutional framework produce what he called an adaptive “order of actions” (i.e., a pattern of cooperation or conflict that emerges from the underlying moral and social rules and the way heterogeneous agents act under them), *but the underlying set of institutions producing this order is itself produced by a process of adaptation*. In a world of complex change, this is a critically important claim. Endogenously, the pace of the growth of innovation and complexity is accelerating; exogenously, the environmental conditions for the order of actions are constantly changing. We need to understand how this institutional structure maintains its adaptiveness in light of these dynamics. Schumpeter (1950, pp. 81-87) brought to our attention that evolved economies are subject to the “gales” of creative destruction: a wide number of niches may be wiped out when there is a major technological change (say, from horse drawn carriages to automobiles) Arthur (2015, p. 141). In an important essay, the biologist, D. S. Wilson (2016) reminds us that complex systems are not guaranteed to be adaptive: we must provide some account of how rules and institutions themselves alter to maintain system functionality (Arthur 2015, p. 141). Gales can result in extinction: why think that this evolved system can maintain itself?

The Main Mainline Answer: Self-Organization and the Foundational Invisible Hand

The mainline answer is to again invoke the invisible hand as a mode of self-organization. Call this the *Foundational Invisible Hand*. The familiar invisible hand is an individualistic, bottom-up, organizing device: focusing of the logic of rational choice, within suitable institutional rules a spontaneous order results (Boettke 2018, pp. 165-166). As Hayek proclaims, “Adam Smith’s decisive contribution was the account of a self-generating order which formed spontaneously if the individuals were restrained by the appropriate rules of law” (quoted in Ibid., p. 166). The question now is how these “appropriate” legal and institutional rules themselves arise. In exploring these problems in *Rules and Order* Hayek focused on the common law (which is essentially a bottom-up self-organizing process. Hayek suggests that there may be something akin to a market in law which determines what law is functional (Ibid., p. 175), just as the market determines what firms are adaptive. This would be a Foundational Invisible Hand, which provides an adaptive framework for the formation of the familiar invisible hand of the market. However, if, as we have been assuming, invisible hands require an institutional framework to function—

the self-organization of the normal market depends on an institutional structure—it is unclear how this Foundational Invisible Hand can function without its own appropriate institutional framework. If on the invisible hand account the market depends on the institutions of law, and supposing the market in law depends on a constitution, we need to consider what is the institutional framework that allows for an invisible hand in constitutional selection—that is, adaptive markets in constitutions. If there is no such framework, the endogenous self-reforming story either runs out, or admits the possibility of a non-institutional invisible hand.

The above suggests a regress problem: in our search to explain how the invisible hand framework organizes itself, we look for a more basic invisible hand, which presupposes a more basic framework; to explain that framework we need to find another invisible hand which implies yet another framework, and on and on. Regress problems are a mainstay of philosophy: they help clarify our models and claims. Yet they often are avoided in actual systems by complicated networks of interconnections, making it difficult to talk about distinct levels. Putting regress aside for now, there is a deeper worry about the type of incremental search procedure—solving one problem at a time—that Hayek thinks is involved in the common law. Just as the set of agent interactions in the market are complicated, a set of institutions is also apt to be densely interconnected. Indeed, this was one of Hayek’s core points: the institutions work as a “whole” producing an emergent order of actions. That is why the order of actions is an emergent property of the entire framework rather than a simple consequence of the aggregation of a set of rules (see §IV). This, though, means that the search for a better framework again confronts us with problems of complexity, as in Figure 1.



