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# **J.B. RUHL'S "LAW-AND-SOCIETY SYSTEM": BURYING NORMS AND DEMOCRACY UNDER COMPLEXITY THEORY'S FOUNDATION**

JEFFREY RUDD\*

## **INTRODUCTION**

If we deny that there are foundations to serve as common ground for adjudicating knowledge-claims, the notion of the philosopher as guardian of rationality seems endangered . . . . Holistic theories seem to license everyone to construct his own little whole—his own little paradigm, his own little practice, his own little language-game—and then crawl into it.<sup>1</sup>

In several related articles,<sup>2</sup> Professor J. B. Ruhl addresses the

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<sup>1</sup> RICHARD RORTY, *PHILOSOPHY AND THE MIRROR OF NATURE* 317 (1979).

<sup>2</sup> See generally J.B. Ruhl, *The Co-Evolution of Sustainable Development and Environmental Justice: Cooperation, Then Competition, Then Conflict*, 9 DUKE ENVTL. L. & POL'Y F. 161 *passim* (1999) (using complexity theory to analyze the co-evolutionary system of sustainable development and environmental justice) [hereinafter Ruhl, *Co-Evolution*]; J.B. Ruhl, *Complexity Theory as a Paradigm, for the Dynamical Law-and-Society System: A Wake-Up Call for Legal Reductionism and the Modern Administrative State*, 45 DUKE L.J. 849 *passim* (1996) (using complexity theory to develop a general behavioral model of legal system) [hereinafter Ruhl, *Complexity Theory as a Paradigm*]; J.B. Ruhl, *Sustainable Development: A Five-Dimensional Algorithm for Environmental Law*, 18 STAN. ENVTL. L.J. 31 (1999) (arguing that complexity theory's optimization algorithms should be used to guide sustainable development policy) [hereinafter Ruhl, *Sustainable Development*]; J.B. Ruhl, *The Fitness of Law:*

problems plaguing the modern regulatory state by applying complexity theory to the "sociolegal system"<sup>3</sup> of environmental law and regulation. He argues that complexity theory<sup>4</sup> provides the "unifying"<sup>5</sup> principles necessary to explain the underlying structure

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*Using Complexity Theory to Describe the Evolution of Law and Society and its Practical Meaning for Democracy*, 49 VAND. L. REV. 1407, (1996) (using complexity theory to develop a general evolutionary model of the legal system) [hereinafter Ruhl, *The Fitness of Law*]; J.B. Ruhl, *Thinking of Environmental Law as a Complex Adaptive System: How to Clean Up the Environment by Making a Mess of Environmental Law*, 34 HOUS. L. REV. 933 *passim* (1997) (arguing that environmental law and its subjects are complex adaptive systems) [hereinafter Ruhl, *Complex Adaptive System*]; J.B. Ruhl & Harold J. Ruhl, Jr., *The Arrow of the Law in Modern Administrative States: Using Complexity Theory to Reveal the Diminishing Returns and Increasing Risks the Burgeoning of Law Poses to Society*, 30 U.C. DAVIS L. REV. 405 *passim* (1997) (using complexity theory to describe the direction in which the behavioral and evolutionary mechanics are leading the sociolegal system given its current transient state) [hereinafter Ruhl & Ruhl, Jr., *The Arrow of Law*]; J.B. Ruhl & James Salzman, *Mozart and the, Red Queen: The Problem of Regulatory Accretion in the Administrative State*, 91 GEO. L.J. 757 *passim* (2003) (using complexity theory to develop an explanatory model of the primary agent of involuntary noncompliance—regulatory accretion) [hereinafter Ruhl & Salzmann, *Red Queen*].

<sup>3</sup> Ruhl, *The Fitness of Law*, *supra* note 2, *passim*.

<sup>4</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 857 n.9.

Trying to understand how dynamical systems evolve into that position of maximum sustainability is the focus of a branch of dynamical systems theory known as complexity theory. The message of complexity theory is that there is a 'sweet spot' in the spectrum of different system structure possibilities that provides the optimal blend of stability, simplicity, and adaptability needed to sustain the system.

*Id.*; see also *infra* Part I.

<sup>5</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 894 (arguing that "once [scientific] approximation no longer is good enough for the level of comfort we seek in our answers to the big questions, all dynamical behavior cannot be explained through these doctrines: Complexity theory represents an advancement in science because it explains why that is so in a unified theory.") (citation omitted); Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 419 (asserting that complexity theory has identified

properties of change that are common to many forms of dynamical systems. These properties can be grouped under

and evolution of the sociolegal system.<sup>6</sup> He describes the loosely-defined "law-and-society system"<sup>7</sup> within a framework premised upon complexity theory's concepts.<sup>8</sup> His explanation for the problems plaguing the environmental regulatory structure assumes that the law-and-society system is a "complex adaptive system"<sup>9</sup> and complexity theory should be used to produce the best strategies for regulatory reform.<sup>10</sup>

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several broad headings: (1) description of the behavior of the system according to the community of its components; (2) description of the mechanics of evolution in the system and the coevolution of that process with change taking place in surrounding, interconnected systems; and (3) description of the direction of change in terms of overall system behavior and success—the system's arrow.).

<sup>6</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 854 (building a model of the "law-and-society system" through illustration of "the lexicon of the scientific theorems that can be used by analogy to describe phenomena of that system").

Dynamical systems do have governing meta-principles; it's just that we will never find them by slicing up the system into smaller parts. Indeed, it is the most sustainable of systems that present the biggest challenge of that regard, for we know that an essential quality of systems that make it into the complex region is that they depend on some level of system coupling, which itself is contra-reductionist, and they sit poised on the edge of chaos, which defies prediction. American legal theory and institutions have not learned those features yet, but must do so eventually if we wish to understand and confront the dynamical qualities of the law-and-society system and swim back to the region of complexity.

*Id.* at 893; *see also infra* Part I.

<sup>7</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2 at 852.

<sup>8</sup> *See id.* at 868 n.37 (noting that complexity theory "owes its origins in large part to the study of how physical systems respond to external sources of disturbances, such as turbulence factors in fluid flows, an area of research that has advanced significantly with the benefit of a greater understanding of chaos behavior") (citation omitted).

<sup>9</sup> Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 416 (positing "that law can be usefully modeled as a complex adaptive system"); *see also infra* Part I.A.

<sup>10</sup> *See infra* Part I.

Ruhl's approach includes formulating a "theory of law"<sup>11</sup> that explains the behavior of legal systems<sup>12</sup> and provides a "nonideological, nonnormative basis"<sup>13</sup> for environmental regulatory reform. He strives to develop a coherent system of environmental law that will successfully adapt to the complexity underlying all phenomena.<sup>14</sup> Complexity theory is the answer to misguided regulatory traditions rooted in "reductionism."<sup>15</sup>

Ruhl astutely notes that relevant government organizations and environmental laws need to become more adaptive and resilient in the face of constant environmental change. He also proposes several noteworthy reforms to the current regulatory system, but he justifies his proposals with complexity theory's unifying principles. The unifying approach buries environmental regulations' essential normative character beneath complexity theory's scientific elegance. Ruhl overlooks the epistemological limits and the normative shortcomings of all-encompassing theories, glossing over important differences between America's law-and-society system and complex physical systems. The theoretical analysis of environmental regulations as an "undifferentiated whole"<sup>16</sup> undermines efforts to alleviate problems and justify regulatory reform proposals.

This Article critiques Ruhl's application of complexity theory to the system of environmental law and regulation. It argues that the unifying strategy is theoretically and practically untenable, producing a worldview at odds with understandings of humanity, normative judgments, and democracy.<sup>17</sup> Unifying theories

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<sup>11</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 854-55.

<sup>12</sup> Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 416; Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 855.

<sup>13</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1488.

<sup>14</sup> See Ruhl, *Complex Adaptive System*, *supra* note 2, at 942-43, 968; Ruhl, *The Fitness of Law*, *supra* note 2, at 1488-90; Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 416; Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 857; see also *infra* Part I.

<sup>15</sup> Ruhl, *Complex Adaptive System*, *supra* note 2, at 968; see also *infra* Part I.A.

