What Might Democratic Self-governance in a Complex Social World Look Like?*

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I. A CRISES OF SELF-GOVERNMENT

In supporting Brexit, Michael Gove declared "people in this country have had enough of experts," a remark that spurred derision among the intelligentsia.[1] But social experts really do have an uninspiring track record.[2] Despite the tremendous resources that have been poured into the economic and social sciences, and the extensive use of their models by policy makers, the level of predictive power required to guide social systems along preferred paths is, I shall argue, increasingly difficult, often impossible. If we understand self-governance as something like the ability of the governor to guide society along a preferred path — be it toward ideal justice, the maximization of welfare, national community or socialism — we have constructed a social world that is too complex for self-governance of any sort, democratic or not.

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[1] *Financial Times*, June 13, 2016. For an expert reply, see Llewellyn, "The Experts Whose Forecasts Help Us Shape Our Lives," *Financial Times*, Saturday, December 16, 2016.

[2] See David M. Levy and Sandra J. Peart, *Escape from Democracy: The Role of Experts and the Public in Economic Policy* (Cambridge: Cambridge University Press, 2017). As Edward Tenner concludes his review of public policy, "[w]hat is almost a constant, though, is that the real benefits usually are not the ones we expected, and the real perils are not the ones we feared." *Why Things Bite Back* (London: Fourth Estate, 1996), p. 272. See further my "Is the Public Incompetent? Compared to Whom? About What?" *Critical Review: A Journal of Politics and Society*, vol. 20 (2009): 291-311 and my "Social Complexity and Evolved Moral Principles" in *Liberalism, Conservatism, and Hayek's Idea of Spontaneous Order*, edited by Peter McNamara (London: Palgrave Macmillan, 2007): 149-176. See also Philip E. Tetlock, *Expert Political Judgment* (Princeton: Princeton University Press, 2005) The recent turn to empirical economics, while in many ways welcomed, has not been inspiring: according to a recent survey the credibility of economics research is something between modest and low. John Ioannidis and Chris Doucouliagos, "What's to Know About the Credibility of Empirical Economics?" *Journal of Economic Surveys,* vol. 27 (2013): 997–1004. On the disappointing predictive power of models in political science, see James Johnson, "Review Essay – Formal Models in Political Science: Conceptual, Not Empirical," *Journal of Politics,* vol. 81(2018) <http://dx.doi.org/10.1086/700590>.

Most find this almost impossible to believe:[3] our intuitions and folk causal reasoning lead us to believe that *of course* we can control our social world, and *of course* we can reform it to conform to our ideals and collective aspirations.[4] In the grips of this certainty, in the face of each failed attempt at system self-governance we go back to the drawing board, and try again. Sometimes we see some positive effects, and this increases our conviction that we can control our social world after all. But ultimately we are disappointed, and we begin to question whether the problem is perhaps in our *democratic* system of self-governance.[5] Maybe it is because democracy lets the idiots have a say. Surely if the experts were empowered (or if voters had to demonstrate expertise), we could effectively control our social world. I shall disagree. The crisis facing democratic self-government is first and foremost a crisis of self-governance, not of democracy.

Section II reviews the nature of complex systems and why our contemporary social and economic order qualifies as technically complex — indeed, increasingly so, and why explicit overall, directed, reform of our social world is hopeless. But hope is not easily abandoned: section III critically looks at two continuing sources of hope. Section IV then turns to a critical issue: if not central direction, how do such complex systems achieve orderliness and functionality? Section V turns to the heart of the matter: is democratic self-governance viable in our increasingly complex systems — or, more subtly, what form of self-governance seems the most viable? Section VI argues that effective self-governance is not a free-standing exercise of a general will, but must be embedded in the deontic principles of a liberal order.

II. COMPLEX SOCIAL SYSTEMS

A. Complexity and Rules

Complexity can be analyzed in different ways: what a physicist considers a complex system may be rather different than what an economist has in mind.[6] In social contexts, a critical

[3] See Mitchell Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Simon and Schuster 1992), chap. 4 ("You Guys Really Believe That?").

[4] I consider some of the reasons why this is so in "Social Complexity and Evolved Moral Principles." For an important and engaging analysis, see Nassim Nicholas Taleb, *Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets* (New York: Random House, 2005).

[5] This, of course, is the theme Hayek's unjustly disparaged *The Road to Serfdom*, edited by Bruce Caldwell (Chicago: University of Chicago Press, 2007).

[6] See Murray Gell-Mann, "What is Complexity?" *Complexity*, vol. 1 (1995): 16-19. In physics complexity

element of complexity is that the terms of interaction among agents is set by a network of laws, institutions, and norms. Each of these can be understood as specifying rules for individual behavior. Consider a simple case: a society in which all are interacting under a small set of rules — say simply those that characterize a simple exchange economy. We might suppose that a group of agents all guided by a small set of rules would produce a highly predictable system. Not so. Operating within the rules is a very large number of individuals with highly heterogenous preferences.[7] Each individual is seeking to satisfy her preferences within the rules, where this requires that she is constantly reacting to the choices of others about how to satisfy their preferences.[8] Such a system will be characterized by multiple levels of feedback loops:[9] Alf's decision becomes an input into Betty's, which is in turn an input into Charlie's, which becomes a new input into Alf's.[10] When this system contains strong positive as well as negative feedbacks, it easily abounds with multiple equilibria and its behavior quickly becomes mathematically incalculable.[11] As Donald Saari concludes:

> even the simple models from introductory courses in economics can exhibit dynamical behavior far more complex than anything found in classical physics or biology. In fact, all kinds of complicated dynamics (e.g., involving topological entropy, strange attractors, and even conditions yet to be found) already arise in elementary models that only describe how people exchange goods (a pure exchange

often focuses simply on the large number of elements; in social science the interconnectivity of the agents' behaviors is typically the main concern. Eric D Beinhocker calls this "interactive complexity." "Reflexivity, Complexity, and the Nature of Social Science," *Journal of Economic Methodology*, vol. 20 (2013): 330–342 at p. 332.

[7] Many economic models normalize these differences away, focusing on homogeneous "representative" agents. See John H. Miler, *A Crude Look at the Whole: The Science of Complex Systems in Business, Life, and Society* (New York: Basic Books, 2015), pp. 9ff, chap. 4.

[8] Such systems are thus reflexive. See Beinhocker, "Reflexivity, Complexity, and the Nature of Social Science," and section IV below.

[9] See Miler, *A Crude Look at the Whole*, chap. 3.

[10] "Complexity, in other words, asks how individual behaviors might react to the pattern they together create, and how that pattern would alter itself as a result." W. Brian Arthur, *Complexity and the Economy* (Oxford University Press, 2015), chap. 1.

[11] With positive feedback, that others are performing some action φ increases one's tendency to also do it; with negative, others' φ-ing decrease one's tendency to φ. In many economic models, it is assumed that the feedbacks are overwhelming negative (i.e. decreasing marginal utility/gains), thus leading the system into a unique equilibrium. See Eric D. Beinhocker, *The Origin of Wealth: Evolution, Complexity and the Radical Remaking of Economics* (Cambridge, MA: Harvard Business School Press, 2006), chap. 2. Once positive feedback becomes strong, multiple equilibria abound. See W. Brian Arthur, *Increasing Returns and Path Dependence in the Economy* (Ann Arbor, MI: University of Michigan Press, 1994). See also John H. Holland, *Complexity* (Oxford: Oxford University Press, 2014); John H. Miller and Scott E. Page, *Complex Adaptive Systems* (Princeton: Princeton University Press, 2007).

> model). Instead of being an anomaly, the mathematical source of this complexity is so common to the social sciences that I suspect it highlights a general problem plaguing these areas.[12]

The hidden complexity of social science derives from aggregation out of the unlimited variety of preferences, "preferences that define a sufficiently large dimensional domain that, when aggregated, can generate all imaginable forms of pathological behavior."[13]

Because such systems have strong positive return dynamics, their behavior is path dependent: the state of the system at time *t*+1 critically depends on its state at *t*.[14] Without good knowledge of the overall state of the system at *t*, and an accurate model of the dynamics that leads to future states, accurate forecasting about its state at *t*+1 is impossible. Slight differences in the initial conditions of the elements — often beyond our ability to measure — can result in very different *t*+1 system states.[15] Even a model based on simple linear dynamics can give rise to a wide variety of possible future states;[16] with non-linear dynamics these problems are greatly aggravated.[17] The behavior of such systems is, within broad parameters, essentially unpredictable. As Hayek stressed, we can know that some sorts of outcomes are not possible, but a very wide range of possible system states — often novel and unexpected — can be generated.[18]

To get a bit closer to reality, now add a large number of other rules (moral, legal, institutional) which further affect agents' behaviors, and whose overall effects are interactive.

[12] Donald Saari, "Mathematical Complexity of Simple Economics," *Notices of the AMA*, vol. 42 (1995): 222-231, at p. 222. Strange attractors are related to chaos theory; see Peter Smith, *Explaining Chaos* (Cambridge: Cambridge University Press, 1998), pp. 142-46.

[13] Saari, "Mathematical Complexity of Simple Economics," p. 229.

[14] With positive return dynamics (a case of positive feedbacks), once a system takes a step toward favoring option 1 over option 2, it can go to fixation on option 1, though if a chance event had tilted it toward option 2, it could have gone to fixation on that. Arthur gives the example of the familiar analog twelve-hour "clockwise" clock: in the fifteenth century there were clocks that went anti-clockwise, including the twenty-four-hour clock in a Florence cathedral. The selection of the familiar clock was path dependent: once most people began using the familiar 12-hour clock, others had increased incentive to also adopt it. See Arthur, *Increasing Returns and Path Dependence in the Economy*, p. 2 (more generally chaps. 3, 8, 10); Beinhocker, "Reflexivity, Complexity, and the Nature of Social Science," p. 333; Miller, *A Crude Look at the Whole*, pp. 132, chap. 8.

[15] Smith, *Explaining Chaos*, p. 20.

[16] Beinhocker, "Reflexivity, Complexity, and the Nature of Social Science," p. 333. It is often the case that measuring these initial conditions sufficiently precisely is beyond our ken.

[17] See David Colander and Roland Kupers, *Complexity and the Art of Public Policy: Solving Society's Problems from the Bottom Up* (Princeton: Princeton University Press, 2014), pp. 117ff.

[18] See also Hayek, "The Pretense of Knowledge" in *The Market and Other Orders*, edited by Bruce Caldwell (Chicago: University of Chicago Press 2014): 362-72.

For example, a rule with strict prohibition of squatter rights in urban areas will have very different effects depending on the presence of other rules and norms about, say, zoning, care for the urban homeless, mental health facilities, family structures, freedom of movement, and so on. And, of course, a host of background conditions are relevant: demographic changes, real estate investment, unemployment and growth rates.[19] When a system is composed of many rules of this sort, which jointly determine their ultimate social realizations (as always, along with a highly diverse set of individuals preferences, values and personal normative commitments), any attempt to optimize along some metric (welfare, justice, etc.) confronts what is known as a "rugged optimization problem."[20] In these optimization problems, even assuming that we could with certainty know the overall value of each set of institutional arrangements ($\mathbf{R}_i$), the overall value of a set of social institutions (rules, norms, etc.) $\mathbf{R}_1$ may be radically different than the overall value of an almost identical set, $\mathbf{R}_2$. Getting even a slight detail wrong can land a reformer in the dire $\mathbf{R}_{11}$ rather than the attractive $\mathbf{R}_{10}$ as in Figure 1:

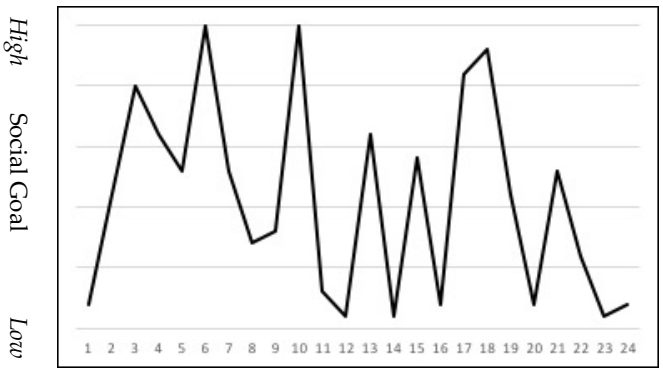


FIGURE 1 CHAOTIC SOCIAL CHANGE

Figure 1 illustrates a set of institutional schemes arrayed in terms of institutional similarity (x-axis)[21] and the value of the emergent social state (y-axis) in terms of some social goal —

[19] This is not a philosophical conjecture. In her extensive fieldwork on actual institutions Elinor Ostrom stressed that institutions are composed of numerous rule configurations; 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." "An Agenda for the Study of Institutions" in *Choice, Rules and Collective Action*, edited by Fillippo Sabetti and Paul Dragos Aligica (Essex, UK: ECPR Press, 2014): 97-119 at p. 111.