Institutional Frameworks Arrayed in Terms of Similarity
Fig. 1: Interconnected Institutional Frameworks

Figure 1 illustrates a set of institutional frameworks (1-24) arrayed in terms of institutional similarity on the x -axis⁵ and the functionality of the system (see Boettke 2018, p. 180) on the y -axis. This sort of “rugged landscape” is the inevitable result of a value (functionality) which is the output of a N -dimensional system with K interdependences (Kauffman 1993; Gaus 2016). In this case N = the set of institutional rules and K = the number of interdependencies between the rules, in the sense that the outcome of rules r_1 and r_2 is not simply the aggregation of their separate outputs. In her extensive fieldwork on actual institutions Elinor Ostrom (2014, p. 111) stressed that institutions are composed of numerous rule configurations in which the constituent rules have strong interdependencies, both with each other and with environmental conditions. “A change in any one of these variables produces a different action situation and may lead to very different outcomes.” When institutional frameworks have high N s and significant K s the framework is itself complex: the individual institutions are sufficiently interconnected that a change in any rule produces functionality-related changes in the outputs of many others, thus producing “rugged landscapes” as in Figure 1. That is what is meant by saying that the set of institutions functions as a “whole.” In this system there is not a high correlation between the adaptive value of one social framework and its institutionally similar neighbor.

The problem, then, is obvious: insofar as “evolutionary” is employed to mean “gradual” (Boettke 2018, p. 176), evolutionary, incremental, change (such as in the common law) does not look effective at reforming system functionality. To be sure, we see some gradients in Figure 1, i.e., areas in which an incremental evolutionary search mechanism can discover improvements by climbing a slope. There is a gradient, for example, from framework 12 and 15, but 15/16 is a local optimum: incremental searches cannot improve upon it, though there are a number of more functional institutional frameworks to be had. An incremental evolutionary search will end at 15/16.

The Subsidiary Mainline Proposal: Modest Top-Down Guidance

Although *Rules and Order* stressed the bottom-up self-organization of the legal framework through the common law, Hayek (1973, p. 88) allowed that explicit (top-down) legislation is sometimes required to solve an evolutionary “impasse,” which is a good description of an evolutionary path that ends up at system 16. Boettke (2018, pp. 288-289)

also defends “top-down” legislation as a way to improve a complex system. But explicit legislation faces perhaps even greater problems in a complex institutional setting. As Figure 1 shows, in order to get out of the “impasse” of system 16 the legislature must move to system 23. But this requires a simultaneous alteration of a number of institutions—and if the legislature gets it wrong by a little, society can end up in the even worse system 24. All the problems raised by Hayek’s critique of economic planning reappear here. The hard truth is that neither bottom-up nor top-down incrementalism are obviously effective in discovering functional changes in complex systems.

Of course this is simply the beginning of the debate: self-organization-invisible hand accounts have a variety of resources to respond. But all responses have significant difficulties (Gaus forthcoming). Most obviously, it might simply be insisted that things are not really very complex. That, though, not only seems empirically dubious, but it “solves” Hayek’s problem by undermining his major contribution. Or perhaps the familiar institutional structure of the market order is so highly functional that no matter what the state and complexity of the economy, we should leave it alone. No searching is necessary (we are already at system 23!). But then, *pace* Boettke (2018, p. 288), Hayek would indeed recommend passivity with respect to the institutional framework (any small change from system 23 will make things a lot worse). In any event, we still have not explained why the framework is adaptive: we seem just lucky to be at system 23.

Hayek’s Departure from the Mainline: Macro Selection

Wilson (2016, p. 44; see also Gowdy et al. 2016, p. 331) indeed, believes that, sans identifying a mechanism to ensure the functionality of the framework, the familiar market invisible hand would be little more than dumb luck. On his view (Wilson 2016, p. 44) the most plausible basis for complex system-level adaptation is some form of macro-evolutionary selection: “[f]rom an evolutionary perspective... only when a society is a unit of selection.... does it function well as a unit.” On his analysis a complex social order will adapt to maintain its cooperative functionality only if, at the societal level, forces are constantly selecting more over less functional variants of its rules and institutions. Recall that the entire set of rules and social institutions generates what Hayek calls an “order of actions”—the emergent property of social order that arises in a rule-based society (SIV). Hayek ([1967] 2014, p. 280) seems to agree with Wil-

son: “[t]he evolutionary selection of different rules of individual conduct operates through the viability of the order it will produce.” The distinction between a set of rules and the emergent order of actions to which it gives rise is a fundamental insight of Hayek’s, which allows him to distinguish the focus of selective pressure (the overall functionality of the institutional order) and the underlying rules and institutions (that structure it), which are transmitted.⁶