<sup>16</sup> CASS R. SUNSTEIN, *AFTER THE RIGHTS REVOLUTION: RECONCEIVING THE REGULATORY STATE* 71 (1990).

<sup>17</sup> See *infra* Part II.

seductively play on human imagination and the desire for Utopia—or at least a world with a bit less uncertainty. The sociolegal version of complexity theory promises the impossible—a unifying link between the structures underlying physical systems, such as ecosystems, and the structures underlying the behavior and evolution of law.<sup>18</sup> Ruhl mistakenly argues that the law-and-society system, social systems, and physical systems mirror one another in a fundamental sense—that they may all be explained as complex adaptive systems.<sup>19</sup> He contends that we must “think as a complex adaptive system” to grasp the underlying, complex adaptive character of the environmental regulatory system.<sup>20</sup>

Part I of this Article introduces Ruhl's basic complexity theory concepts and his explanations of the environmental regulatory system. The discussion illustrates Ruhl's use of complexity theory's unifying principles to explain the behavior, evolution, and structure of the regulatory system. Part II demonstrates that complexity theory's concepts do not satisfactorily “translate”<sup>21</sup> regulatory system phenomena into “an analogical model of law and society as a unified dynamical system.”<sup>22</sup> It explains the theoretical limitations precluding reasonable application of complexity theory to a non-physical system from three distinct, but related, perspectives. First, it shows that the model does not “conform”<sup>23</sup> to reality; humans are sacrificed for an illusion of conceptual coherence.<sup>24</sup> Second, it examines the argument that complexity theory should be used to evaluate the “fitness” or “success” of a law,<sup>25</sup> and the consequences of that position for concepts of liberty

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<sup>18</sup> See *infra* Parts I-II.

<sup>19</sup> See *infra* Part I.

<sup>20</sup> Ruhl, *Complex Adaptive System*, *supra* note 2, at 980.

<sup>21</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 862; see also *infra* note 47.

<sup>22</sup> *Id.* at 855-56 n.7.

<sup>23</sup> See HELEN LONGINO, *THE FATE OF KNOWLEDGE* 117 (2001) (arguing that conformation is an improvement over classical truth “where degree and respects fall away. [Conformation] avoids the crudity of binary evaluation, and hence avoids one of the problems attributed to true or false.”) [hereinafter LONGINO, *FATE OF KNOWLEDGE*].

<sup>24</sup> See *infra* Part II.A.

<sup>25</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1451; see *infra* Parts I.A.3, II.B.

and democracy. The reconceptualization of laws as "species" and democracy as "neo-Darwinian sex" is fundamentally flawed; complexity theory's "explanatory power" does not reasonably account for political liberty or democracy.<sup>26</sup> Third, it discusses Ruhl's application of complexity theory to sustainable development policies and practices. The practical context further illustrates that the unifying approach produces unacceptable epistemic and normative ramifications for regulatory reform strategies.

Part III reviews several of Ruhl's reform proposals noting the need to release them from their complexity theory justifications. The theory's unifying principles undercut the wisdom of Ruhl's laudable reform proposals.<sup>27</sup> He convincingly argues that agencies' political power should be significantly curtailed by Congress, for example, by shifting the burden of proof in judicial proceedings to agencies. Congress should also become more proactive in environmental matters critical to advancing the public's interests; agencies' legislative functions are misguided. Ruhl's proposals for environmental regulatory reform easily shed their complexity theory rationale in favor of democratic and constitutional justifications.

Society should give up the unproductive pursuit of unifying theories purporting to explain the underlying structure of environmental law, policy, and regulation, and focus instead on the particular regulations and agency decision-making processes impeding the resolution of environmental conflicts. Practical solutions to regulatory problems develop *in context*, not through philosophical holism justified by "unifying" theories. Foundationalist<sup>28</sup> theories will never "screen off"<sup>29</sup> uncertainty or eliminate normative influences from regulatory decisions.

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<sup>26</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1417 (using "the development of environmental law to provide an example of the explanatory power of the Complexity Theory paradigm for the sociolegal system"). *See generally id.*

<sup>27</sup> *See infra* Parts II-III.

<sup>28</sup> "Foundationalists seek to identify what can serve as basic grounds in justification (i.e., grounds that themselves do not require justification)." LONGINO, *FATE OF KNOWLEDGE*, *supra* note 23, at 81.

<sup>29</sup> *See generally* NANCY CARTWRIGHT, *THE DAPPLED WORLD: A STUDY OF THE BOUNDARIES OF SCIENCE* 107-10 (1999) (discussing "screening off" and its role in building probabilistic causal models).

Democratic principles should guide efforts to improve the quality of the environmental regulatory system and its decision-making organizations. The hopeless endeavor of searching for "unifying" principles diverts valuable time and energy away from a productive, democratic renaissance in environmental law and regulation. "The answer to the defects of democracy is not denial of the democratic idea."<sup>30</sup>

# I. J.B. RUHL'S "UNIFYING" THEORY OF ENVIRONMENTAL LAW AND REGULATION

The application of complexity theory to the law-and-society system is necessarily complicated. Part I reviews Ruhl's use of complexity theory's basic concepts and principles to describe and explain the sociolegal system, before turning to his application of the theory to the environmental regulatory system. Complexity theory's fundamentals must be digested to understand its severe epistemic and normative consequences for environmental law and policy.

## A. *Applying Complexity Theory to the Law-and-Society System*

Ruhl explains the behavior<sup>31</sup> and evolution<sup>32</sup> of the socio-legal system<sup>33</sup> in terms of complexity<sup>34</sup> theory,<sup>35</sup> while targeting the

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<sup>30</sup> FELIX FRANKFURTER, *THE PUBLIC & ITS GOVERNMENT* 128-29 (1930).

<sup>31</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, *passim*; Ruhl, *Complex Adaptive System*, *supra* note 2, *passim*.

<sup>32</sup> See Ruhl, *The Fitness of Law*, *supra* note 2, *passim*; Ruhl & Ruhl, Jr., *The Arrow of the Law*, *supra* note 2, *passim*.

<sup>33</sup> Certainly anything that improves our understanding of how the environment works, as many scientists believe complexity theory has done, should also improve our ability in the long run to manage the environmental consequences of social activity. But my focus is not exclusively on nature's dynamical environmental system; rather, we must also consider the dynamical forces within the legal system we devise to manage our impacts on the environment. Law, in other words, has the capacity to operate as a complex adaptive system.

Ruhl, *Complex Adaptive System*, *supra* note 2, at 937-38 (citation omitted).

<sup>34</sup> See Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 410-11 n.6.

law-and-society system's structure for comprehensive, fundamental reform.<sup>36</sup> Traditional, reductionist approaches to legal theory and

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Unfortunately, 'complex' is the best term to use to describe both the structure and the behavior of many nonlinear dynamical systems. When referring to structure, complexity generally means many system components, complicated organizations, intricate details, and so on. When referring to behavior, complexity generally is associated with adaptive and robust sustainability of the system. The distinction is crucial for . . . a simply structured system could behave complexly, and a complexly structured system could behave simply.

*Id.*

<sup>35</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 857 n.9.

Although the familiar label for dynamical systems theory is *chaos* theory, in fact what is known as *complexity* theory more fully captures the whole picture of dynamical systems behavior than the scientific research has revealed. . . . Dynamical systems theory is developing, and there is not complete agreement in the scientific literature as to its lexicon or meaning. . . . [D]ynamical systems theory has been developing as fast as advancements in computers allow, and complexity theory represents its most advanced model.

*Id.* (citation omitted).

<sup>36</sup> See Ruhl, *The Fitness of Law*, *supra* note 2, at 1418-19.

The centralized federal regulatory state, [is] . . . impeding the adaptiveness of the American sociolegal system. With Complexity Theory as a foundation, I make the case that it may be time for a long jump out of those outmoded structures and towards a more adaptive system which may be realized through greater reliance on common law and other nonfederal initiatives.