[20] For accessible discussions see my *Tyranny of the Ideal: Justice in a Diverse Society* (Princeton: Princeton University Press, 2016), chap. 2.; Beinhocker, *The Origin of Wealth*, pp. 202-13.

[21] On such similarity measures, see my *Tyranny of the Ideal*, pp. 51-61, 251-59.

overall welfare, justice, etc. In this case the laws, institutions and norms are so tightly interconnected that a change in any rule, etc. produces changes in the outputs of every other. This system is chaotic: there is no correlation between the value of one social state and the next.[22] In such chaotic worlds there are no gradients to climb: if a change from scheme 9 to 10 was, say, welfare enhancing, a move from 10 to 11 can make us worse off than we started out. Only if a controller had perfect knowledge of the value of each institutional scheme, and perfect ability to bring about precisely the changes that would hit a specific institutional set up (with no variance or "near misses," landing on scheme 20 when we aimed for 19) is intelligent control possible.[23] In lieu of that, changes are essentially random moves around the possibility space, there is no room for expert control.

It may help to turn from macro to micro analysis. A traditional multivariate regression analysis focuses on a many-to-one casual relation as in Figure 2.

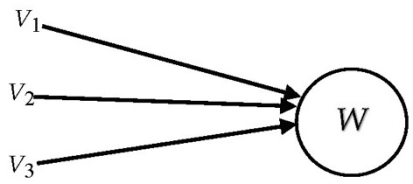


FIGURE 2: A MANY-TO-ONE CAUSAL RELATION

Here W is the dependent variable we seek to manipulate, and variables V_1 to V_3 are the variables that determine it; if we are able to manipulate them, control of W is possible. Of course even within a complex system such relations may, at least approximately, obtain. Yet typically even in relatively simple cases we should expect feedback and unanticipated variables as in Figure 3.

[22] Cf. Stuart Kauffman's analysis of "complexity catastrophe." *The Origins of Order* (New York: Oxford University Press, 1993), pp. 52-4.

[23] See *Tyranny of the Ideal*, pp. 67-72.

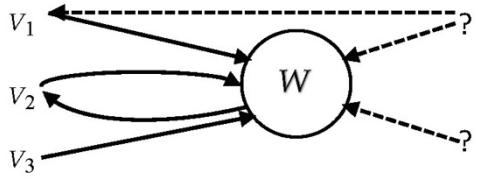


FIGURE 3: A MANY-TO-ONE CAUSAL RELATION WITH FEEDBACKS AND UNKNOWN INFLUENCES

Prediction becomes surprisingly difficult as soon as feedbacks enter in. But still, it might be thought, if what we really care about is only manipulating *W*, so long as there are not too many layers of feedback and we have identified many of the relevant variables, we can have a reasonable chance at successful policy interventions aiming to manipulate *W*'s value. If we are single-minded in our concern (§V.C) — say, we care only about how minimum wage laws affect employment — something akin to the relations in Figure 3 might well give us sufficient causal leverage.[24] But unless we are very limited in our concerns, we would like to predict and perhaps control other aspects of the social order as well. However, we are then apt to be confronted with many cases more akin to Figure 4:

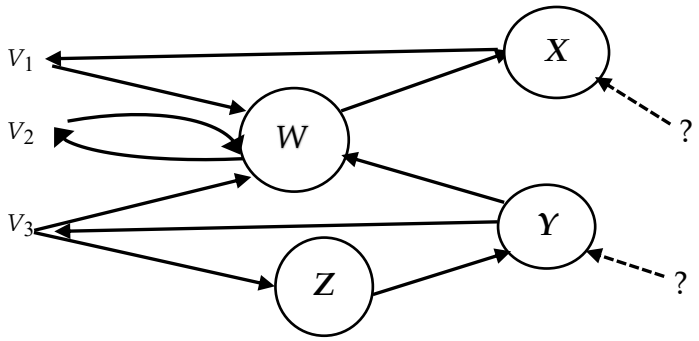


FIGURE 4: A MANY-TO-MANY CAUSAL RELATION WITH FEEDBACKS

[24] This is a typical sort of case that more skeptical readers may have in mind. It is worth noting that, as the current analysis would predict, it is surprisingly uncertain what the employment effects of minimum wage laws are. They tend to be negative, but the magnitude of effects is very difficult to predict, and sometimes employment is not affected at all, or even positively. For a review of a number of studies see my "Is the Public Incompetent?"

The problem is now becoming clearer: as we seek to influence a number of variables — *W, X, Y* and *Z*, even if we do secure some initial leverage on *W*, we find that it affects, and is affected by, a host of other variables that we are also interested in manipulating. Thus, as Hayek suggested, one intervention produces effects that may (or may not) give us some of what we aimed for, but which produces unexpected changes that require a policy intervention, which in turn produces effects that further require amelioration.[25] As we proceed our initial manipulation of *W* is apt to be undone.

B. Emergence

Complex systems give rise macro, emergent, properties, which are not reducible to analysis of the constituent micro-elements apart from their interaction in the system.[26] This, perhaps, is the core idea of complexity analysis: a reductionist program of seeking to understand the micro parts in isolation cannot explain the global patterns of their large-scale interactions.[27] There is nothing spooky about such properties. In social systems emergent properties are best understood as a global behavior or pattern that arises from the self-organized interaction of the constituent agents — a pattern that "is rather alien to its origins."[28] Simplistically but still

[25] See note 5.

[26] See Sunny Y. Auyang, *Foundations of Complex-systems Theories in Economics, Evolutionary Biology and Statistical Physics* (Cambridge: Cambridge University Press, 1998), pp. 173-183. One accessible formulation was proposed by John Stuart Mill. Supposing a system *S* composed of elements (e.g., rules) $\{\mathbf{R}_1 \ldots \mathbf{R}_N\}$ and an overall resulting order *O*, Mill suggests that *O* is an emergent property if: (1) *O* is not the sum of $\{\mathbf{R}_1 \ldots \mathbf{R}_N\}$; (2) *O* is of an entirely different character than $\{\mathbf{R}_1 \ldots \mathbf{R}_N\}$; (3) *O* cannot not be predicted or deduced from the behavior of the members of $\{\mathbf{R}_1 \ldots \mathbf{R}_N\}$ considered independently (i.e., apart from their interactions in *S*). *A System of Logic* in *The Collected Works of John Stuart Mill*, vol. 7, edited by J.M. Robson (Indianapolis: Liberty Fund, 2006), pp. 370-3; 438-40.

[27] Miller, *A Crude Look at the Whole*, chap. 2.

[28] Ibid., p. 6. See also pp. 133-5. Miller points to Adam Smith's invisible hand as a very early example (pp. 5, 231), but this is debatable. As Smith presents the argument, the claim is that the aggregation of individual value maximization leads to the maximum possible sum of value, which is the "annual revenue of society." *The Wealth of Nations*, edited by Edwin Cannan (Chicago: University of Chicago Press, 1976), p. 477. It is not clear how "alien" this aggregation claim is from its origins. If, however, one understands this as a primitive general equilibrium theory, then it seems right to see the invisible hand as giving rise to an emergent property. On Miller's claim that Smith's "invisible hand" posits an almost miraculous process (*A Crude Look at the Whole*, p. 231), see my "Public and Private Interests in Liberal Political Economy, Old and New" in *Public and Private in Social Life*, edited by S.I. Benn and G.F. Gaus (New York: St. Martin's Press, 1983): 183-222 at pp. 189-92.

usefully, we can say that the whole is more than the sum of its parts.[29] One of the features of such global properties is that they can be realized by a variety of underlying rules and agents — different agents and systems of rules can all give rise to a pattern of interaction that we associate, say, with democracy.[30] On the other hand, an identical rule system states can give rise give rise to very different global patterns.[31]

Hayek's analysis is especially helpful here. On his view, rule-based large-scale human interactions produce an "order of actions" — a pattern of cooperation or conflict that emerges from the underlying moral and social rules and the way heterogeneous agents act under them.[32] When we ask whether a society is cooperative or conflictual, just or oppressive, productive or dysfunctional, we are asking about the character of its order of actions, about the global pattern of behavior that emerges from diverse agents operating under its social norms, laws, culture and so on. The critical point of complexity analysis is that this order of actions is not the aggregation of the resultant individual consequences of many laws and rules, where the interconnected effects of a large set of rules (and the diverse agents acting under them) produce an ongoing global pattern of social life. That pattern of social life is the ultimate concern of most social philosophy and social reform. When we inquire as to what will make our society more cooperative, less conflictual, more just, more tolerant, more conducive to human welfare, more productive, or ecologically sustainable, we are focusing on the global, emergent, property of the order of actions.

C. Understanding Complex Systems

There is little doubt that our social systems are complex in these ways — they thus produce "perpetual novelty."[33] As I have said, when we intuitively think about the world using our folk concepts of causation, and as we recall what we remember as past cases as successful

[29] Holland, *Complexity*, p. 54. "The overall order of actions in a group is … more than the totality of regularities observable in the actions of the individuals and cannot be wholly reduced to them." Hayek, "Notes on the Evolution of the Rules of Conduct: The Interplay between the Rules of Individual Conduct and the Social Order of Action," in his *The Market and Other Orders,* pp. 278-92 at p. 282

[30] Miller, *A Crude Look at the Whole*, p. 138.

[31] "The same set of rules of individual conduct may in some circumstances bring about a certain order of actions but not do so in different external circumstances." Hayek, "Notes on the Evolution of the Rules of Conduct," p. 280.

[32] Ibid, pp.. 278-92. See also Eric Mack, "Hayek on Justice and the Order of Actions" in Edward Feser, *The Cambridge Companion to Hayek* (Cambridge: Cambridge University Press, 2006), pp. 259-86.

[33] John Holland, *Complexity,* p. 10.

control, many refuse to accept this.[34] Here — as in evolutionary theory and much physics — commonsense and analytic reasoning part ways.[35] However, at this last thought makes clear, like evolutionary theory, complexity analysis does not advocate a generalized skepticism, but seeks to model and understand the workings of complex systems. Important agent-based complexity models, for example, abstracting from many of the details of a specific system, generate probability distributions that the system will end up in different parts of the possible system space.[36] Models may also help identify tipping or "lever" points, i.e., system states in which a small change can produce large predictable changes.[37] At least in some biological systems, we can model what is required to reverse engineer an emergent property.[38]

That we can develop a science of complex systems — such as economics — is constantly stressed by Hayek.[39] Our question concerns the type of predictions such a science might yield about the future of our current society. In order to accurately predict the range of possible outcomes, the modeler needs to define the possible state space of society (the set of possible outcomes), the rules of interactions, and the value functions of the individuals modeled (the bases of choices).[40] Even allowing that these models will become considerably more sophisticated in the future, because these variables are maddeningly difficult to measure and, indeed, are always in flux, it seems well-nigh impossible to identify the parameters for an accurate model of the probability distributions of overall social outcomes of our current social order. And, of course, we must always remember that in complex systems, getting the

[34] See Nassim Nicholas Taleb, *The Black Swan* (New York: Random House, 2007), pp. 68ff.

[35] It was recently remarked to me that social scientific reasoning is essentially a confirmation of commonsense. When successful, it is usually just the opposite: it shows that intelligent common sense misunderstands the social world. That is why Adam Smith's "invisible hand" in some ways invented social science: the commonsense conviction that orderly social outcomes must be produced by a directing intelligence (which was Mercantilist common sense) is fundamentally erroneous. And, of course, Darwin provides a similar rebuke to common sense.

[36] See Miler, *A Crude Look at the Whole*.