Such evolution is a form of cultural multi-level (group) selection. As Hayek (1973, p. 18) says, “[t]he rules of conduct have ... evolved because the groups who practiced them were more successful and displaced others.” If society S_1 , characterized by order of actions O_1 , is more productive than S_2 based on O_2 , society S_1 will tend to win conflicts with S_2 , a mechanism akin to natural selection: O_1 is more adaptive than O_2 . Alternatively, the members of S_2 , seeing the better-off participants in S_1 characterized by O_1 , may either immigrate to S_1 , or seek to copy its underlying rules, thus inducing differential rates of reproduction between the sets of rules underlying S_1 and S_2 . The overall order of actions is adaptive because systematic selection pressures favor institutional frameworks that promote overall orders that are more adept at facilitating cooperation and securing its social benefits.

My concern here is not about the ultimate explanatory adequacy of the macro-selection account. Rather, for our purposes what is critical is Hayek’s great insight that it offers a promising explanation of the adaptiveness of the institutional framework that departs from mainline thinking. *If* there are strong macro-selection pressures, and *if* a large number of institutional frameworks compete, functional “wholes” can be selected even on relatively rugged landscapes such as Figure 1. Because the selection pressures are on the functionality of the entire framework, its interconnections are, in a sense, also selected. It is a potentially elegant solution to the problem of the adaptiveness of highly interconnected institutional frameworks—the problem with which self-organization-invisible hand analyses struggle.

Macro-selection, though, is manifestly a departure from the strongly bottom-up form of explanation to which mainline economics is devoted. Joseph Henrich (2016, p. 318), who adopts a broadly similar social evolution approach, explicitly compares individual cells in an organism to individuals in the evolving “superorganisms” of our societies. This is no mere metaphor: once the selection pressure is on the order as whole, its functionality, not the freedom of the agents, drives evolution. Whereas self-organized sys-

tems depend on allowing individuals large degrees of freedom to reflexively do their own thing in responding to the decisions of others (Ismael 2011, 2016), macro-selected systems' frameworks impose constraints on the freedom of the parts. On a multilevel (group) selection account, the higher-level (societal) selection inherently restrains lower-level (individual) activity. Indeed, there is no point to higher-level selection if it does not. Critical to the integrity of an organism is restricting the freedom of parts to go their own way—a cancer cell is precisely a part that has broken free of these restraints, and because of this threatens ultimate system collapse. We might say, in a rough and ready way, that restricting individual decisions in order to secure system-wide functionality is precisely what macro-selection accomplishes. How, then, can this provide a basis for an individualistic and liberal theory?

HAYEK'S INDIVIDUALISM AND LIBERALISM

Emergence, Macro-Selection and “Methodological Individualism”

Boettke (2018, pp. 4, 186-191) insists that it is an error to infer from Hayek's use of multi-level selection that he drew back from the core methodological individualism of the Austrian program. Now it is often not pellucid what “methodological individualism” is: sometimes the term indicates an explanatory reductionist program, sometimes a metaphysical claim about what are the “real entities” in society, sometimes a commitment to agent-based modelling of social outcomes, sometimes a type of subjectivism, sometimes a claim that social causation always runs from individual decisions to social facts. All are distinct. Caldwell (2004, pp. 279-287) rightly recognizes that, given his commitments to complexity theory and multi-level selection, if Hayek is a methodological individualist it is of a complicated type—perhaps what Philip Pettit (1993) has called “holistic individualism.”