*Id.*

[W]e should reexamine the schemata and structures of our laws. To the extent they are premised on the need for centralized federal administrative control and that need has been reduced or eliminated, laws based on those premises may not be fit for much longer. . . . Solutions not permitted in the federal domination scheme may prove more fit, but we are hindered from reaching them while stuck in the local landscape of the administrative state and trying as hard as we might to keep it from changing below our feet. We need, in other words, to evolve, and to do so expeditiously through long jumps to new schemata and structures.

reform are self-defeating, "causing us to focus on attempting to achieve absolute system predictability by adopting an increasingly complicated architecture of rules and organizations."<sup>37</sup> Reductionist views<sup>38</sup> fail to account for the chaos,<sup>39</sup> catastrophe,<sup>40</sup>

*Id.* at 1486.

Law and society interact together, and can be thought of as doing so in a nonlinear dynamical manner. The law-and-society system model in this sense exhibits qualities similar to those which scientists have observed in other natural and social systems. For legal theory and legal institutions to ignore the findings of dynamical systems theory, therefore, is to remain ignorant of the underlying qualities and evolution of the law-and-society system model. . . .

I have also taken a risk . . . and posited the first steps for reforming the system toward nonreductionist structures intended to carry the law-and-society system toward the region of dynamical complexity.

Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 927.

In general, therefore, those making laws must alter their focus from reductionist, problem-specific approaches to system-level approaches. They must also recognize that the complexity of legal structure itself is often the cause of social problems. Both structurally and philosophically, therefore, self-critical measures can be taken to stem the tide of increasing legal structure before social collapse does so instead.

Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 475.

<sup>37</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 859-60.

<sup>38</sup> When reductionism has prevailed, it has prevented that insight from becoming an organizing principle of study because reductionism is premised largely on five extremely intuitive, but false, principles:

1. Small, gradual changes in causes give rise to small, gradual changes in effects.
2. Deterministic rules of behavior give rise to completely predictable events.
3. All real-world truths are the logical outcome of following a set of rules.
4. Complicated systems can always be understood by breaking them down into simpler parts.
5. Surprising behavior results only from complicated, hard-to-understand interactions among a system's component parts.

and emergence<sup>41</sup> phenomena characterizing complex adaptive

*Id.* at 893-94 (citing JOHN L. CASTI, COMPLEXIFICATION (1994)). "These are the subheadings for the second through sixth chapters from Casti's book on complexity theory." *Id.* at 895 n.116.

<sup>39</sup> "Chaos occurs when the deterministic rules of the system produce seemingly random system behavior." *Id.* at 856. "That is *chaos*: sensitive dependence on initial conditions in a system dictated by simple, deterministic rules produces what appears to be highly complicated, random system behavior. Chaos, in that sense, is 'order *masquerading* as randomness,' and it is the unmistakable fingerprint of a strange attractor." *Id.* (quoting JAMES GLEICK, CHAOS 22 (1987)). "The rules determining the presence of chaos may be simple, but the organizing structure of the overall system, known technically as the system's 'fractal curve,' is not at all simple." *Id.* (citing PETER COVENEY & ROGER HIGHFIELD, THE ARROW OF TIME 362 (1990)). "Thus, chaos 'only looks complicated because you don't know what the rule is.'" Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 867-77. (quoting JACK COHEN & IAN STEWART, THE COLLAPSE OF CHAOS 197 (1994)).

<sup>40</sup> "Catastrophe occurs when a system suffers a discontinuity that radically shifts the location and trajectory of the system." *Id.* at 856.

That is *catastrophe*: a sudden qualitative change in a dynamical system brought about by a continuous change in a system variable. Catastrophe disturbances change the attractors of the dynamical system, and "it may take only the tiniest of changes to trigger the switch." The two subtle features of catastrophe thus are that large changes in behavior can result from arbitrarily small changes in conditions, and that after the system crosses the catastrophe point it may land near or on a previously unfamiliar, or perhaps even unknown, attractor.

*Id.* at 878 (quoting COHEN & STEWART *supra* note 39, at 212) (emphasis in original).

<sup>41</sup> "Emergence is characterized by changes in the system's trajectory as a result of the self-organized patterns of interaction between the system's components." *Id.* at 856.

That is *emergence*: the appearance of unforeseen qualities from the self-organizing interaction of large numbers of objects, which cannot be understood through study of any one of the objects. The key to emergence is understanding that the emergent behaviors of dynamical systems are "high-level patterns arising from the indescribably complex interaction of lower-level subsystems." Hence, removing or otherwise changing any interacting component of the system potentially changes the entire system since the interactions leading to the global emergent behaviors may no longer be possible. The presence or

systems, unintentionally threatening the system with "social collapse."<sup>42</sup> The backdrop of scientific reductionism led to a regulatory structure that precludes constructive, systemic change.<sup>43</sup> Regulatory reform must produce a revolutionary, decentralized law-and-society system<sup>44</sup> designed to enhance adaptability and avoid reductionist tendencies.<sup>45</sup>

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not of emergence thus depends on the condition of the system as a whole.

*Id.* at 877-78 (quoting COHEN & STEWART, *supra* note 39, at 397) (emphasis in original).

<sup>42</sup> Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 475, 467-69 (providing a general discussion of social collapse).

[C]lassical American legal theory and legal institutions, like classical science, are based on the reductionist tenet that through ever finer decompositions of the system we can discover the system's governing meta-principles. Chaos, emergence, and catastrophe do not lend themselves to analysis through such dissection, and thus are "an enormous problem for reductionism."

Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 893 (quoting COHEN & STEWART, *supra* note 39, at 191).

<sup>43</sup> See *id.* at 859-60 (arguing that "hyperdetailed regulation and ingrained reliance on top-heavy administrative structures have buried the more fundamental legal structures—the first principles—so deep that we no longer can explain, much less predict, how the law-and-society system will respond to a new socio-legal challenge"); Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 860.

<sup>44</sup> The unifying theme of [complexity theory] is that it is not just the rules of the system that matter but the entire system structure. Hence, legal reform directed at the goals of increasing system adaptability must focus on working with the complete law-and-society system, not on just tinkering with laws.

Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 889-90; cf. RORTY, *supra* note 1, at 315-16 (arguing that "[t]he notion that there is permanent neutral framework whose 'structure' philosophy can display is the notion that the objects to be confronted by the mind, or the rules which constrain inquiry, are common to all discourse, or at least to every discourse on a given topic").

<sup>45</sup> [P]erhaps more so in law than in any other field of humanities does a culture of reductionism doom the system, for only in the law-and-society system do the system components [i.e., humans] get to write the rules and decide whether to obey them. When those rules—society's laws—are written, studied, and evaluated

## 1. An Overview of the Sociolegal Model

Ruhl contends that complexity theory applies to the sociolegal system and other non-physical domains through an analogical model.<sup>46</sup> He experiments with the "observational form of [complexity theory] . . . through application to an analogical model of law and society as a unified dynamical system."<sup>47</sup> Following in

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from a predominantly reductionist perspective, we inevitably are befuddled when the dynamical system surprises produced by chaos, emergence, and catastrophe occur. Fighting those phenomena with more reductionist approaches leads us only further into the abyss.

Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 859.

<sup>46</sup> Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 436-37 ("The general model of system change offered by complexity theory fits the sociolegal system. Whether that fit is direct or simply one of analogy, the model provides a new and powerful analytical tool for assessing the process of sociolegal evolution."); Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 862 ("Dynamical systems theory provides a lexicon . . . [that] can easily be used through analogy to describe a model for the interaction of law and society.") (citation omitted); Ruhl, *The Fitness of Law*, *supra* note 2, at 1417 ("The Complexity Theory fitness landscape paradigm is simply a powerful way of explaining dynamical system evolution generally. Indeed, law and society being, as I analogize, in a dynamical system relationship, the concept of an evolving fitness regime for the sociolegal system seems worth exploring."); *see also* Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 862 n.19.

As Geu points out, at least one legal commentator has suggested direct applicability of dynamical systems theory to the law-and-society system, whereas [Geu] prefers to leave it as a metaphorical relationship. . . . I am not convinced the relationship is one of direct applicability or simple metaphor, and thus I choose to describe it as analogical.

*Id.* (citing Thomas E. Geu, *The Tao of Jurisprudence: Chaos, Brain Science, Synchronicity, and the Law*, 61 TENN. L. REV. 933, 935 (1994)); Ruhl, *Complex Adaptive System*, *supra* note 2, at 944.