[37] Holland, *Complexity*, chap. 3. See also Miller, *A Crude look at the Whole*, chap. 11.

[38] Sara Green, "Can Biological Complexity be Reverse Engineered?," *Studies in History and Philosophy of Biological and Biomedical Sciences,* vol. 53 (2015): 73-83.

[39] Hayek's Nobel laureate address, "The Pretense of Knowledge" (in his *The Market and Other Orders*, pp. 362-72) is about economist's pretense to specific types of knowledge, not that there can exist scientific economic knowledge. For a recent analysis economics as a complex science, see Robert Axtell et al. "Challenges of Integrating Complexity and Evolution in Economics" in *Complexity and Evolution: Toward a New Synthesis for Economics*, edited by David S. Wilson and Alan Kirman (Cambridge, MA: MIT Press, 2016), pp. 65-84.

[40] Miller, *A Crude Look at the Whole,* pp. 217ff.

parameters a little wrong can often lead to very different predicted outcomes (think again of Figure 1). Hayek's view remains sound: a science of social complexity can predict, for social state *S*, "a pattern of a certain class" — say, marked disequilibrium or high conflict — not a "prediction of the appearance of a particular instance of this class."[41]

III. TWO HOPES FOR SUCCESSFUL SOCIAL GUIDANCE

Given that our social system is highly complex in these ways, and that prediction and guidance of a highly complex system seems a most dubious enterprise, under what conditions might we nevertheless hope to successfully guide the emergent order of actions along a preferred path?

A. The First Hope: Decomposability

The most viable route is to reduce the complexity of the system, and the most plausible hypothesis about how this can occur maintains that complex systems are often decomposable.[42] Suppose we have a set of rules, institutions, etc. $\{\mathbf{R}_1 \ldots \mathbf{R}_{25}\}$ with subsets $\{\mathbf{R}_1 \ldots \mathbf{R}_{10}\}$, $\{\mathbf{R}_{11} \ldots \mathbf{R}_{15}\}$, $\{\mathbf{R}_{16} \ldots \mathbf{R}_{25}\}$, where the rules within each subset are highly interconnected (in the ways analyzed in §II.A), but the connections between the subsets are modest. At a limit, each subset could be a module that could connect with the others such that regardless of the changes that occurred within in it, it could be "plugged into" the others without inducing any change in them.[43] In this case we could optimize within each subset and then assemble the results, maintaining the optimization within each set. Herbert Simon has powerfully argued that evolving complex systems must be decomposable in this way.[44] If a change in one element produced changes in all the others, a species could not climb an evolutionary gradient, becoming increasingly fit. If, say, every change in the organism's

[41] Hayek, "The Theory of Complex Phenomena" in his *Market and Other Orders*, pp. 257-77, at pp. 259-60.

[42] See Fred D'Agostino, "From the Organization to the Division of Cognitive Labor," *Politics, Philosophy & Economics*, vol. 8 (2009): 101–129. Much of what I say in §III.A follows D'Agostino's excellent analysis.

[43] In this respect recall Rawls's claim that a public conception of justice is a module that fits into multiple comprehensive conceptions. *Political Liberalism,* expanded edn. (New York: Columbia University Press, 2005), p. 12. Interestingly, Rawls is claiming that people's normative systems are decomposable. It is not clear why they should be.

[44] Herbert A. Simon, *The Sciences of the Artificial*, third edn. (Cambridge: MIT Press, 1996), pp. 183-216.

ability to run faster affected all its other traits, the organism would be in a state of constant instability. Decomposability, then, makes the system less complex (less tightly interconnected).

Some have taken the necessity of decomposability for evolution to show that, after all, intelligent attempts to guide complex systems along desired paths are feasible.[45] We can manipulate one part of the system without altering the rest, so if we focus on one decomposable subsystem at a time, real guidance can be achieved. Now certainly we shall sometimes fund relatively independent subsystems and, when we do, the probability of success of our intervention will be enhanced. Nevertheless, for at least two reasons we must not infer that we possess the ability to direct social change from the necessity of decomposability in evolved systems.

First, each subset might itself highly complex. In this case, although a change in $\{\mathbf{R}_1 \ldots \mathbf{R}_{10}\}$ may have minor impact on the rest of the system, a change in any rule within the subset produces changes in the output of many of the subset's other rules, again producing highly complex outcomes. Natural selection can often cope with such "high dimensional" selection.[46] If a species has a large number of offspring, a wide range of possible genetic combinations (in our case, $\{\mathbf{R}_1 \ldots \mathbf{R}_{10}\}$ variations) can compete, and the most adaptive complex combinations selected. So we can understand how biological evolution can function with decomposability conjoined with highly complex subsystems. However, in social "experimentation" this problem is almost always intractable (see §§II.B, V.B). Ethically, we cannot simply randomly experiment with types of social arrangements to see which work (and which die out); practically, insofar as these are large-scale arrangements, there simply are not sufficient number of variants to cope with the problem of such high complexity partitions. We can only try out a modest number of the possibilities to determine which are adaptive. Only if the subsystems themselves are relatively non-complex does it seems that decomposability be much of a help here.

[45] Allen Buchanan and Russell Powell, *The Evolution of Moral Progress* (Oxford: Oxford University Press, 2018), pp. 263ff.

[46] It is high dimensional since the trait being selected in an emergent property of many interacting genes. We are learning that few traits are controlled by a single gene. See Sergey Gavrilets, "High-Dimensional Fitness Landscapes and Speciation" in *Evolution—the Extended Synthesis*, edited by Massimo Pigliucci and Gerd B. Müller (Cambridge, MA: MIT Press, 2010): 45-80.

Secondly, there is good reason to think that as human-constructed functional systems evolve they become more complex and less decomposable. Consider Brian Arthur's study of the evolution of the jet engine.[47] The original jet engine had one moving part; current engines have over 22,000 moving parts. What started as a remarkably simple system is now a highly complex one. Moreover, jet engine technology is now intimately linked to a number of other systems — e.g., those producing alloys, computer systems, the FAA. Jet engine technology has thus become more complex and less decomposable. Because of this, as Schumpeter stressed, advanced economies are subject to the "gales" of creative destruction: entire areas of the economy may ultimately be wiped out when there is a major technological change (say, from horse drawn carriages to automobiles).[48] And in many ways technology is a better model of the evolution of institutional complexity than natural selection: simple technologies are assembled and combined to solve problems, modified with an eye to increasing functionality and solving new problems, producing ever-greater complexity. Of course, compared to human society a jet engine is astoundingly simple: experts (though perhaps now only in highly-trained teams) continue to know how it works. But like technology, we have constantly rendered our institutions more complex, and more intimately tied to the rest of our social system. As Miller observes, for example, "[w]e have unknowingly created a complex adaptive financial system that we do not understand and cannot control. At each stage of its creation, we have accrued additional complexity in the name of added benefits…."[49]

B. The Second Hope: Experiments in Complex Living

From Mill, Dewey, and Popper, to important and innovative contemporary political philosophers, great hope has been placed on discovering better societies through social "experimentation."[50] Often this is simply a name for exploring new ways of living together,

[47] Arthur, *Complexity in the Economy*, chap. 9. See also Kevin N. Laland, *Darwin's Unfinished Symphony: How Culture Made the Human Mind* (Princeton University Press, 2017), pp. 10-11.

[48] Joseph A. Schumpeter, *Capitalism, Socialism and Democracy*, third edn. (London: Allen and Unwin, 1950), pp. 81-87; Arthur, *Complexity in the Economy,* p. 141.

[49] Miller, *A Crude Look at the Whole*, p. 62. Cf. Neil Johnson, *Simply Complexity* (London: Oneworld, 2007), chap. 6

[50] Mill, *On Liberty* in *The Collected Works of John Stuart Mill*, vol. 18, edited by J.M. Robson (Toronto University of Toronto Press, 1965), pp. 213-310; John Dewey, *The Public and its Problems* (Chicago: Swallow Press, 1954), esp. chap. VI; Karl Popper, *The Open Society and its Enemies*, vol. 1: Plato (London: Routledge, and Kegan Paul, 1945), pp. 162ff. For recent proposals, see Ryan Muldoon, *Social Contract Theory for a Diverse*

but we should not confuse innovation, or being open to learning, with experimentation. The thought behind social experiments or "experiments in living" is that, while we cannot predict whether social policies will improve the order of actions (making it more just, say) experiments can be conducted that help us learn the consequences of various rule sets and institutions, and so obtain information that can be guide other situations or societies. The key to experimentation is that the lessons learned in experiments are in some way replicable — they provide data that can show what works in other places. In place of strong predictive knowledge based on models or theories, we might take a more inductive, experimental, approach.

I have argued elsewhere that such informal experiments are unlikely to give us much useful information about workable social arrangements,[51] but let us assume that the experiments could meet the strongest contemporary standard for studying interventions — Randomized Controlled Trials. In some ways it seems that Randomized Control Trials (RCT) are ideally suited to studying the combinatorial effects underlying complexity.

> An RCT is a study design based on John Stuart Mill's method of difference for making causal inferences …. Mill's method-of-difference supposes, as we do here, that effects are produced in accord with causal principles. The causal principles for a given kind of situation or population, *S*, say what the causes of a given effect in *S* are, what each contributes, and how they combine. A method-of-difference study then aims to compare individual units that are the same with respect to all causal factors relevant to the given effect except the one in question, by which they differ. If individuals that are otherwise the same differ in values for the effect, then the factor by which they differ must be among the genuine causes of the effect under the principles governing *S*.[52]

The great problem, though, is identifying all the relevant causal factors: if we have not identified the full set of relevant factors, our confidence that we know the causal network is undermined. And it is precisely this plethora of relevant (and indeed changing)[53] causal factors that confounds study of complex social systems. Using a Randomized Control Trial in one situation, against the background of a specific complex system at a specific time, is apt to tell one little about future interventions against a different state of the system. If many

World (New York: Routledge, 2016), chap. 2; Julian Müller, *Capitalizing on Political Disagreement* (New York: Routledge, 2019), Part II.

[51] *The Tyranny of the Ideal,* pp. 89-93.

[52] Nancy Cartwright and Jeremy Hardie, *Evidence-Based Policy* (Oxford: Oxford University Press, 2012), p. 33..

[53] Beinhocker, "Reflexivity, Complexity, and the Nature of Social Science," pp. 335-36.

parts of the system affect the outcome, and the input of the system at time $t+1$ includes people's reactions to its state at t_1, it will be fiendishly hard to have any confidence that one has accounted for the causal influences during one's controlled trial.[54] "Like us," Cartwright and Hardie observe, "you want evidence that a policy will work here, where you are. Randomized controlled trials do not tell you that. They do not even tell you that a policy works. What they tell you is that a policy worked there, where the trial was carried out, in that population."[55]

IV ADAPTIVE COMPLEXITY

A. Why Not the State of Nature?

The sort of social systems we have been analyzing — where agents respond to each other's actions, and adapt their actions in response to each other's previous adaptations — are known as complex (and reflexive) adaptive systems.[56] In an important essay D. S. Wilson presses the question: what renders these complex interactions *adaptive* as opposed to simply complex but dysfunctional?[57] (We can be loose here as to what we mean by "dysfunctional": great conflict, low levels of cooperation, mass emigration, are all familiar indicators.) We cannot simply assume that complex systems are able to maintain their functionality. Indeed, if we compare a complex system — with its pervasive positive feedbacks and path dependencies — to the world of neoclassical economics — with its strong negative feedbacks leading to unique equilibrium — it may seem a marvel that it gives rise to any order at all.

In the history of political theory it has often been thought, following Hobbes, that functional social order is constructed through the politico-legal system. Unlike say, Locke or Rawls, Hobbes does not simply analyze the basis of a just political order among those who

[54] See Gillian Trent, "Weird Things are Happening to the Market," *Financial Times*, April 5, 2019. This is one of the reasons why big data is no panacea. If the parameters change, regularities that were once law-like can suddenly cease to hold. Cf. Liran Einav and Jonathan Levin, "Economics in the Age of Big Data," *Science*, vol. 346 (6210, November 2014).

[55] Cartwright and Hardie, *Evidence-Based Policy*, p. ix.

[56] On the relation between complex adaptive and complex reflexive systems, see Beinhocker, "Reflexivity, Complexity, and the Nature of Social Science," p. 334.