Rather than staking any claim as to what “methodological individualism” might be, it is useful to stress commitments of Hayek's view that are, methodologically, unusual both in mainstream and mainline economics. Consider the claim that the “order of actions” is an emergent property of an institutional framework and the heterogeneous individuals acting within it. Emergent properties are sometimes distinguished from mere “resultant” properties on the grounds that, while a resultant property is the expected consequence

of an underlying set of individual properties, emergent properties are often novel and unexpected. In perhaps the earliest analysis of such systems, John Stuart Mill (2006, pp. 370-373, 438-440) considered a system, say, S , composed of elements (e.g., rules) $\{r_1 \dots r_n\}$ and an emergent order O . Mill proposes three features of property O :

- (1) O is not the sum of $\{r_1 \dots r_n\}$;
- (2) O is of an entirely different character than $\{r_1 \dots r_n\}$;
- (3) O cannot not be predicted or deduced from the behavior of the members of $\{r_1 \dots r_n\}$ considered independently (i.e., apart from their interactions in S).

These claims defeat any reductionist program according to which claims about social properties can be reduced to those of individuals. Emergent properties are characterized by multiple realizability: the same emergent property can arise from different sets of individual properties. Hayek ([1964] 2014) stresses the novel O 's that may arise given the same underlying set of rules. This novelty implies a looseness between the individual properties and the emergent properties: knowing the full set of individual properties does allow prediction of the emergent properties.

The analysis becomes even less “individualistic” when we add macro-selection to complexity. To say that a set of rules was selected is—at least in the most straightforward cases—to say that it produced a more adaptive order of actions in comparison with competing rule sets. It is the functionality of the whole order that explains institutions—the explanation of an institution depends on its functional contribution to the whole. Indeed, once we take the perspective of complex systems we need to contemplate the antithesis of what some might consider the heart of methodological individualism: top-down causation: higher-level phenomenon cause lower-level ones (Ellis 2012).

Rather than worrying whether Hayek's analysis qualifies as some version of methodological individualism, I'd suggest that it is more productive to analyze the types of claims and processes that the Hayekian complexity/macroevolution thesis entails. Debates about methodological individualism are in many ways a quintessential mid-twentieth century obsession; as we have developed more sophisticated social analyses they seem more a blinder than a helpful lens.

Hayek's Two Liberalisms

Boettke (2018, p. 274) closes his fine book with a discussion of “true radical liberalism”—a theory about the framework of society. I concur that Hayek’s liberalism is a claim about the framework of a type of evolved complex society. As I understand it, the complexity/macro-selection perspective suggests that Hayek proposes two distinct liberalisms—the Whig and the radical.

Evolutionary macro-selection lays the foundation for a Whiggish liberalism. The crux of a macro-selection analysis is that we do not really understand what our rules do for us: they were selected as part of a functional whole. In his recent wide-ranging overview of cultural evolution Henrich (2016, p. 57) observes that “[I]ndividuals reliant on cultural adaptations often have little or no understanding of how or why they work, or even that they are ‘doing’ anything adaptive.” In particular “[s]ocial norms make it possible for humans to solve—often without anyone understanding how—what would otherwise be inescapable social dilemmas” (Henrich 2016, p. 145). In a fundamental sense, then, our institutional rules and norms cannot be understood, for we do not know why they were selected or what social ends they serve. Hayek (1973, p. 81) describes these rules as “purpose-independent.” This would certainly preclude standard consequentialist justifications of rules: we often do not know what rules do, for their effects may be linked in surprising ways to other rules. Yet Hayek (1988, p. 27) draws back from an evolutionary ethics in which the outcome of evolution simply defines the good or right. We must start with our evolved inheritance, but we must critically examine its features. The resulting liberalism is, as Hayek (1960, p. 409) explicitly holds, of a “Whiggish” inclination. Edmund Burke, a Whig admired by Hayek, was a moral critic of English policy towards the American colonies and the slave trade, while adamantly opposed to the radical social and moral reconstruction attempted by the French revolution. From within an evolved tradition (English law) one can strenuously criticize rules, laws and policies that violate its traditions—stepping back on this or that matter and evaluating it “piecemeal” in light of the whole (Hayek 1988, p. 8). But one cannot sensibly step back from the whole (as Burke believed the French sought to do), and seek to reconstruct the society in light of some philosophical commitment such as utilitarianism or naturalism rights. “We must always work inside a framework of values and institutions which is not of our own making” (Hayek 1960, p. 63). In the last few hundred years Western society has evolved a lib-