It may be too soon to tell whether complexity theory represents a scientific revolution in the Kuhnian sense, but it is not too soon to say that complexity theory, despite its detractors, has pushed its way into the forefront of research in virtually every field of physical and social science.

*Id.* (citations omitted).

<sup>47</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 855-56 n.7.

the footsteps of researchers in other disciplines,<sup>48</sup> Ruhl applies complexity theory concepts to describe the law-and-society system.<sup>49</sup>

The interaction of law, society, and the real world environment in which that system is embedded can be described through analogy to a nonlinear dynamical system. The playing space<sup>50</sup> is the full socio-legal dimension—that is, anything that has to do with the interaction of law and society as broadly as we wish to define those two domains. The rules of motion<sup>51</sup> are laws themselves, on the law side, and social mores and ethics, on the society side. The initial state,<sup>52</sup> at its most distant, was when society first emerged, but for purposes of this study, it is whenever we want to begin examining the effect of a new rule of motion on the system. The trajectory<sup>53</sup> is the rate and direction of the historical socio-legal evolution of the total system in phase space.<sup>54</sup>

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<sup>48</sup> See Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 436-37 (noting that "other disciplines embraced the model long before legal theorists have. They have been using the model to make important findings about the fate of complex structure and behavior in various settings, including proteins, immune systems, brain circuits, economies, cultures, and ecosystems.") (citations omitted).

<sup>49</sup> See Ruhl, *Complex Adaptive System*, *supra* note 2, at 954-67.

<sup>50</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 863. "Each dynamical system has an n-dimensional *playing space*, known technically as a manifold or phase space, which contains all the possible system states." *Id.* (citation omitted).

<sup>51</sup> "Each system also must have a set of *rules of motion*, known technically as vector fields, which tell the system components where and how to go next from wherever they are now." *Id.* at 863.

<sup>52</sup> "The initial state, also known as the initial condition, consists of '[t]he quantities (such as position and velocity) which must be specified at an initial moment in time in order to predict subsequent behavior.'" *Id.* at 863 n.23 (quoting COVENEY & HIGHFIELD, *supra* note 39, at 362).

<sup>53</sup> "Thus, '[a]s the system evolves in time it maps out a trajectory in the phase space.'" *Id.* at 863 n.22 (quoting COVENEY & HIGHFIELD, *supra* note 39, at 364).

<sup>54</sup> *Id.* at 867.

As do all such dynamical systems, the analogical law-and-society

The complex "system's behavior is defined by the number and character of [the system's] attractors."<sup>55</sup>

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system model has a multi-dimensional playing field, or "space," within which the system dynamics occur; it is governed by a nonfinite set of rules prescribing the system's trajectory, and that trajectory is hurtling among basins of influence defined by the system's "attractors."

Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 854.

[P]hase space is not simply the four-dimension space-time space that we observe in the physical world, but rather an *n*-dimensional playing field, with *n* being all the relevant variables of system operation, within which the instantaneous state of the system is a single point representing the concurrently instantaneous values of all the variables of the system.

*Id.* at 862-63 n.21 (citations omitted).

<sup>55</sup> *Id.* at 863. "Find the attractors and you will understand the system as much as current science allows, for while any point in the playing space can define the system's behavior for the very short term, in the long term 'the only possible behaviors are the attractors themselves.'" *Id.* at 864 (quoting JAMES GLEICK, *CHAOS* 138 (1987)). "[I]n dynamical systems theory parlance there are three types of attractors of relevance to this discussion: *fixed point*, *limit cycle*, and *strange*. Each type of attractor corresponds to a type of dynamical system behavior pattern." *Id.* at 863-64 (citations omitted).

One type of behavior would be represented by a trajectory moving towards a fixed point in the plotting space. This is known as a fixed point attractor system exhibiting stable steady state behavior in which all of its variables stop changing (stasis) once it is on the attractor. In a more complicated type of behavior, the system, once on the attractor, exhibits a cyclical, trajectory repeatedly visiting some fixed set of points. This is known as a limit cycle attractor system exhibiting stable periodic behavior. In the third type of behavior, the system's trajectory would be plotted as a tangled web buzzing around the surface of its attractor in a never-repeating, never-crossing, aperiodic trajectory. This is known as a strange attractor system exhibiting chaotic behavior. Strange attractors are a core subject matter of complexity theory.

Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 419-20. "An attractor is simply a model representation of the potential long term behavior of the system, a useful concept for exploring different kinds of long-term behavior." *Id.* at 419 n.27 (citing COVENEY & HIGHFIELD, *supra* note 39, at 360). "The attractor is not

The law-and-society system's adaptive state (which optimizes "balance"<sup>56</sup> among the attractors) is threatened by the current system's reductionist structure.<sup>57</sup> The system structure needs to be adjusted to enhance "the degree to which the system exhibits complexity and thus the ability to adapt."<sup>58</sup> The law-and-society system optimizes "sustainability" when the attractors' influence moves the system closer to the chaotic state without sacrificing the system's order.<sup>59</sup> The complex system's resulting "state" describes the relation of the attractors when sustainability is achieved.<sup>60</sup>

## 2. "The Complicating Factor of Human Free Will"<sup>61</sup>

Ruhl argues that the sociolegal model illustrates how the system's rules of motion—its laws—behave given a system component's—a human's—potential exercise of free will.<sup>62</sup> When applied to physical systems, complexity theory allows researchers

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a force of attraction or a goal-oriented presence in the system, but simply depicts where the system is headed based on the rules of motion in the system." *Id.* (citing COHEN & STEWART, *supra* note 39, at 206-07). *See generally id.* at 420-26 (discussing the relationship between attractors and chaos, emergence, and catastrophe and the adaptive system concepts' analogical relation to law).

<sup>56</sup> *See* Ruhl, *The Fitness of Law*, *supra* note 2, at 1442 ("When a 'community' of fixed and strange attractors is assembled in the proper balance, therefore, the forces of order and disorder combine to allow the system to operate at optimal adaptability, that is, to operate as what is known as a Complex Adaptive System.") (citation omitted); Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 890 n.108 ("By balance I do not mean equilibrium in the familiar sense of stasis, which would be the result of a system defined exclusively by a fixed point attractor. Complex systems—sitting on the edge of chaos—are far from that sort of equilibrium.").

<sup>57</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 890-91; *see also supra* notes 36-45 and accompanying text.

<sup>58</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 889-90, 928.

<sup>59</sup> *Id.* at 890.

<sup>60</sup> *Id.*

<sup>61</sup> *Id.* at 855.

<sup>62</sup> *See id.* at 867-68.

to build computer models describing the rules of motion governing components' behaviors.<sup>63</sup> Human components, however, present unique problems that Ruhl classifies under "free will."<sup>64</sup> "Humans are not that accommodating, and attempting to 'program' or 'model' their exercise of discretion requires more of dynamical systems theory than science may ever have to offer."<sup>65</sup>

Ruhl contends that human free will "eliminates [the] possibility of . . . a stationary model."<sup>66</sup> Free will can, however, help explore the application of complexity theory to the law-and-society system model.<sup>67</sup> He uses "free will as the parameter for defining the system's law attractors,"<sup>68</sup> asking "when confronted by the potential for exercise of free will . . . how does the law side of the law-and-society system behave?"<sup>69</sup>

Ruhl posits that on the law side of the sociolegal system, freedoms,<sup>70</sup> rights,<sup>71</sup> and regulations<sup>72</sup> are important attractors defining how the system uses laws to address "the complicating factor of human free will."<sup>73</sup> The Supreme Court's decision in *Lucas v. South Carolina Coastal Council* provides insight into the relationship among law, the law attractors,<sup>74</sup> and free will.<sup>75</sup>

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<sup>63</sup> *Id.* at 867 (noting that "[w]hen a mathematician programs a dynamical system into a computer model, the components obey the rules as given"); see also *supra* notes 49-55.

<sup>64</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 867.

<sup>65</sup> *Id.*

<sup>66</sup> *Id.* at 867-68.

<sup>67</sup> *Id.* at 868.