[57] D. S. Wilson, "Two Meanings of Complex Adaptive Systems," in *Complexity and Evolution: Toward a New Synthesis for Economics*, edited by David S. Wilson and Alan Kirman (Cambridge, MA: MIT Press, 2016): 31-46. Another way of making this point is to ask why there is organized, as opposed to disorganized, complexity. See Miller and Page, *Complex Adaptive Systems*, pp. 48-53.

disagree: *Leviathan* lays out the conditions for social order itself under conditions of deeply heterogeneous and conflicting ends.[58] Hobbes's social contract rationally constructs the path out of a barely social, self-interested, existence in which "there is no place for industry,…no culture of the earth,… no knowledge of the face of the earth, no account of time, no arts, no letters, *no society*…."[59] Hobbes is so appealing to the philosophical mind because reason has a starring role in the story. Although strategic rationality is a cause of our conflict in the state of nature, reason also points the way to society: it shows us that we can only attain a functional, cooperative, social order by renouncing unconstrained self-interested maximization and binding ourselves into a cooperative, rule-based, truly social order. Captivated by this idea, a long line of distinguished moral and political theorists, right up to the present, have developed sophisticated accounts of social life grounded on essentially self-interested, instrumental, rationality.[60]

Hayek famously argued that complex social orders cannot be consciously constructed or ordered purely through planning.[61] And, on this, I think, almost all complexity theorists would agree, for the reasons canvassed in section II. What we cannot guide we certainly cannot construct. But then Wilson's question becomes pressing: just how does an unplanned complex order maintain itself?

B. Macro-selection (CAS 1)

In what Wilson calls "CAS 1" systems, the complex system is subject to adaptive pressures at the system level. This is a form of multi-level selection — in the most familiar form, a type of "group selection."[62] On Wilson's view this is the most plausible basis for complex system-level adaptation: "[f]rom an evolutionary perspective…only when a society is a unit of

[58] See Talcott Parsons, *Social Action, Parsons, Social Action: A Study in Social Theory with Special Reference to a Group of Recent European Writers,* second edn. (Glenco, IL: Free Press, 1949), pp. 89-95.

[59] Hobbes, *Leviathan*, edited by Edwin Curley (Indianapolis: Hacket, 1994), p. 76 (chap. 13, ¶9). Emphasis added.

[60] See, e.g., James Buchanan, *The Limits of Liberty: Between Anarchy and Leviathan* (Chicago: University of Chicago Press, 1975); David Gauthier, *Morals by Agreement* (Oxford: Clarendon Press, 1986), esp. chap. 3; Peter Vanderschraaf, *Strategic Justice: Convention and Problems of Balancing Divergent Interests* (New York: Oxford University Press, 2019); Michael Moehler, *Minimal Morality: a Multilevel Social Contract Theory* (New York: Oxford University Press, 2018).

[61] Hayek, *Rules and Order* (Chicago: University of Chicago Press, 1973), chaps. 1-2.

[62] See Samir Okasha, *Evolution and Levels of Selection* (Oxford: Oxford University Press, 2006).

selection…. does it function well as a unit."[63] The critical claim is that a complex social order will maintain its cooperative functionality only if, at the societal level, forces are constantly selecting more over less functional variants of the rules $\{\mathbf{R}_1 \ldots \mathbf{R}_N\}$. Recall that the entire set of rules and social institutions $\{\mathbf{R}_1 \ldots \mathbf{R}_N\}$ generates what Hayek calls an "order of actions" — the emergent property of social order that arises in a rule-based society (§II.B). Hayek agrees with Wilson: "[t]he evolutionary selection of different rules of individual conduct operates through the viability of the order it will produce."[64] 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 order) and the underlying rules and institutions (that structure it), which are transmitted.[65]

Social evolution is often thought to be a form of cultural group selection. "The rules of conduct have … evolved because the groups who practiced them were more successful and displaced others."[66] 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 was more adaptive than O_2.[67] 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 the underlying rules R_1, thus inducing differential rates of reproduction between the two sets of underlying rules.[68] The overall order of actions is adaptive because systematic selection pressures favor rule sets that promote overall orders that are more adept at facilitating cooperation and securing its social benefits, satisfying the interests and commitments of its populating agents.

[63] Wilson, "Two Meanings of Complex Adaptive Systems," p. 44.

[64] Hayek, "Notes on the Evolution of Systems of Rules of Conduct," p. 280.

[65] There is an obvious analogy here to natural selection: selective pressures select a successful phenotype, with the underlying genotype being transmitted.

[66] F.A. Hayek, *Rules and Order*, p. 18.

[67] For formal modelling of this process see Samuel Bowles, and Herbert Gintis, *A Cooperative Species: Human Reciprocity and Its Evolution* (Princeton: Princeton University Press, 2011); Robert Boyd and Peter J. Richerson, *Culture and the Evolutionary Process* (Chicago: University of Chicago Press, 1983), chap. 6.

[68] Peter J. Richerson, and Robert Boyd, *Not by Genes Alone: How Culture Transformed Human Evolution* (Chicago: University of Chicago Press, 2005), chap. 3; Alex Mesoudi, *Cultural Evolution* (Chicago: University of Chicago Press, 2011), chaps. 3-5. The extent to which successful copying is possible depends on the complexity of the social systems and the luck the copier has in copying the set of rules of a decomposable subunit of the more adaptive society. As societies become more complex, the possibility for copying the right set of rules to induce the desired results would seem to radically decrease — witness the efforts over the last fifty years of development experts to transplant institutions from developed to developing countries.

I think it is plausible to hold, as many do, that such macro social selection pressures have been great during some epochs. It is certainly plausible to hold that in the Late Pleistocene era humans groups were subject to severe selection pressures, and those orders that were less intensely cooperative were eliminated.[69] A similar case can be made for eras of intense warfare.[70] It is, I would venture, considerably less plausible to think that most societies are subject to equally strong pressures of this sort today. To be sure, some societies do look severely dysfunctional and the expected mass emigration has occurred. But most social orders have become, as societies, sufficiently wealthy that they can withstand competition with other societies without great adjustments.[71] For the same reasons that group selection pressures were so strong in the Late Pleistocene era — harsh, quickly changing, climate, numerous socially distinct groups near the margin of viability — we would expect that our modern era, characterized by the absence of these features, would have greatly mitigated macro-selection pressures. Moreover, what Hayek called "the Great Society"[72] — an expansive trans-national network of rule-based cooperation — blurs the boundaries between groups on which macro competition depends. While some investigators see strong group (macro-) selection pressures continuing today,[73] this seems highly conjectural.

C. Individual-level Adjustment (CAS 2)

This leads us to the second type of complex adaptive system identified by Wilson (his "CAS 2" system): adaptation via adjustment by each actor to the previous and anticipated actions of others. This can be understood as a strongly self-organized system. "Self-organizing systems are a special subset of dynamical systems. The hallmark of self-organization is the emergence of order from the interactions among a typically large number of components

[69] See Bowles, and Herbert Gintis, *A Cooperative Species*, chap. 6; Richerson, and Robert Boyd, *Not by Genes Alone,* pp. 224-29; Peter J. Richerson, and Robert Boyd, "Rethinking Paleoanthropology: A World Queerer than We Supposed" in *Evolution of Mind*, edited by Gary Hatfield and Holly Pittman (Philadelphia: Pennsylvania Museum Conference Series, 2013): 263–302.

[70] Peter Turchin, *Ultrasociety* (Chaplin, CT: Beresta Books, 2016).

[71] Compare here Schumpeter's analysis of late capitalism, in which firms have grown sufficiently large to weather the gales of creative destruction, and so competition and innovation slow. *Capitalism Socialism and Democracy*, pp. 87ff.

[72] F. A. Hayek, *The Political Order of a Free People* (London: Routledge, 1979), p. 160.

[73] This is an implication of Wilson's view. "Two Meanings of Complex Adaptive Systems," pp. 42-46. Small-scale societies continue to be subjected to stronger macro-selection pressures. See Peter J. Richerson and Robert Boyd*, Not by Genes Alone,* pp. 206-9.

without any centralized control. … In cases of pure self-organization there is no real centralization of information or control, but the behavior of each affects that of the others in a manner that produces an overall appearance of deliberately coordinated activity."[74] The invisible hand is, of course, the most famous model of self-organization in the social sciences.[75] These systems seem truly *self*-organized: rather than being formed by the pressure of competition with other groups: each individual acts in a way to adjust her activity to that of others, producing a cooperative and functional order.

Wilson believes that such systems could only be functionally organized by chance because of what might be called his "evolutionary mindset:" at each level actors are seeking to maximize their individual fitness in competition with others, and so unless this competition is suppressed by a higher-level selection, there is no reason to think that group functional cooperation will emerge — it would be only a random event.[76] This, of course, is a very large issue indeed: any response to Wilson's challenge must ultimately involve a comprehensive account of a human cooperative social order. Nevertheless, I think we can get a sketch of the nature of a defense of CAS 2 adaptation by distinguishing three levels of responses, from that which shares most with Wilson's evolutionary mindset to the increasingly cultural. All, I believe, are part of the story, though the later layers are more critical.

1. Cooperation Among Egoists

A standard problem for the evolutionary theorist has been to explain how cooperative sentiments and morality can arise in the ruthless evolutionary "state of nature,"[77] in which

[74] J.T. Ismael, *How Physics Makes Us Free* (Oxford: Oxford University Press, 2016), p. 19. See also her "Self-Organization and Self-Governance," *Philosophy of the Social Sciences*, vol. 41 (2011): 327-51.

[75] Not surprisingly, macro-evolution theorists tend to be dismissive of the idea of the invisible hand unless it occurs in the context of a system with fairly strong selection at the group level. See Wilson, "Two Meanings of Complex Adaptive Systems," p. 44; John Gowdy, Mariana Mazzucato, Jeroen C. J. M. van den Bergh, Sander E. van der Leeuw, and David S. Wilson, "Shaping the Evolution of Complex Societies" in *Complexity and Evolution* edited by David S. Wilson and Alan Kirman (Cambridge, MA: MIT Press, 2016): 327-50 at p. 331. However models that understand evolution in terms of learning rules that lead agents to adopt more advantageous cooperative strategies and norms ("CAS 2" systems) seem well described as "the invisible hand of evolution." See J. McKenzie Alexander, *The Structural Evolution of Morality* (Cambridge: Cambridge University Press, 2007), p. 18.

[76] Wilson, "Two Meanings of Complex Adaptive Systems," p. 40.

[77] Darwin, *The Origin of Species, in The Origin of Species and the Descent of Man* (New York: Modern Library, 1936), p. 54.

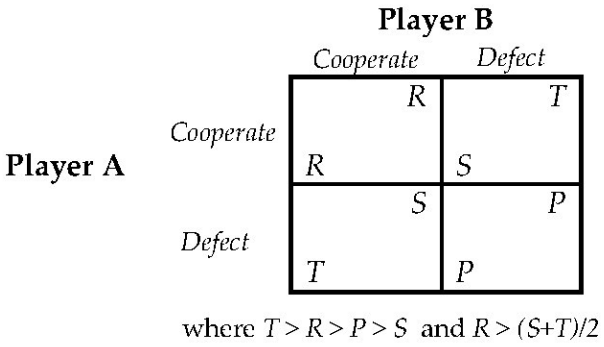
each organism is in a never-ending struggle with other members of its own species (as well as others) to insure the survival of itself and its descendants. At the heart of Darwinian natural selection is the Malthusian doctrine of a "struggle for existence" produced by population growth outstripping the environment's carrying capacity.[78] "In looking at Nature, it is most necessary to keep the foregoing considerations always in mind—never to forget that every single organic being around us may be said to be striving to the utmost to increase in numbers; that each lives by a struggle at some period of its life; that heavy destruction inevitably falls either on the young or old, during each generation or at recurrent intervals."[79] The horror of Hobbes's state of nature pales in comparison to never-ending destruction of the less fit in Darwin's. Without strong macro-selection pressures, how could such a thoroughly nasty, ceaseless competition, produce anything but Machiavellian cooperators, feigning commitment to the social contract and social cooperation while, like Hobbesian agents, always keeping an eye out for opportunistic cheating?[80]

It is commonplace to suppose that, in many of their interactions such egoistic agents would be playing Prisoner's Dilemmas (PDs), as in Figure 5:

[78] The title of Chap. 3 of T*he Origin of Species*. See Malthus, *An Essay on the Principle of Population* (London: Printed for J. Johnson, in St. Paul's Church-Yard, 1798), p. 14.