eral open society: on Hayek’s Whiggish liberalism, liberal principles arise from a critical reconstruction of its evolved content.

Hayek’s complexity analysis, however, points to a more radical liberalism. He (Ibid., p. 379ff) chides the conservative for accepting whatever outcome has been produced by the latest intervention, and so his failure to stand up for the core principles of a free order, such as liberty and property. Now interestingly, Hayek (Ibid., p. 401) believes that these principles can be derived—or at least confirmed by—the theory of complexity: “A commitment to principles presupposes an understanding of the general forces by which the efforts of society are co-ordinated, but it is such a theory of society and especially of the economic mechanism that conservatism conspicuously lacks.” The principles of liberty and property are firmly grounded in the need of individuals in complex systems to effectively reflexively adjust their behavior: “a state in which each can use his knowledge for his own purposes” (Hayek 1973, pp. 55-56). Freedom and markets, Hayek insisted, are first and foremost ways for individuals to successfully coordinate their heterogeneous plans, and adjust within a complex system. We are constantly tempted, says Hayek, to limit this freedom in the pursuit of desired collective outcomes, but these outcomes are most uncertain, and it is only the principle of freedom that allows the constant adjustments on which a complex order depends. He thus makes what *prima facie* appears as a startling claim for one who stresses uncertainty and complexity in social life: we should be dogmatic in our defense of liberal principles (Hayek 1973, p. 61; Mack 2006). This is surely a radical liberalism.

THE HAYEKIAN TRACK

Boettke’s book is an excellent account of Hayek’s critical contributions to mainline political economy. In this and other works Boettke has done us a great service in distinguishing mainline political economy from the highly formal, static, research program that has defined so much of modern mainstream economics. Yet we can understand the mainline tradition in various ways. I have suggested that, if we bring to the foreground evolutionary and complexity theses, we get a rather different view of the mainline tradition and Hayek’s place in it. If we focus on reciprocity, exchange and the division of labor we bring out the roots of market complexity and novelty. The invisible hand is the favored adaptive, self-organizing, mechanism in mainline economics. However, it has considerable difficulty in ex-

plaining just how the institutional framework for the invisible hand itself adapts. Here, I think, Hayek branches off the mainline, developing a highly innovative macro-evolution analysis—an analysis that, while still unpopular among economists, is at the forefront of the current social evolution research agenda. I myself am skeptical that this analysis ultimately succeeds, but we miss too much of Hayek’s stunning originality if we see him as too closely adhering to the main line.

NOTES

- 1 For important attempts see Alexrod (1981), Binmore (2005), Trivers (1971).
- 2 See Gintis, Boyd and Fehr (2005, chaps. 5-8), Gaus (2011, pp. 101-122).
- 3 And Smith (1976, vol. 1, p. 17) really is concerned with *contracting*: he is clear that trade is not simply a coincidence of passions where both may benefit from cooperation—something he thinks animals are capable of.
- 4 The work of Paul Lewis (2012, 2015a, 2015b, 2016a, 2016b, 2017) has tremendously deepened our knowledge of the development of Hayek’s complexity theory.
- 5 On such similarity measures, see Gaus (2016, pp. 51-61, 251-259).
- 6 There is an obvious analogy here to natural selection: selective pressures select a successful phenotype, with the underlying genotype being transmitted.

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