<sup>68</sup> *Id.*

<sup>69</sup> *Id.*

<sup>70</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 873-74 (stating that "[f]reedom is a person's ability to act without restriction in accord with his own subjective free will in the absence of any countervailing right or regulation").

<sup>71</sup> *Id.* ("A right is the ability, enforced by society, of one person to constrain another's freedom in the absence of direct governmental intervention.").

<sup>72</sup> *Id.* ("A regulation is society's direct intervention with respect to exercise of a freedom, regardless of the exercise of any one individual's rights.").

<sup>73</sup> *Id.* at 855. "Humans pose a complication for the model in the form of free will." *Id.* at 867 (citation omitted).

<sup>74</sup> See *supra* notes 70-72.

<sup>75</sup> 505 U.S. 1003 (1992).

The *Lucas* decision<sup>76</sup> illuminates the new meanings traditional legal concepts acquire in the law-and-society system.<sup>77</sup>

The result is that the *freedoms* to use property as one wishes are limited by the *rights* others have to recover in nuisance and the ability of the government to duplicate the effect of those rights through direct *regulations*. If one could "map" the locations of freedoms, rights, and regulations in the law-and-society system's playing space, the regulatory takings doctrine as a law value would be on the law-and-society system's trajectory somewhere between these three attractors.<sup>78</sup>

Law resolves the free will dilemma "through the balance of freedoms, rights, and regulations."<sup>79</sup>

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<sup>76</sup> Ruhl quotes the following section from the *Lucas* opinion:

We believe . . . confiscatory regulations, *i.e.*, regulations that prohibit all economically beneficial use of land . . . cannot be newly legislated or decreed (without compensation), but must inhere in the title itself, in the restrictions that background principles of the State's law of property and nuisance already place upon land ownership. A law or decree with such an effect must, in other words, do no more than duplicate the result that could have been achieved in the courts—by adjacent landowners (or other uniquely affected persons) under the State's law of private nuisance, or by the State under its complementary power to abate nuisances that affect the public generally, or otherwise.

Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 869 (quoting *Lucas*, 505 U.S. at 1027).

<sup>77</sup> *Id.* at 870.

<sup>78</sup> *Id.*

<sup>79</sup> *Id.* at 874-75.

Hence, although it may not always manifest itself as neatly as it did in *Lucas*, law contributes to the resolution of issues of free will in a law-and-society system—contract disputes, gender discrimination, environmental pollution, or whatever else—through the balance of freedoms, rights, and regulations. Those are the law-and-society system's attractors for determining the mix of law-based mechanisms for managing the

### 3. The "Nonideological, Nonnormative Basis"<sup>80</sup> for Regulatory Reform

Complexity theory's improved version of evolutionary theory<sup>81</sup> provides the conceptual foundation for Ruhl's attempt to develop a "nonideological, nonnormative basis" for regulatory change.<sup>82</sup> He describes change in the law as a mechanical process<sup>83</sup> occurring

complications posed by human freedom of will.

*Id.*

<sup>80</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1488.

<sup>81</sup> *See id.* at 1416. "The real feat of Complexity Theory, however, is in accommodating the competing order and chaos themes of evolutionary biology in one unified theory." *Id.* "[T]he fitness landscape model of Complexity Theory, by unifying the uphill march of natural selection with the downhill error catastrophe made possible by species selection, begins to adjust the neo-Darwinian theoretical features to the reality of evolution." *Id.* at 1453; *see also* Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 418.

One of complexity theory's most striking developments has been identifying properties of change that are common to many forms of dynamical systems. These properties can be grouped under several broad headings: (1) description of the behavior of the system according to the community of its components; (2) description of the mechanics of evolution in the system and the coevolution of that process with change taking place in surrounding, interconnected systems; and (3) description of the direction of change in terms of overall system behavior and success—the system's arrow.

*Id.*

<sup>82</sup> *See* Ruhl, *The Fitness of Law*, *supra* note 2, at 1488; Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 416 (arguing that complexity theory provides the foundation to build "a coherent model of law's process of change").

<sup>83</sup> *See* Ruhl, *The Fitness of Law*, *supra* note 2, at 1449. "Complexity Theory uses the metaphor of a topographic landscape to describe the mechanics of dynamical system evolution and the resulting fitness of a species relative to its environment." *Id.* (citation omitted); *see also* Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 434. "As complexity theory develops deeper understandings of the mechanics of fitness landscapes and system coevolution, perhaps the dynamics of legal evolution will be better understood as well." *Id.* *See generally* Ruhl, *The Fitness of Law*, *supra* note 2, at 1448-56 (discussing the mechanics of the evolving environmental law); Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 429-34 (discussing the mechanics of coevolution of systems by illustration of the "fitness landscape metaphor").

dynamically and interdependently through the co-evolution of the "law" and "society" subcomponents within the law-and-society system.<sup>84</sup> Law's evolution is not described solely in terms of the rules of motion—"laws . . . on the law side, and social mores and ethics, on the society side,"<sup>85</sup> nor exclusively as an incremental historical process resulting primarily from normative choices.<sup>86</sup> Evolutionary explanations relying upon a historical discussion of human choices "fail to convey an essential characteristic of the process—law can only move in one direction along its path of change."<sup>87</sup> Ruhl relies upon the unifying power of complexity theory to describe law's evolution "not as movement along a gradual, straight, up-hill slope, but over a topography of fitness peaks, valleys, and planes—a fitness landscape."<sup>88</sup>

Individual laws are analogous to organisms within complexity theory's improved explanation of Neo-Darwinian evolution.<sup>89</sup> Law's success is a function of "fitness."<sup>90</sup> "Fitness of laws, just as for

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<sup>84</sup> See Ruhl, *The Fitness of Law*, *supra* note 2, at 1437-67; Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 854; Ruhl, *Co-Evolution*, *supra* note 2, at 166.

Two key co-evolutionary design properties of such [complex] systems are (1) their focus on multi-trait optimization goals rather than single-trait maximization goals and (2) the mix of cooperation, competition, and conflict they adopt in their adaptive, evolutionary decision-making strategies. These properties define how complex adaptive systems, including legal systems, will seek to maintain fitness in their environments, and how successful they will be at doing so.

*Id.*

<sup>85</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 867; see also *supra* notes 49-55 and accompanying text.

<sup>86</sup> See Ruhl, *The Fitness of Law*, *supra* note 2, at 1448-54; Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 414-17.

<sup>87</sup> Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 415-16 (arguing that "[w]hen society wants to change the direction of law, it can make a sharp turn towards the path that might have been, but it can not retrace its steps. The path of the law is a one-way street; it has an arrow.").

<sup>88</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1416 (citation omitted); see also *id.* at 1453-58; Ruhl, *Sustainable Development*, *supra* note 2, at 45.

<sup>89</sup> See Ruhl, *The Fitness of Law*, *supra* note 2, at 1453; see also *id.* at 1437-57.

<sup>90</sup> *Id.* at 1451; see also *id.* at 1449-50 (explaining that "[m]ost biological definitions of species fitness involve some measure of a species' propensity to

species, is measured in terms of how successful the law is in meeting its goals. . . . A law is fit if it achieves its policy."<sup>91</sup> Complexity theory provides a view of the law-and-society system that permits the assessment of a law's success independently of other (e.g., normative) evaluation methods.<sup>92</sup>

The point, of course, is that the fitness of a normatively undesirable law—a law the policy for which no longer is (or perhaps never was) one we wish to pursue in the sociolegal system—may lead us to consider the need for modifying or repealing the law more immediately and more thoroughly . . . .<sup>93</sup>

#### *B. Applying Complexity Theory to Environmental Law*

Environmental law provides an important opportunity for the application of the complexity theory to the law-and-society system model.<sup>94</sup>

Environmental law, as much as any component of the law-and-society system, has witnessed a flux and struggle in the system's movement between freedoms, rights, and regulations as to which has been

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contribute offspring. The whole point of evolutionary theory is determining whether such fitness changes with variations in the behavior and structure of the organism, and if so, in what direction and to what degree.") (citation omitted).

<sup>91</sup> *Id.* at 1451; see also *id.* (stating that "[t]he goals of laws are those expressed as the motivation for legislative enactment or judicial decision—what we might call the law's policy").