[79] Darwin, *The Origin of Species,* p. 55

[80] This Hobbesian view of the evolutionary state of nature is reinforced by the characterization of our nearest relatives, chimpanzees and bonobos, as "Machiavellian" cooperators. As Tomasello concludes, "chimpanzees and bonobos are built for competition. Thus, not only are they intentional, decision-making agents, who make instrumentally rational decisions themselves, but they also perceive others as intentional, decision-making agents with whom they must compete." Indeed, "chimpanzees and bonobos live their lives embedded in constant competition for resources, so they are constantly attempting to outcompete others by outfighting them, outsmarting them, or outfriending them." Michael Tomasello, *A Natural History of Human Morality* (Cambridge: Harvard University Press, 2016), pp. 21, 26. See also Richard W. Byrne and Andrew Whiten, "Machiavellian Intelligence" in *Machiavellian Intelligence II: Extensions and Evaluations*, second edn. edited by Richard W. Byrne and Andrew Whiten (Cambridge University Press, 1997), pp. 1-23.



5:FIGURE 5 AXELROD'S PD

This is a relentlessly competitive game, in which the best outcome of each is to take advantage (*T*) of the other, who ends up a sucker (*S*): in a one-play game the only outcome in equilibrium is "Defect/Defect." However, as Robert Axelrod, famously demonstrated, in repeated interactions — where players confront each other an indeterminate number of times — cooperation can arise and be sustained via a tit-for-tat strategy, according to which Player A first cooperates, and from then on responds on the next move with whatever play (defect or cooperate) that player B made on the previous move.[81] Later Ken Binmore stressed the abundance of possible cooperative equilibrium strategies in iterated PDs — indeed, any contract to which rational players might agree to extricate themselves from the "Defect/Defect" outcome is a possible equilibrium strategy in an indefinitely repeated PD.[82] Binmore, Trivers and others have held that such "direct reciprocity" or "reciprocal altruism" is the key to the evolution of human cooperation.[83]

[81] Robert Axelrod, "The Emergence of Cooperation Among Egoists," *The American Political Science Review*, vol. 75 (1981): 306-18. It is worth noting the striking convergence of evolutionary and rational actor analyses of the evolution of cooperation via iterated Prisoner's Dilemmas.

[82] Ken Binmore *Natural Justice* (Oxford: Oxford University Press, 2005), pp. 79-82.

[83] Ibid., chap. 5; Robert L. Trivers, "Evolution of Reciprocal Altruism," *The Quarterly Review of Biology*, vol. 46 (March 1971): 35-57; Leda Cosmides and John Tooby. "Cognitive Adaptations for Social Exchange" in *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, edited by Jerome H. Barkow, Leda Cosmides and John Tooby (New York: Oxford University Press, 1992), pp. 163-228, at pp. 170-9.

To be sure, this work does not get us to complex systems, only to the conclusion that even if we accept a strongly egoistic starting point it is still plausible, *pace* Hobbes (§IV.A), to explain the evolution of self-organized cooperation. In later work Axelrod sought to show how similar starting points can give rise to agent-based complex systems.[84] Still, it does seem that this approach has not been entirely successful:[85] modeling the evolution of cooperation on the basis of, say, dyadic play in iterated Prisoner's Dilemmas turns out to have rather demanding informational requirements about the previous move of all of one's partners if opportunistic cheating is to be curtailed.[86] The point to note in this context, however, is not so much the limits to this approach, but its striking power given its relentlessly egoistic starting point.

2. Strong Reciprocity

As noted above (§IV.B), it seems that during the last Pleistocene era there were indeed intense group-level selection pressures that likely forged us into a more cooperative species.[87] On this view humans are now, to significant extent, strong reciprocators: we tend to respond to cooperation with cooperation and tend to inflict punishment on those who cheat on cooperative rules.[88] At this point in our evolutionary history, the assumption of ruthless self-interestedness is no longer sensible. While, of course, we are sometimes selfish (and a few of us are almost always selfish), most are often willing to cooperate when others cooperate. This is critical: it is at the heart of Adam Smith's analysis of the market, and ultimately his account of the invisible hand. For Smith it is the tendency to *exchange* that is at the core of markets

[84] Robert Axelrod, *The Complexity of Cooperation: Agent-based Models of Competition and Collaboration* (Princeton: Princeton University Press, 1997). See also Miller and Page, *Complex Adaptive Systems*, chap. 10.

[85] To be effective it requires an extended series of dyadic interactions in which comparable benefits at comparable costs are exchanged. In Christopher Boehm's judgment, this so severely limits its application that "reciprocal altruism must be largely set aside" as an explanation of group cooperation. *Moral Origins: The Evolution of Virtue, Altruism and Shame* (New York: Basic Books, 2012), p. 73.

[86] For review of problems see my *Order of Public Reason* (Cambridge: Cambridge University Press, 2011), pp. 87-96. Tomasello, while accepting these worries about direct reciprocity, develops a mutualistic model that has some affinities; see *A Natural History of Human Morality,* pp. 13ff. In "mutualism" benefits are exchanged at the same time, and so it is not open to defection worries. While surely this is a source of cooperation, it seems of limited applicability. But cf. Kim Sterelny, "Cooperation, Culture, and Conflict," *British Journal of the Philosophy of Science,* vol. 67 (2016), 31–58, at pp. 43-6.

[87] See Samuel Bowles, and Herbert Gintis, *A Cooperative Species.*

[88] See *Moral Sentiments and Material Interests: The Foundation of Cooperation in Economics Life*, edited by Herbert Gintis, Samuel Boyd and Ernst Fehr (Cambridge, MA: MIT Press, 2005), chaps. 5-8. See also my *Order of Public Reason*, pp. 101-22.

and the division of labor.[89] Smith is often mistakenly read as if he thinks economic agents are egoistic,[90] but he stresses that it is our tendency to pursue our interests through exchange, not our tendency to maximize self-interest, that drives economic life and encourages the growth of extensive markets. Smith is explicit that individuals, specializing through the division of labor, need each other's cooperation,[91] and so in trading are playing a cooperative game. As Brian Skyrms and his students have emphasized, such reciprocal cooperators tend not to play Prisoner's Dilemmas but more often Stag Hunts, as in Figure 6.[92]

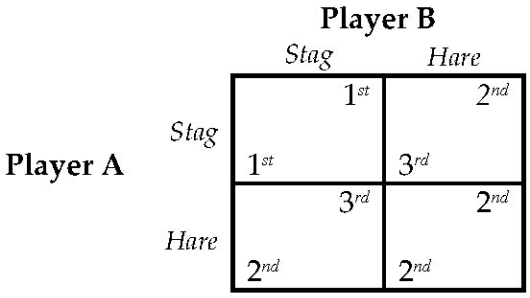


FIGURE 6 A STAG HUNT

In this game both player's first choice is to hunt stag together: mutual cooperation can bring higher gains than solo hunting of hare, but it takes two to successfully hunt the stag (a division of labor is required). But to do one's part in the stag hunting effort when the other does not is the worst option: one wasted one's effort on an unsuccessful attempt to cooperate. Thus there are two equilibria in this game: the "payoff dominant" Stag/Stag and the "risk dominant" Hare/Hare. The problem here is not the each is tempted to defect, but that each needs to trust the other to do their part if both are to secure the payoff dominant equilibrium.

[89] Smith, *Wealth of Nations*, p. 17.

[90] The famous passage that misleads so many occurs in Chapter II of *The Wealth of Nations*, p. 18: "It is not from the benevolence of the butcher, brewer, or the baker, that we expect our dinner, but from regard to their own interest." But that cooperation does not rely on benevolence, and instead draws on self-interest, does not imply that it relies on egoism. The core idea of reciprocity is clear in the sentence immediately preceding: "Give me that which I want, and you shall have that which you want…." That is not something that players in a one-play Prisoner's Dilemma can say.

[91] Smith, *Wealth of Nations*, p. 18.

[92] Brian Skyrms, *The Stag Hunt and the Evolution of Social Structure* (Cambridge: Cambridge University Press, 2004); Alexander, *The Structural Evolution of Morality*, pp. 102ff, 238ff.; Justin Bruner, "Diversity, Tolerance, and the Social Contract," *Politics, Philosophy & Economics* vol. 14 (2015): 429–448.

The rational play in this game is by no means trivial: it is all-too-easy for a population to spend most of its time hunting hare.[93] It is critical that individuals successfully signal their trustworthiness to each other.[94] But, as Smith was the first to stress, among strong reciprocators the evolution of extensive cooperation through the division of labor is not at all mysterious. Once cooperation is established it tends to stably proceed and expand, and benefits all. Each individual is constantly adapting to the ongoing division of labor, and the mutually beneficial exchanges on offer.

Of course in any social systems — certainly including markets — people sometimes find themselves with opportunities to cheat. One can get the benefits without paying the costs. But not only do only do strongly reciprocal cooperators confront these situations less regularly (since they seek out cooperative interactions in which they are willing to do their part), but because strong reciprocators tend to punish those who do defect on cooperative arrangements they tend to effectively police cooperation to halt the spread of would-be opportunistic cheaters.[95]

3. Conformity

Although I have stressed game theoretic analyses such as the Prisoner's Dilemma and the Stag Hunt, most agent-based models of complex systems do not typically employ robust assumptions about individual rationality and maximization — many formal models employ simple learning rules. Indeed what is striking about complex systems is how heterogeneity can give rise to complexity under simple choice algorithms or "personal rules."[96] The great contribution of the work of Boyd and Richerson has been to show how modes of learning such as conformity bias, prestige bias and copying successful neighbors can promote the spread of group beneficial norms in a population.[97] We are alert to how well our neighbors

[93] Skyrms, *The Stag Hunt and the Evolution of Social Structure*, chap. 3.

[94] Ibid., Part II. See also Brian Skyrms, *Signals: Evolution, Learning and Information* (New York: Oxford University Press, 2010). Public rituals may be helpful in providing common knowledge that all wish to cooperate. See Michael Suk-Young Chew, *Rational Ritual: Culture, Coordination and Common Knowledge* (Princeton: Princeton University Press 2001), esp. pp. 25ff.

[95] I have called these "rule-following punishers." For supporting data, see *The Order of Public Reason*, chap. 3.

[96] Ruth Lane, *The Complexity of Self-Government: Politics from The Bottom-Up* (Cambridge: Cambridge University Press, 2017), p. 21. For extensive applications to various models concerning morality and cooperation, see Alexander, *The Structural Evolution of Morality*.

[97] Robert Boyd and Peter J. Richerson, *The Origins and Evolution of Cultures* (Oxford: Oxford University Press,

are doing, for example, and as we observe them thriving we are apt to copy their actions. When such copying seems successful, others then join in. Because culture has evolved complex adaptive practices, humans typically do well by imitating the behavior of others around them. We often do not understand precisely the overall benefits of our cultural practices, but because culture is largely transmitted via imitation, people typically do not have to know why something is done, only that it is the useful done thing around here, or the most successful. Whereas intelligent primates such as chimps tend to figure out problems for themselves, human infants have a much stronger tendency to simply copy what they observe being done, copying "stupid" acts which the chimp sees as pointless.[98] But by copying so much we learn a great deal from others.

Our tendency to copy prestigious people, those who do well, and the majority has two important implications for complexity. For *one*, it helps explain the stability of the social rules that structure social systems. Although since Rawls many political philosophers have been obsessed by the worry that just societies might not be stable,[99] our basic social rules and norms tend to be stable since we are prone to do what others do. Even when norms change, it of often because most are following a few trendsetters.[100] *Secondly*, because we tend to imitate those who seem prestigious or successful, the effects of heterogeneity are dampened. In the social game of follow-the-prestigious-or-successful-or-majority, uniformity can spread throughout a diverse society. Summing up both points, Laland observes that both norms and fashions are thus characteristic of humans alone.[101] This by no means shows that our social

2005), chaps. 1, 2, 5, 12, 18. See also T. J. H. Morgan, L. E. Rendell, M. Ehn, W. Hoppitt and K. N. Laland "The Evolutionary Basis of Human Social Learning," *Proceedings of the Royal Society B* 279 (2012): 653-662. For an accessible treatment see Henrich, *The Secret of Our Success: How Culture Is Driving Human Evolution, Domesticating Our Species, and Making Us Smarter* (Princeton: Princeton University Press, 2016), esp. chap. 2.

[98]Victoria Horner, Victoria and Andrew Whiten, "Causal Knowledge and Imitation/Emulation in Chimpanzees (*Pan Troglodytes*) and Children (*Homo Sapiens*)," *Animal Cognition*, vol. 8 (2005): 164-181; Josep Call, Malinda Carpenter, Michael Tomasello, "Copying Results and Copying Actions in the Process of Social Learning: Chimpanzees (*Pan Troglodytes)* And Human Children (*Homo Sapiens*)," *Animal Cognition*, vol. 8 (2005): 151-63.

[99] See Rawls, *Political Liberalism*, pp. 140ff. This is not to sat that the problem is trivial, only that it is not nearly so daunting as game theoretic approaches would seem to indicate.

[100] See Cristina Bicchieri, *Norms in the Wild: How to Diagnose, Measure and Change Social Norms* (New York: Oxford University Press, 2017), chap. 5; Cass R. Sunstein refers to these trendsetters as "norm entrepreneurs." This, perhaps, underplays the importance of imitation. *How Change Happens* (Cambridge: MIT Press, 2019).

[101] Kevin N. Laland, *Darwin's Unfinished Symphony: How Culture Made the Human Mind* (Princeton: Princeton University Press, 2017), p. 6.

orders are not highly complex, but it does help them avoid chaos, and spend more of their time at functional states.[102]

D. Self-governance in CAS 1 and 2 Systems

A third alternative (in addition to CAS1 (§IV.B) and CAS2 (§IV.C) systems) is self-governance. Writes Jenann Ismael:

> These are systems in which at least some organized activity is the result of a centralized process that involves the sharing of information and the formation of an overall plan and deliberate coordination of joint activity. Self-governance contrasts with pure self-organization. In a purely self-organizing system, all behavior is emergent from the aggregated activity of components, each doing its own thing. The coupling among components can generate the appearance of coordination, but there is not really any pooling of information and centralized control of activity. In a self-governing system, by contrast, at least some of the information distributed throughout the systems is collected, synthesized, and used to fuel a decision procedure that plays a role in guiding the system's behavior.[103]

Self-governance functions alongside the other mechanisms of system functionality, macro-selection (CAS 1) self-organization (CAS 2). No plausible analysis of complex systems would hold that the entire system can be regulated by a central controller. The critical claim made by advocates of complex system self-governance such as Ismael is that, in addition to the bottom-up forces of self-organization, there occurs a top-down direction of the entire system. The self-governance center aggregates information from the lower-levels of the system and uses that information to make decisions that guide system behavior (the emergent order) and, perhaps, can change system parameters so that it functions in the desired way.

Strong self-governance appears in tension with strong self-organization, which is maintained by agent-level adaptations and dispersed information. Self-organized complex systems depend on ongoing numerous micro-adjustments in the reflexive decisions of each agent. Because the system is in a state of constant flux, and its functionality produced via these ongoing reflexive micro-decisions, it is not obvious to what extent a central information processor can guide the system along a desired path without interfering with the freedom of the individuals to reflexively adjust. As Adam Smith (certainly a CAS 2 theorist) stressed in

[102] Complexity is often understood as existing between simple order (a la Hobbes) and chaos. M. Mitchell Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Simon and Schuster, 1992).

[103] Ismael, *How Physics Makes Us Free,* pp. 19-20.

the *Theory of Moral Sentiments*, "in the great chess–board of human society, every single piece has a principle of motion of its own, altogether different from that which the legislature might chuse to impress upon it."[104]

In contrast, in a macro-selection account, the entire complex system was selected because it was, among the options, a good adaptive solution to past environmental challenges. And this could well include a complex system that had just the correct level of self-governance to promote systemic functionality. Ismael's thesis that self-governance is critical to individual human beings is consistent with the entire (human) complex system, including a certain level of self-governance, being the best solution to past adaptive challenges. We may not know why or how this level of self-governance has come to be or even why it is functional, but that is often be the case with an evolutionary phenomenon.

Whereas self-organized systems depend on allowing individuals large degrees of freedom to reflexively 'do their own thing' in responding to the decisions of others, macro-selected systems impose strong constraints on the freedom of the parts. On a multilevel selection account, the higher-level selection inherently restrains lower-level (individual) selection. There is no point to higher-level selection if it does not. Critical to the integrity of an organism, for example, 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; thus extensive instructions by the governor need not be at odds with the degree of freedom required for system maintenance. Not too surprisingly, in the history of social theory this type of social order typically has been identified with the idea of a "social organism"[105] and a morality of "my station and its duties."[106] Leaving aside this rather dubious normative basis for self-governance, because strong macro-selection looks implausible today (§IV.B), I henceforth shall focus on self-governance in self-organized complex systems (CAS 2) — a far more puzzling issue.

[104] Adam Smith, *The Theory of Moral Sentiments* (Indianapolis, IN: Liberty Find, 1982), p. 234.

[105] Interestingly, this idea has been revived in current theories of social evolution, which often stress group-level selection. Joseph Henrich explicitly compares individual cells in an organism to individuals in the evolving "superorganisms" of our societies. *The Secret of Our Success,* p. 318.

[106] F. A. Bradley, *Ethical Studies,* second edn. (Oxford: Clarendon Press, 1927), Essay V.

V. IS DEMOCRATIC SELF-GOVERNANCE POSSIBLE?

A. From Democratic Decision Making to Self-Governance

In his recent *Securities Against Misrule,* Jon Elster is acutely aware of the difficulties posed by social complexity. In the end, he seems to accept that we can achieve little in the way of effective self-governance. Secure fairness, guard against bias, try to utilize whatever intelligence there is, and after that "we have to let the chips fall where they may."[107] Essentially, self-governance is abandoned for fair proceduralism: we make fair decisions, though we cannot be said to truly govern our social order — we cannot reliably improve our order of actions. We can hold elections and make decisions — we can do things, and maybe even convince ourselves that we know what we are doing — but we will not really be governing our society. What is required for self-governance, as Ismael stressed, is a "decision procedure that plays a role in guiding the system's behavior" rather than simply modifying its structure.

Let us, then, distinguish *centralized decision making* from *centralized self-governance*. Centralized decision making in system *S* occurs when there is a centralized decision procedure that can reliably change the rules, laws, and institutions structuring *S* (or, as a Rawlsian might say, the basic structure of *S*);[108] *S*'s centralized decision-making is democratic when it sufficiently conforms to the principles and procedures of democracy. But that *S* possesses a centralized decision-making procedure does not imply that those operating the procedure can change the overall system to move it closer to a desired state. To employ Hayek's idea of an emergent order of actions (§III.B), self-governance requires that the decision maker reliably observes the current order of actions *O*, forms a judgment that *O** would be a superior order, and makes a decision that reliably enhances the probability that *S* will move closer to *O**. This requires both "cognitive" and "manipulative" functions.[109] "As Beinhocker puts it, *"If I perceive state A (cognitive function) and take action X (manipulative function) then state B will result, bringing me closer to (or farther from) my goal G."*[110] If a

[107] Jon Elster, *Securities against Misrule* (Cambridge University Press, 2013), pp. 1-2, 281-82.

[108] See Rawls, *Political Liberalism*, Lecture 7.

[109] George Soros, "Fallibility, Reflexivity, and the Human Uncertainty Principle," *Journal of Economic Methodology*, vol. (2013): 309–329.

[110] Beinhocker, "Reflexivity, Complexity, and the Nature of Social Science, p. 332. Emphasis in original.

centralized decision-making procedure does that, it is also self-governing. Complexity, then, constitutes a barrier in moving from centralized decision making, which can reliably change the underlying structure, to self-governance, which reliably induces changes in the justice, welfare levels, efficiency etc. of emergent outcome of the structure.[111] We can, as it were, fiddle with the genes: the problem is whether we can improve the emergent phenotype in a reliable way. Our question, then, is whether Elster's proposal — to focus on making the decision procedure democratic and fair — is all we really can do, and after that we can only let the chips fall where they may.

B. Centralized Democratic Reflective Self-Governance

Jack Knight and James Johnson recently have developed a powerful case for a centralized form of democratic self-government in heterogenous social systems. To their great credit, Knight and Johnson are sensitive to the importance of accounting for the heterogeneity and dispersed information characteristic of complex systems.[112] Moreover, they rightly analyze contemporary socio-economic orders as composed of diverse interacting institutions at different levels — there is no illusion of an overall democratic central controller, selecting various preferred social states and planning society to secure them. Rather, on their view the task of centralized democratic decision making is a reflexive monitoring of other social institutions — and itself — with an eye to improving the social order. Consistent with Ismael's understanding of self-governance in complex systems, they see centralized democratic decision making as aggregating information dispersed throughout the system to evaluate the system's functioning and employing the information to "experimentally" reform it in socially desirable ways. The tasks of centralized democratic decision making are "(1) to coordinate effective institutional experimentation, (2) to monitor and assess effective institutional performance for the range of institutions available in any society, (3) to monitor and assess its own ongoing performance."[113] In addition to the cognitive functions of (2) and (3), the democratic self-governor must have a sufficiently strong manipulative ability, to

[111] I shall focus on the idea of self-governance as guiding the emergent order, though any attempt to simultaneously control a significant set of important macro variables would lead to similar problems, as Figure 4 indicated.

[112] Jack Knight and James Johnson, *The Priority of Democracy* (Princeton: Princeton University Press, 2011), pp. 42ff.

[113] Ibid., p. 169.

make experimental adjustments that have a significant likelihood of producing reform in the desired direction.[114] The stress on institutional "experimentation" is fundamental to their essentially pragmatic approach: democratic self-governance does not simply select a path to be followed, but is an ongoing process of monitoring, evaluating, and "experimenting" to discover better institutional arrangements that yield a better social results. To be sure, as pragmatists, they hold back form specifying these desired social results — their determination is also a matter of democratic self-reflective judgment. But whatever it is, the democratic public must possess not only the cognitive but also the manipulative function. Such centralized reflexive capability is held to give democratic decision making a priority over all forms of decentralized self-organization.[115]

Knight and Johnson's proposal is, in my view, by far the most sophisticated attempt to defend the priority of centralized democratic self-government in heterogenous systems with dispersed information. It certainly merits closer examination than I can give it here. Nevertheless, it is hard not to conclude that it too heavily taxes both the (*i*) *cognitive* and (*ii*) *manipulativ*e capacities of reflexive self-government (§IV.A)

RE: (*i*). In the spirit of pragmatism, Dewey observed that each person knows best "where the shoe pinches."[116] Following Dewey, Knight and Johnson view democracy as a method of gathering and aggregating the dispersed information about how well the system is functioning (how many toes are being pinched). However, as we have seen, in complex systems the dynamics underlying why one's toes are being pinched may be intimately related to why other things are going well — perhaps given the limits on current technology, shoes with great arch support pinch, and we remain ignorant of the critical fact that only because one's shoe pinches one does not have crippling backaches. Thus aggregating complaints about pinched toes may well be entirely misleading about how well the system is doing. Less

[114] There are times when they seem to draw back from advocating any form of "collective" self-governance, focusing instead simply on democracy as a way to manage disputes (ibid., p. 20). But it is, I think, clear that their worry here is identifying independent goals, rather than those goals coming out of the democratic process itself. Without any goal-based decisions, their core idea of experimentation is unmotivated. And unless the goals aim at social improvements, rather than just institutional change, it would not be a form of self-governance.

[115] They also hold that self-organized (CAS 2) systems cannot ensure society-wide coordination (ibid., pp. 105-6), and thus centralized self-governance is required to ensure the normative acceptability of the overall system. Cf. Wilson's view in section IV.B.