<sup>92</sup> *Id.* (arguing that "it is crucial that we disaggregate questions of fitness from questions of desirability in law, for it is important to know as an independent matter whether a law is or is not successful in fulfilling its goals on a sustainable basis").

<sup>93</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1451-52.

<sup>94</sup> See Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 460 (noting that "the story of environmental law is the story of society increasing legal structure to solve problems, but facing diminishing returns along the way").

and will be the dominant attractor.<sup>95</sup> Describing a law-and-society system through analogy to the lexicon of dynamical systems theory allows us to understand better how the system chooses from these various instruments for implementing socio-legal structures.<sup>96</sup>

Ruhl develops three themes to justify the application of complexity theory to the environmental law system.<sup>97</sup> First, many of the subjects of environmental law (Ruhl outlines, for example, ecosystems,<sup>98</sup> technology,<sup>99</sup> economies,<sup>100</sup> and land use<sup>101</sup>) consist of "interlinked complex adaptive systems."<sup>102</sup> Second, the environmental law system does not account for the adaptive

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<sup>95</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 855 n.6.

As Professor William H. Rodgers, Jr. states: "The catchword for the study of environmental law is complexity . . . . The field presents an ongoing kaleidoscope of tussling organizations, interests, jurisdictions, and states where strategies, goals and outcomes are subject to constant redefinition." This complicated, evolving quality of environmental law, plus environmental law's intricate connection to changing social perceptions, make it a prime candidate for nonlinear dynamical systems theory. To the extent environmental law is in this respect more 'unstable' than other fields of law, lessons dynamical systems theory teaches us about environmental law provide all the more value to the general thesis of how we go about promoting sustainability of the law-and-society system.

*Id.* (quoting WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW § 1.2, 24-25 (1994)); *see also* Ruhl, *Co-Evolution*, *supra* note 2, at 171 (arguing that environmental law "must" be designed "as a complex adaptive system") (citation omitted).

<sup>96</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 855; *see also id.* at 880-86 (describing "Chaos, Emergence, and Catastrophe as . . . Powerful Descriptive Tools for Legal Theory" through environmental law case studies).

<sup>97</sup> Ruhl, *Complex Adaptive System*, *supra* note 2, at 939, 941.

<sup>98</sup> *Id.* at 954.

<sup>99</sup> *Id.* at 958.

<sup>100</sup> *Id.* at 962.

<sup>101</sup> *Id.* at 964.

<sup>102</sup> *Id.* at 939; *see also* Ruhl, *Complex Adaptive System*, *supra* note 2, at 980-91.

complexity characterizing its subject matter.<sup>103</sup> Consequently, the regulatory apparatus is unable to effectively respond to environmental challenges; "it is mired in a reductionist, linear, predictivist mentality ignorant of underlying complex system behaviors."<sup>104</sup> Third, regulatory "deregulation" and incremental regulatory "reinvention" models are fundamentally inadequate to cure the incoherence and inconsistency permeating environmental law; these models "are misguided responses based on outdated conceptions of law and society that conceal the complex adaptive nature of the legal system."<sup>105</sup>

In order for environmental law to function well as a complex adaptive system, it should include five behavioral design features: "[a]ggregation,"<sup>106</sup> "[f]lows,"<sup>107</sup> "[n]onlinearity,"<sup>108</sup> "[d]iversity,"<sup>109</sup> and "[s]elf criticality."<sup>110</sup> In theory, principles of "aggregation" or "emergent collective behavior"<sup>111</sup> explain how the system's decision-making processes achieve positive, adaptive

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<sup>103</sup> *Id.* at 940. "[T]he second theme . . . is that our present framework of environmental law is designed as if its subject matter is dictated by uniformitarianism rather than a set of dynamic, adaptive systems." *Id.* (citation omitted); *see also id.* at 980.

<sup>104</sup> *Id.* at 940-41.

<sup>105</sup> *Id.* at 941; *see also* Ruhl, *Complex Adaptive System*, *supra* note 2, at 980.

Law is one of society's problem-solving mechanisms. As complex adaptive systems research has demonstrated . . . it is very difficult to solve problems in such systems unless you think like a complex adaptive system. I posit, therefore, that the environmental law we use to address the problems of the future in environmental quality must itself incorporate the qualities of its subject matter—in other words, we *must* think of environmental law as a complex adaptive system.

*Id.*

<sup>106</sup> *Id.* at 981.

<sup>107</sup> *Id.* at 983.

<sup>108</sup> *Id.* at 986.

<sup>109</sup> *Id.* at 989.

<sup>110</sup> Ruhl, *Complex Adaptive System*, *supra* note 2, at 990.

<sup>111</sup> *Id.* at 945.

results by maximizing the number of decision-making components ("patches"<sup>112</sup>) and enhancing the degree to which they are "intertwined, or 'coupled.'"<sup>113</sup> New information "flows" informing the sociolegal system's decisions should be patterned after the "market," which is "highly adaptive and open ended—the difficulty is not in our inventing it, but in our not getting in its way."<sup>114</sup> In contrast with such an adaptive system model, Ruhl contends that the modern administrative state's reductionist organization, linear perspective, and predictivist purpose "has managed to clog the information flow pipes. . . ."<sup>115</sup> The sociolegal system's design should also reflect that disturbance is necessary to create "diversity," fostering learning and long-term system adaptability.<sup>116</sup>

The new system design must overcome agencies' tendencies to rely upon a linear, "quantitative-based command-and-control model."<sup>117</sup> "Nonlinearity" characterizes the behavior of system components oscillating between "deterministic randomness," or

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<sup>112</sup> See Ruhl, *The Fitness of Law*, *supra* note 2, at 1474 (explaining that "[p]atchiness refers to the degree of dispersal of lawmaking power, and coupling refers to the degree of interrelatedness between the units into which that power is dispersed").

<sup>113</sup> Ruhl, *Complex Adaptive System*, *supra* note 2, at 945; see also Ruhl, *The Fitness of Law*, *supra* note 2, at 1469 (arguing that

the basic idea of patch procedure is simple: take a hard, conflict-laden task in which many parts interact, and divide it into a quilt of nonoverlapping patches. Try to optimize within each patch. As this occurs, the couplings between parts in two patches across patch boundaries will mean that finding a 'good' solution in one patch will change the problem to be solved by the parts in adjacent patches.).

<sup>114</sup> Ruhl, *Complex Adaptive System*, *supra* note 2, at 985, 984-86.

<sup>115</sup> *Id.* at 984.

<sup>116</sup> See *id.* at 990. "When the pendulum of disturbance stops, the breeding ground of diversity runs dry. If we plant a stake in the ground and say that is where environmental law will stick, even if we are supremely pleased with where it is at the moment, we have at that point stopped learning." *Id.*; see also *infra* notes 118-26 and accompanying text.

<sup>117</sup> Ruhl, *Complex Adaptive System*, *supra* note 2, at 988.

chaos, and order.<sup>118</sup> The subjects of environmental law function as complex adaptive systems,<sup>119</sup> but the command and control model's poor design precludes reasonable policy choices.<sup>120</sup> The sociolegal system must incorporate nonlinear features to open the door for flexible experimentation with environmental policy and regulations.<sup>121</sup> Finally, self criticality requires the ongoing reevaluation of the complex design attributes addressing issues of aggregation, flows, nonlinearity, and diversity.<sup>122</sup> Ruhl suggests that the five system design features<sup>123</sup> "should be the guiding principles of environmental law."<sup>124</sup> He argues that in the absence of structural change, the command and control model's reductionist features will inhibit learning and curb system adaptability.<sup>125</sup> "[F]or the environmental law system to be adaptive, it has to learn . . . Learning in a management context, when the subject matter itself is complex and adaptive, requires sustained creative interference—events that tilt the apple cart—and a willingness to treat the logic of yesterday as 'a disposable expedient.'"<sup>126</sup> Furthermore, the failure to design the regulatory structure by "think[ing] of

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<sup>118</sup> *Id.* at 946-47.

<sup>119</sup> *See id.* at 943. "The subject matter of environmental law, in other words, consists of complex adaptive systems, and hence it behooves environmental policy decision makers to examine what the science of complex adaptive systems has to say about how such systems behave, evolve, and co-evolve." *Id.*

<sup>120</sup> *See id.* at 968.