[116] John Dewey, *Intelligence in The Modern World: John Dewey's Philosophy*, edited by Joseph Ratner (New York: Modern Library, 1939), p. 402.

homely, in a complex system we often only know the surface (immediate) effects of our rules, norms and institutions: since we cannot know the invisible effects, reports of the felt problems do not give much insight into system performance. The functionings of our norms, practices and institutions are, as Henrich says, often "*causally opaque* — an individual cannot readily infer their functions, interrelationships, or importance," and so "intuitions and personal experiences can lead one astray."[117] If a voter is in the dark that the other side of what she is unhappy about is that it satisfies a need, complaints about what she is unhappy about do not provide much information about how well the system is doing.

RE: (*ii*). Presumably, at this juncture an advocate of centralized reflexive democracy would stress the reflexive, incremental and "experimental" nature of democratic interventions: as the system discovers that it has eliminated arch support shoes, it can better learn about its own performance (it just made things worse, not better). Successful interventions are not once-and-for all determinations, but ongoing iterative experiments in improving our social system. Now to be sure, an iterative "experimental" procedure does not require hitting the correct answer at one go; it does, though, require that after an intervention the governor reliably knows, as it were, in what direction to move next. To use a cybernetic example, if the governor has decided that it is too cold in a room, it must reliably know whether this should lead to turning the heat up or down.[118] In a simple system such as Figure 7, this will be easy.

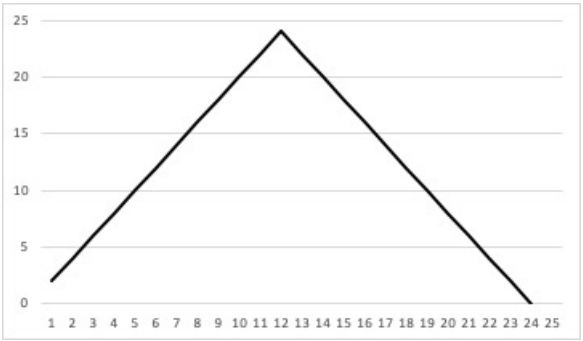


FIGURE 7 A SYSTEM GROUNDING INCREMENTAL SOCIAL CHANGE

[117] Henrich, *The Secret of Our Success*, pp. 99-100, emphasis in original.

[118] See Paul Lewis, "Purposeful Behaviour, Expectations, and the Mirage of Social Justice: The Influence of Cybernetics on the Thought of F.A. Hayek." Prepared for the History of Economics Society meeting, Durham NC, 2016. Available at SSRN: https://ssrn.com/abstract=2790169

Note that here one does not have to know precisely where one will end up. Once one knows the direction of improvement (turning the heater up at social world 3) one can keep evaluating the outcome, and proceeding in the same direction until movement in that direction is no longer an improvement; one then has reached the optimum. Here incremental social improvement really is truly incremental and improving, since each move produces a better result until no better is possible. But as get nearer to Figure 1, the governor is unclear about the proper response to a decision (the cognitive capacity) that the system is not functioning well. Move right or left? But then the *manipulation* capacity is lacking: even if we are not happy with the current system, we do not, as it were, know which way to turn the dial.

Both these problems — with the cognitive and manipulation functions — are greatly aggravated by the fact that the democratic self-governor is just one reflexive agent in a world of reflexive agents. All agents are reflexively responding to each other and to the governor as the governor seeks to reflexively respond to them. As the centralized self-governor acts by *X*, changing rules and institutions in current state *S*, the constituent agents reflexively respond to that very institutional change, bringing about *S*.* But *X* may no longer be appropriate against this new background, so the centralized self-governor responds with *X**, to which other agents reflexively respond in myriad and unpredictable ways, making *X** also inappropriate. The rugged landscape (§II) is thus constantly shifting as the democratic self-governor seeks to traverse it.

C Democratic-Governance in a Polycentric Order

It certainly looks as if, contrary to their core claim, Knight and Johnson's reflexive learning model of centralized democratic self-governance strains under great diversity. To effectively apply it diversity and complexity must be reduced. The key to doing so, I believe, is implicit in their Deweyan focus on problem solving.[119] Pursuing this insight has been the great contribution of Paul Dragos Aligica.[120] One of the lessons we have learned from the work of

[119] Knight and Johnson, *The Priority of Democracy*, pp. 36ff. Cf. John Dewey, *The Public and its Problems* (Chicago: Swallow Press, 1954).

[120] In his recent *Public Entrepreneurship, Citizenship and Self-Governance* (Cambridge: Cambridge University Press, 2018). See also Paul Dragos Aligica, Peter J. Boettke and Vlad Tarko, *Public Governance and the Classical-Liberal Perspective* (Oxford: Oxford University Press, 2019).

the Ostroms is that effective joint action is most apt to arise when a group of people face what I shall call a *pressing problem solving context*. For example, we face the degradation of a common pool resource and seek to do something about it. In problem-solving contexts diversity is reduced because people share (*i*) a common perception of a problem to be solved, (*ii*) an agreement that a range of policies constitute plausible solutions to the problem and (*iii*) a belief that most any of these solutions would be preferable to leaving the problem unresolved. If crime is rising in my neighborhood, my focus is on solving *that* problem; to a significant extent, many of my other diverse aims and goals are bracketed; a crime-fighting community becomes a simpler (less heterogenous) community, thus reducing the complexity of the public policy problem. Our problem becomes closer to Figure 3, or even Figure 2, above.

When the problem is, in addition, *pressing*, most individuals in group *G* believe that solving the problem is sufficiently important that other unintended consequences are not weighty *as far as they are concerned*. Given the inevitable interconnectivity of activities in a complex system, when the group solves their pressing collective action problem there are bound to be other effects, both known and unknown. But when the problem is pressing, the participants will tolerate a significant range of unintended consequences in order to effectively solve the problem. To be sure, insofar as these can anticipated they will enter into the problem-solving deliberations, but the critical point is that when everyone in group *G* sees a collective action problem as pressing the system becomes, virtually, simpler. Heterogeneity is reduced (because members of *G* shares similar goals) and, the system's interconnections can be bracketed by the group member (because members of *G* do not care much about them).

The key to the Ostrom-inspired polycentric approach is to, as far as possible, allow problem-solving groups to organize themselves in such a way that the level of governance approaches the optimal public for that problem: just large enough to encompass the stakeholders who perceive a pressing common problem and whose participation is essential to solve the problem. Note that there is limitation on the scope of the aims of governance: to adequately solve perceived common problems — not, say, to guide the overall system along a preferred trajectory of social improvement. In the polycentric vision, diverse problem-solving institutions — state as well as nonstate —— self-organize in forming rule-based

reflexive efforts to solve shared, pressing, problems.[121] Such polycentricity has five major attractions.

(*i*) Because the self-governing unit is focused on a smaller set of problems and common perceptions of solutions, its reflexive monitoring task is much easier. We saw above (§§II.A, V.B) that in a reflexive system each participant reflexively responds to the judgments of the self-governor, greatly complicating the problem of governing the system. When the self-governor is solving shared pressing problems of the group, anticipating the reflexive responses to the self-governor's decisions is simplified. Note here that when self-government covers a large and diverse population such that it seeks to solve problems that many participants do not see as problems, this benefit of polycentricity is lost. The governor is then no longer able to anticipate their reflexive response to its decisions, since they do not share its problem-solving orientation.

(*ii*) As far as possible the polycentric program encourages duplication and competition among different polycentric problem-solving institutions, which provides some approximation of the ideal of experimenting with diverse institutional designs, to see which institutional schemes are more functional and efficient (§III.B).[122]

(*iii*) Polycentric institutions are in an important sense themselves part of social self-organization (§IV.C). As we see in Elinor Ostrom's work, they often arise within a self-organized network of relations; they certainly are not top-down governance imposed on the self-organized system.[123] They form out of the self-organized networks and common perceptions of inadequacies in them. Polycentric systems thus provide space for norm exploration: groups experiencing perceived unsolved (or badly solved) collective action problems seek to resolve them within the context of their current social networks.[124]

[121] See here Vincent Ostrom, "Polycentricity: The Structural Basis of Self-Governing Systems" in *Choice, Rules and Collective Action: The Ostroms on the Study of Institutions and Governance* (Essex: ECPR Press, 2014) chap. 3. See also Paul Dragos Aligica, *Institutional Diversity and Political Economy* (Oxford: Oxford University Press, 2014).

[122] See Vincent Ostrom, Charles M. Tiebout and Robert Warren, "The Organization of Government in Metropolitan Areas: A Theoretical Enquiry," *American Political Science Review*, vol. 55 (December 1961): 831-42. For a philosophical analysis, see Julian Müller, *Political Pluralism, Disagreement and Justice*.

[123] See Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990); Ruth Lane, T*he Complexity of Self-Government.*

[124] See Colander and Kupers, *Complexity and the Art of Public Policy*, pp. 28, 181ff.

(*iv*) The social conflict that heterogeneity can engender is transformed in problem-solving contexts into a more cooperative inquiry looking for better solutions. Once politics is conceived in terms of inquiry into the best solutions to common problem, we can draw on results such as Scott Page's, which show how diverse groups possess enhanced problem-solving capabilities.[125] It is important that Page's diversity theorems are about problem solving contexts: when we have identified a common problem and have agreed on what would be a good solution, then Hong-Page dynamics can get going. Because democratic polycentric citizenship is about collective problem solving, the stage is set for diversity to assist in social searches for better solutions.[126] Pressing collective action problems thus have something of the perfect mix of homogeneity and heterogeneity: an agreement on the problem, its importance, and a general concurrence on what would constitute good solutions with heterogeneity of perspectives, tool kits and cognitive resources, so that the solution space can be more adequately explored.

(*v*) Because polycentric self-organization does not commence with a certain pre-defined group (say, a national state), it can adjust its boundaries to encompass all those who share the pressing problem orientation. Rather than commencing with a preferred unit (which is apt to be highly diverse and complex) as the focus for all policy, different publics form at different levels in response to various collective action problems: the boundaries of the public seek to track the simplification of the social problem induced by the pressing problem orientation, which also enhances the ability to actually solve the problem. It is of the first importance that polycentrism is not understood in terms of the autonomy of local or small communities. For any given problem, the proper size of the democratic self-governing public ranges from the neighborhood to the globe.

Polycentricity's partial reconciliation of self-organization and self-governance leads, on Aligica's analysis, to a revised conception of democratic citizenship. Especially prominent in his account is the task of the "public entrepreneur," who takes the leading role identifying

[125] See e.g., See Lu Hong and Scott E. Page, "Problem Solving by Heterogeneous Agents," *Journal of Economic Theory,* vol. 97 (2001): 123–163; "Groups of Diverse Problem Solvers Can Outperform Groups of High-Ability Problem Solvers," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 101, No. 46 (Nov. 16, 2004): 16385-16389; Page, *The Diversity Bonus* (Princeton: Princeton University Press, 2017).

[126] See further my "The Complexity of a Diverse Moral Order," *The Georgetown Journal of Law and Public Policy*, Vol. 16 (2018, Special Issue, The Ethics of Diversity): 646-80.

and showing the importance of potential collective problem-solving contexts. That a group confronts a collective action problem does not mean that the problem is obvious or is recognized as pressing. The public entrepreneur takes a leading role in mobilizing recognition of the problem and ways to solve it, which includes providing the contexts for discussion and exchange of information.[127]

Alas, polycentric problem-solving publics are no panacea (there are no panaceas in this area). I have stressed that when a group sees a pressing problem, they tolerate a great deal of unforeseen consequences in pursuit of a solution to their pressing problem, thus practically reducing the relevance of interconnections. As far as they are concerned, it is pretty simple to evaluate whether their self-governance secures its goals: it adequately solves and manages the pressing collective action problem. But the tight coupling that characterizes complex systems still exists, and those who do not share the problem-solving perspective will be far more sensitive to the often-unpredictable effects of their neighbor's solutions to their collective action problems. Sometimes these effects will be cognized, but at other times they will be unseen, but for all that very real. Put in the familiar terms of economics, *G*'s solution to its collective action problem can impose externalities on others. This problem is not obviated by point *v* above*:* even when ensuring the problem-solving group includes all those with a pressing interest in solving the problem, others, who do not share the problem orientation, can nevertheless be affected by *G*'s rules, and behaviors, and impacts. There is no algorithm about the proper response. Sometimes the effects of *G*'s behaviors are simply exogenous variables that another group responds to in solving its own collective action problems — your solution is often simply part of my problem. At other times, the effects are sufficiently obvious and serious that an overarching system of rules must regulate the externalities or adjudicate conflicts.[128] It is critical, however, not to see this encompassing framework as itself a high-order project in self-governance. Rather, it constitutes a framework of constraints, rights and powers that define the limits of each subgroup's exercises in self-government. It is to this important framework that I now turn.

[127] *Public Entrepreneurship, Citizenship and Self-Governance*, chap. 2, where Aligica shows that the entrepreneur can build on different preferences for public goods, helping to show how diversity of preferences can cause convergence on outcomes, not simply divergence.

[128] Aligica, *Institutional Diversity and Political Economy*, pp. 58ff.

VI. THE DEONTIC FRAMEWORK

A. "Purpose-independent" Rules

We should not become so enamored with the resources of polycentricity for democratic self-governance that we suppose that it can be the sole form of social regulation in complex systems. Self-governing problem-solving groups arise within an overall framework of rules specifying the rights of citizens and prohibiting various forms of harmful externalities. *Pace* Rousseau, self-governance, is not a sovereign supreme, locus of social regulation;[129] it occurs within an overall systems of norms, moral rules, and laws that both empower and delimit the jurisdictions of self-governing publics and so control externalities.[130] And again, *pace* Rousseau, these rules cannot be understood as themselves efforts at a higher-level self-government. Such rules do not govern the system in the sense of guiding it toward preferred social states: they structure the ways that self-organization takes place. In this sense they are what Hayek called "purpose-independent" rules.[131] They are purpose-independent not because we do not intentionally follow them to avoid certain forms of prohibited conduct, but because they are not followed as a means to securing more favored social states, as we do not know what social states they will produce, and some may have grave problems.

To see why this is so, we must remember that the moral upshot of any rule depends not simply on the degree of conformity to the rule's deontic imperatives, but on how heterogenous reflexive agents react to the rule, and the morally-relevant options they take.[132] Rules, after all, seldom mandate specific actions: they generally permit and prohibit actions.[133] Consider a moral rule that prohibits religious arguments in the democratic

[129] Jean-Jacques Rousseau, *The Social Contract*, in *The Social Contract and Other Later Political Writings*, edited by Victor Gourevitch (Cambridge: Cambridge University Press, 1997), Bk. I.

[130] As I have pointed out elsewhere, by specifying jurisdictions complexity is reduced, since many of the externalities of one's actions within one's jurisdiction (say, what God one worships) are considered normatively irrelevant — as if they did not exist. *The Tyranny of the Ideal*, pp. 198-202. We might call this "normatively-induced decomposability."

[131] Hayek, *Rules and Order*, pp. 85ff.

[132] "It is important always to remember that a rule of conduct will never by itself be a sufficient cause of action but that the impulse for actions of a certain kind will always come either from a particular external stimulus or from an internal drive (and usually from a combination of both), and that the rules of conduct will always act only as a restraint on actions induced by other causes." Hayek, "Notes on the Evolution of Systems of Rules of Conduct," pp. 280-81.

[133] See Gerald Gaus and Shaun Nichols, "Moral Learning in the Open Society," *Social Philosophy & Policy*, vol. 34 (Summer 2017): 79-101.

deliberations about basic justice.[134] Suppose that societies S_1, S_2 and S_3 all fully comply with the rule. In S_1 many are religious citizens, and while they comply, their moral perspectives lead them to retreat from the public sphere, where they cannot appeal to what they consider the fundamental basis of their convictions, leaving political matters to their secular brethren. In S_2 religious people tend to have a much stronger devotion to civic engagement, and so participate actively in political debate while complying (though perhaps with some misgivings) with this duty. In S_3 the secular citizens, interpreting this moral duty as confirming their conviction that religious arguments are bogus and are unworthy of admittance into public debate (their scientific arguments *are* admissible, after all), become even more dismissive of religious comprehensive doctrines. All three societies perfectly comply; the emerging moral relations between citizens are vastly different.

B. Deontic Rules in Complex Adaptive Systems

Earlier (§IV.A), I stressed that it is far from automatic that complex systems will be functional or adaptive. We are thus pressed to ask: what is the relation between the deontic framework and system functionality?

Those — including, at least in some works, Hayek — who embrace macro-selection (§IV.B) can invoke a rather comforting analysis: the "purpose-independent" rules of our basic framework have evolved as part of our overall society, and thus are (or at least, have been) adaptive, though we do not know the causal basis of why this is so.[135] These explanatory resources obviously are not available to a self-organization (CAS 2) analysis. CAS 2 systems are self-organized, and that includes many of their basic norms and social rules.[136] Individuals in CAS 2 systems are constantly affirming the current social rules, or exploring the personal consequences of defecting on them. Some considerations incline towards acceptance: obeying rules is an entry condition to participation in many social networks: if one wishes to join a groups cooperative endeavor, one must sign on to certain rules. And, of

[134] Rawls, with a rather complex proviso, endorses this as a moral duty. See his "Public Reason Revisited" in *Political Liberalism*, pp. 440-90.

[135] See Hayek *The Fatal Conceit: The Errors of Socialism*, edited by W. W. Bartley III (Chicago: University of Chicago Press, 1986), chap. 5 (but cf. *Rules and Order*, pp. 88ff). See also Henrich, the *Secret of Our Success*, pp. 145ff.

[136] For models of such moral self-organization, see Alexander, *The Structural Evolution of Morality*, and my "Self-Organizing Moral Systems."

course, both punishment for non-compliance and conformity bias (§IV.C) also support compliance. On the other hand, rules may limit one's opportunity to pursue important aims or conflict with one's personal normative convictions.[137] Thus some individual are always probing and testing the rules. And as Hayek observes, "it is, in fact, desirable that the rules should be observed only in most instances and that the individual should be able to transgress them when it seems to him worthwhile to incur the odium this will cause. … It is this flexibility of voluntary rules which in the field of morals makes gradual evolution and spontaneous growth possible, which allows further modifications and improvements."[138]

None of this guarantees that the self-organized moral rules are justified to all or even to many: societies can get stuck in norm traps where all follow norms of which all disapprove.[139] Often norms can be changed through a bottom-up approach,[140] while at other times democratic legislation may be used in an attempt to induce normatively required change.[141] It is inevitable that democratic decision making (not, in this case, an act of self-governance) will often be a form of what we might call "myopic morality" (or, less pejoratively, "deontology").[142] That is, democratic decision makers may conclude that some forms of social interaction — e.g., racial discrimination — are inherently wrong and are to be prohibited and then, *al la* Elster, they let the chips fall where they may. To be sure, the democratic decision maker may consider some immediate and highly predictable proximate effects of a rule, but as we have seen, anything approaching a sound judgment of its overall effects will be impossible. The system will then proceed to reflexively adjust to this new input, usually in surprising ways. For the CAS 2 theorist, we can have no assurance that large parts of deontic framework are not causing more problems than they solve.

[137] This raises the normative issue of public justification: do those living under a rule view it as normativity acceptable? See *The Order of Public Reason*, esp. chap. 5.

[138] Hayek, *The Constitution of Liberty* (Chicago: University of Chicago Press, 1960), p. 63.

[139] See Cristina Bicchieri, *The Grammar of Society* (Cambridge: Cambridge University Press, 2006), chap. 5; Sunstein, *How Change Happens*, chap. 1.

[140] See Bicchieri, *Norms in the Wild*.

[141] This is not a simple task. In a reflexive system changing a law is by no means equivalent to changing behavior. For an in-depth survey see *Governance and the Law: World Bank Development Report, 2017* (Washington: The World Bank Group, 2017).

[142] I have argued for this in some detail in "Social Complexity and Evolved Moral Principles."

C. The Liberal Principles of Self-organization

Deontic moral and social rules are thus necessary in social systems; there must be rules to structure self-organization — including regulating the externalities of various self-governing communities — in ways that conform to the public's moral convictions. Of course we should be aware that as we multiply such rules the adaptability of the system may be compromised. As Ismael reminds us (§III.D), letting individuals do their own thing is the key to CAS 2 functionality.

However, as we learn more about the functioning of complex social and moral systems, we obtain theoretical knowledge of features of the deontic framework that facilitate self-organization. In this vein, Hayek argued that the principle of liberty was 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."[143] Freedom and markets, he insisted, were first and foremost ways for individuals to successfully coordinate their heterogenous plans. 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.[144] And Shaun Nichols and I have argued that rules stated as prohibitions — what Adam Smith called the "negative" aspect of justice[145] —are more effective in encouraging innovation and exploration than a rule system based on permissions.[146] We are by no means in the dark about the types of deontic rules that facilitate the coordination of different plans and interests in a diverse society, and so bolster the functionality of our CAS 2 system. Here we have something between self-governance and deontic imperatives — rules that facilitate self-organization, the specifics of which cannot be anticipated.[147]

[143] *Rules and Order*, pp. 55-56. See Eric Mack, "Hayek on Justice and the Order of Actions" in, *The Cambridge Companion to Hayek*, edited by Edward Feser (Cambridge: Cambridge University Press, 2006): 259-86.

[144] Hayek, *Rules and Order,* p. 61.

[145] Smith, *The Theory of Moral Sentiments*, p. 82

[146] See our "Moral Learning in the Open Society."

[147] This seems more accurate than the claim that public policy, while it cannot control, can "tweak" or "shape" the evolution of a complex order. Shaping evolution is no mean feat. Cf. Colander and Kupers, *Complexity and the Art of Public Policy* pp. 8, 59; John Gowdy et al., "Shaping the Evolution of Complex Societies."

VII. CLOSING REMARKS ON DEMOCRATIC SELF-GOVERNMENT

A. The Fatal Democratic Conceit

I have departed from Hayek's pathbreaking analysis of complexity in important ways, most importantly regarding his strong reliance on macroevolution. The analysis has brought us to conclusions about democratic self-governance much closer to those of Vincent and Elinor Ostrom than Hayek. Yet my itinerary has paralleled his. Much thinking about democracy starts with small group contexts in which the decision determines the resulting state of affairs. It is then implicitly supposed that problems of scale are essentially linear: as the questions become more complex, more information and expertise is required, but scale does not fundamentally alter the basic dynamic. This strong intuitive conviction — something approaching a certainty — that we can control our world is, to borrow from Hayek, a fatal conceit. It is a conceit because it not only wildly overestimates our intelligence and information but is blind to the intractability of the task of governing complex social orders. And it is fatal because the conviction that democratic control is possible ultimately delegitimizes democratic self-governance. No form of self-governance could do what so many insist is not only possible, but required: to guide the order of actions to increasingly just states.[148] When we ask the impossible of it, democracy is bound to disappoint.

B. A Coda on Rule by Experts

Karl Popper famously criticized some of the towering figures in philosophy for their elitist rejection of a democratic, open, society.[149] Today we are again witnessing a resurgence of those who propose, or at least seriously contemplate, the benefits of rule by experts. There may perhaps be something about the philosophic mind that all-too-easily leads it to turn its back on democracy. Not known for their intellectual modesty, philosophers are often convinced they have true knowledge of the right and the good, and are frustrated by the folk's ignorance (that is, their contrary views). And of course, as I noted at the outset, the folk often give less deference to social scientific expertise. I have not set out here to defend democracy over elitism, but to investigate what real, effective, democratic self-governance might look like. However — as I hope is clear — just because the social systems are so

[148] On this, see my *Tyranny of the Ideal,* chaps 1 and 2.

[149] This, of course, was the theme of his great *The Open Society and Its Enemies* (London: Routledge and Kegan Paul, 1945), 2 vols. Philosophers are generally dismissive of this great work. What a surprise.

complex rule by experts is deeply implausible. Experts possess neither the cognitive nor the manipulative capacities to *govern* a complex system. Indeed, I have argued that the condition for self-governance in complex systems depends on the *simplification* of parts of the social system induced by some public's recognition of a common pressing collective problem. The people themselves produce the conditions for self-governance. The context for any real self-governance is thus inherently and necessarily democratic: when a public converges on a common understanding of their pressing problem.[150]

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[150] And then, as Page (§V.C), Knight and Johnson (§V.B) and Aligica (§V.C) have shown, the public can draw on their diversity of perspectives to better solve it than could a gaggle of experts.