[B]oth the present structure of the law as well as the most touted proposed reforms display an amazing degree of ignorance of complex adaptive system dynamics. The underlying tradition of environmental law . . . is based on a conception of nature as uniformitarian, a nature in which change takes place, but in the form of trends that are capable of extrapolation and prediction which lead toward an ordered state of equilibrium. We know that this paradigm is a fiction; so why does our legal framework cling to it?

*Id.*

<sup>121</sup> Ruhl, *Complex Adaptive System*, *supra* note 2, at 987-88.

<sup>122</sup> *Id.* at 990-91.

<sup>123</sup> *See supra* notes 106-10 and accompanying text.

<sup>124</sup> Ruhl, *Complex Adaptive System*, *supra* note 2, at 991.

<sup>125</sup> *Id.* at 988-89.

<sup>126</sup> *Id.* at 989 (citation omitted).

environmental law as a complex adaptive system"<sup>127</sup> will encourage counter-productive rule accretion<sup>128</sup> and potential societal collapse.<sup>129</sup>

C. "Regulatory Accretion"<sup>130</sup>

Although the sociolegal system took great strides in the 1970s toward improved forms of environmental regulation, the sociolegal system has failed to keep pace with an evolving culture,<sup>131</sup> leading Ruhl to claim that the "single largest threat to the modern administrative state is itself."<sup>132</sup> Ruhl applies complexity theory to the modern environmental regulatory structure to demonstrate the rule accretion phenomenon.<sup>133</sup> Rule accretion occurs when cultures

<sup>127</sup> *Id.* at 980.

<sup>128</sup> See Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 452; see also *infra* Part I.C.

<sup>129</sup> See Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 452.

<sup>130</sup> Ruhl & Salzman, *Red Queen*, *supra* note 2, at 782-87.

<sup>131</sup> *Id.* at 432-33.

[I]n the 1970s, the system made a long jump to what was then a much fitter form of regulation—command-and-control statutes. . . . [t]he rest of society [however,] has . . . evolved in response to that statutory response and today poses very real challenges to the fitness of the command-and-control approach.

*Id.* (citations omitted).

<sup>132</sup> Ruhl & Ruhl, Jr., *Arrow of the Law*, *supra* note 2, at 481.

<sup>133</sup> *Id.* at 452.

When any one law in such a complexly structured legal system fails to work as planned, society is vulnerable to more than just the failure of that law. Society is also faced with the unpredictable ripple effects the law's failure will have on the proper functioning of many other laws and, consequently, the other social institutions with which the laws are intertwined. As this failure reverberates through the legal system, society responds with more inherently (but not intentionally) interdependent laws designed to patch up the system, adding to the vulnerability of the system. Structural complexity breeds vulnerability, which breeds more structural complexity, which breeds more vulnerability, and so on.

*Id.*

[W]hen law and society in general have become highly

change and society responds with new laws, more courts, and an increase in the number of regulatory and enforcement agencies and "other apparatus of legal institutions designed to distribute legal justice."<sup>134</sup> The "law of declining [diminishing] returns"<sup>135</sup> affects societies investing in new, incremental laws to offset changing cultural conditions.<sup>136</sup>

The environmental regulatory structure overlooks system complexity and strives for simplicity at the expense of adaptability.<sup>137</sup> Rigid rules lead to short-term predictability,

structured, each new law has effects, some of which are unanticipated and unintended. . . . Any new law added to the pot of existing laws is likely on average to produce less marginal net benefits to society than did the previous law. Lawmakers in a complexly structured society must deal with the law of declining returns.

*Id.* at 443; see also Ruhl & Salzmann, *Red Queen*, *supra* note 2, at 821-22.

<sup>134</sup> Ruhl & Ruhl, Jr., *Arrow of the Law*, *supra* note 2, at 443.

<sup>135</sup> *Id.* at 443.

<sup>136</sup> *Id.* at 442-43. Ruhl describes the sociolegal system's "cycle of increasing structural complexity:"

1. Society responds to a perceived problem by increasing the complexity of legal structures—for example, a new law, a new agency, a new precedent, or a new administrative program.
2. The increasingly complex legal structure distributes costs and benefits, both directly and through unforeseen mechanisms, unevenly throughout the population, thus increasing heterogeneity.
3. With each additional increment of legal structure, each individual moves closer to a unique set of costs and benefits, thus increasing the number of groups and decreasing the cross-membership between groups.
4. As heterogeneity increases, the spectrum of inequality across the population widens, thus leading to other perceived problems for social response.
5. Society responds to the new problems through further investment in legal structure.

*Id.* at 466. The fifth step differs from the first step "in the important respect that the decreasing returns effect requires the intensification of investment in legal structure at Step 5." *Id.* (citation omitted)

<sup>137</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 908.

centralized authority, and decreased interaction among those most affected by regulatory decisions.<sup>138</sup> System adaptability suffers as a result of three legal elements that "combine to produce a highly effective rulemaking machine."<sup>139</sup> "Congress and the Nondelegation Doctrine,"<sup>140</sup> multiple, "atomized agencies,"<sup>141</sup> and legislative and judicial deference to agency decisions.<sup>142</sup>

In essence, the modern administrative state unsuccessfully tries to alleviate uncertainty by creating more and more rules. The promulgation of new rules dominates the landscape, preventing

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<sup>138</sup> *Id.*; see also Ruhl & Salzmann, *Red Queen*, *supra* note 2, at 766 (arguing that "even in a [Regulatory Kingdom] comprised of individually perfect rules—rules that satisfy the three qualities of efficiency, clarity, and freedom from institutional bias—accretion can . . . impede the ability of government to demonstrate its efficient delivery of regulation's purported benefits") (citations omitted).

<sup>139</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 908.

<sup>140</sup> *Id.* (stating that Congress "has evolved into a body that no longer *makes* decisions but rather *assigns* them to be made by agencies").

<sup>141</sup> *Id.* at 909 (arguing that "reductionism permeates our legal system down to its structural approach of dividing the administration function into many discrete agencies with specific missions").

<sup>142</sup> *Id.* at 910-11 (arguing that Congressional and judicial deference to agencies' decisions and decision-making processes ensures "that whatever emanates from the agencies' reductionist-bred black boxes . . . [survives] all but the most probing legislative and judicial scrutiny"). Professors Ruhl and Salzmann contend that the "political economy of regulation" also explains regulatory accretion. See Ruhl & Salzmann, *Red Queen*, *supra* note 2, at 785-87. The "[p]olitical [e]conomy of [r]egulation" is "the product of an alignment of both the agencies' and the regulated community's economic interests in promoting more rules." *Id.* at 785. Political economy includes several related phenomena. First, the power of interest groups benefitting from specific regulations versus the relatively weaker position of those favoring regulatory reduction or limitation. *Id.* at 786. Second, regulatory agencies are motivated to promulgate new rules satisfying particular interest groups, rather than eliminate existing regulations. *Id.* at 787. Third, greater resources are necessary to remove rules than to add rules to existing statutes. *Id.*; see also Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 910; Ruhl & Salzmann, *Red Queen*, *supra* note 2, at 784-85 (using evolutionary biologists' "Red Queen" concept to describe "natural selection" in the administrative domain and the "constant competition between agencies and the regulated community" as separate cause of regulatory accretion).

the environmental law system from "reach[ing] a state of dynamic equilibrium over time, in which a balance between agents of change is maintained until perturbed by external events."<sup>143</sup> Modern legal theories inadvertently facilitate regulatory accretion and the sociolegal system's eventual collapse by failing to accept unpredictable complications as "an essential part of the system."<sup>144</sup>

#### D. Conclusion

Ruhl's application of complexity theory to the law-and-society system produces a novel way of conceptualizing environmental law. The characterization of regulatory problems as a function of complexity theory principles challenges traditional notions of causality in democratic governments. Ruhl's theoretical position raises interesting questions about the role of normative judgments and democracy in the design, implementation, and evaluation of environmental laws and regulations.

### II. THE LIMITS OF COMPLEXITY THEORY IN LAW AND SOCIETY

Ruhl illustrates the need to improve the flexibility of the environmental regulatory system in the face of an ever-changing world. But his regulatory reform efforts suffer from an attempt to tackle the "archetypal philosophical problem: the problem of how to reduce norms, rules, and justifications to facts, generalizations, and explanations."<sup>145</sup> His theoretical approach yields an analogical model implicitly premised on epistemic and normative superiority.

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<sup>143</sup> Ruhl & Salzmann, *Red Queen*, *supra* note 2, at 776 (citing PER BAK, *HOW NATURE WORKS passim* (1996)).

<sup>144</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 906.

<sup>145</sup> RORTY, *supra* note 1, at 180. "[T]he importance of Sellars's approach to epistemology is that he sees the true and interesting irreducibility in the area not as between one sort of particular (mental, intentional) and another (physical) but as between descriptions on the one hand and norms, practices, and values on the other." *Id.* at 180 n.13 (citing WILFRID SELLARS, *SCIENCE, PERCEPTION AND REALITY* 131 (1963)).

The assumption that complexity theory is the unifying conceptual framework for regulatory analysis and reform produces an unrealistic, foundationalist<sup>146</sup> worldview.<sup>147</sup>

The underdeveloped version of complexity theory presents a threat, not a remedy, to the environmental regulatory system.<sup>148</sup> Human abilities to cause particular results disappear in the law-and-society system. Complexity theory's explanations supersede alternative views of causality and displace humans as causal agents. The theory's failure to reasonably account for human cognitive and moral behaviors undermines the theory's epistemic claims.<sup>149</sup> "Reality has to do with causation and our

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<sup>146</sup> See Daniel A. Farber, *The Inevitability of Practical Reason: Statutes, Formalism, and the Rule of Law*, 45 VAND. L. REV. 533, 539 (1992) (arguing that "practical reason means a rejection of foundationalism, the view that normative conclusions can be deduced from a single unifying value or principle"); cf. CARTWRIGHT, *supra* note 29, at 34 (stating that

it is just the point of scientific activity to build models that get in, under the cover of the laws in question, all and only those circumstances that the laws govern. Fundamentalists want more. . . . they want true laws; but most of all, they want their favourite laws to be in force everywhere. I urge us to resist fundamentalism. Reality may just be a patchwork of laws.).

<sup>147</sup> See generally LARRY LAUDAN, PROGRESS AND ITS PROBLEMS 61 (1977) (arguing that "worldview difficulties are like intra-scientific difficulties, except that here the inconsistency, or lack of mutual reinforcement, is not *within* the framework of science itself, but rather between science and our 'extra-scientific beliefs.' Such beliefs fall in areas as diverse as metaphysics, logic, ethics and theology.") (emphasis in original).

<sup>148</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 858 (acknowledging that applications of complexity theory to non-physical systems are "controversial because they involve transporting principles learned initially from computer-generated mathematical models to real-world contexts"); *id.* at 857 n.9 (noting that the "theory is developing, and there is not complete agreement in the scientific literature as to its lexicon or meaning"); see also *id.* at 856-57 n.7 (refusing to "begin to explore the elaborate mathematical theorems used to portray dynamical system behavior and phenomena").

<sup>149</sup> Ruhl's approach raises questions about the epistemic and normative relationship between complexity theory's "elaborate mathematical theorems" and the non-mathematical concepts Ruhl extracts from the theoretical nexus. Should we consider the extracted concepts a reasonable means for determining the theory's applicability? Do the extracted concepts retain their intended

notions of reality are formed from our abilities to change the world."<sup>150</sup>

Complexity theory and the sociolegal model do not provide sufficient conceptual space for political liberty, democracy, or the importance of normative judgment to laws' evaluation. In his quest for a unifying explanatory theory, Ruhl moves far afield from the fundamental human thoughts and actions that led to the formation of the constitutional government. Environmental regulatory reform surely depends upon deliberative democratic processes; in the unified law-and-society system those processes disappear.

#### A. *Sacrificing "Human-ness" for a Unifying Theory*

Ruhl's application of complexity theory to the law-and-society system unsuccessfully attempts to account for human capacities—cognitive, moral, or social—and their role in important causal processes. Ruhl's theoretical approach attributes causal priority to forces outside human beings, as might be expected from the application of a physical systems theory. Complexity theory's physical systems' concepts do not produce a sociolegal model that reasonably conforms to the environmental regulatory system.<sup>151</sup>

#### 1. Prologue: C. S. Holling's and Karl Popper's Overlapping Experiences

Ruhl is definitely not the first to imagine he is participating in a "loftier critical point of view"<sup>152</sup> that reveals a fundamental theory of explanation. C. S. Holling experienced the setbacks associated with momentarily believing that a version of complex

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meanings when separated from the theoretical nexus? Ruhl does not address these and other questions bearing upon the determination of whether his non-mathematical interpretation of complexity theory continues to constitute a theory.

<sup>150</sup> IAN HACKING, REPRESENTING AND INTERVENING: INTRODUCTORY TOPICS IN THE PHILOSOPHY OF NATURAL SCIENCE 146 (1983).

<sup>151</sup> See LONGINO, FATE OF KNOWLEDGE, *supra* note 23 and accompanying text.

<sup>152</sup> RORTY, *supra* note 1, at 188.

adaptive systems theory was science's "silver bullet."<sup>153</sup> Holling, Lance H. Gunderson, and Donald Ludwig acknowledge their experience with the "temptation to extend a theory of adaptive cycles developed for ecosystem dynamics and renewal to other systems, particularly organizational ones, business ones, and more generally, social and political ones."<sup>154</sup>

The three scientists note that apparent explanatory success "did not help us avoid the pitfall of overstretched generality . . . rather it made it worse."<sup>155</sup> After reviewing the numerous scientific theories and the natural and social phenomena they initially believed fit their adaptive cycle model of change, Holling, Gunderson, and Ludwig conclude with a succinct statement of the lesson learned: "If a theory explains everything, it explains nothing."<sup>156</sup> The scientists also suggest that adaptive systems strategies should include an empirical approach designed to explain change in human and in natural systems.<sup>157</sup> "What are needed are alternative hypotheses and specific predictions that can be tested empirically. That is possible for natural science component systems but much less so for social components."<sup>158</sup>

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<sup>153</sup> C.S. Holling et al., *In Quest of a Theory of Adaptive Change*, in PANARCHY 21 (Lance Gunderson & C.S. Holling, eds. 2002) (stating that "[o]ur goal for this book was to develop and test theories that explain transformational change in systems of humans and nature, theories that are inherently integrative").

<sup>154</sup> *Id.* at 20 (internal citations omitted).

<sup>155</sup> *Id.*

<sup>156</sup> *Id.*; see also *id.* at 19 (noting risks associated with too much generality in theory).

Generality is desired—but also to be feared. It is to be feared because once a theory is formed, once it seems to resolve paradoxes, and once it passes some empirical tests, proponents are sorely tempted to extend its application beyond its natural context. That is particularly true if the theory emerges in the natural sciences and is applied to humans.

*Id.*

<sup>157</sup> Holling et al., *supra* note 153, at 19-20.

<sup>158</sup> *Id.* at 20. "[W]e can continually ask where the emerging theory encounters observations that are not consistent with the theory. Why living systems are not like nonliving organisms. . . . Why social systems are not like ecosystems. And why linked ecological, social, and economic systems are not like any of the above." *Id.*; see also SIMON A. LEVIN, *FRAGILE DOMINION: COMPLEXITY AND THE*

Decades ago, Karl Popper anticipated the empirical challenge that often subdues unifying theories claiming to produce useful and reliable knowledge. In 1919, Popper was stymied by the apparent explanatory power of three purportedly revolutionary theories: Marx's theory of history, Freud's psycho-analysis, and Alfred Adler's "so-called 'individual psychology.'"<sup>159</sup>

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COMMONS 188-89 (1999) (arguing that human society presents conceptual challenges unique to social systems for complex adaptive systems theory and justifying his decision to "view evolution from the bottom up, starting from the individual cell"). *Compare id.* at 188-89 (arguing that

[a]s we move up the ladder of complexity, not only the definitions but also our understanding of the processes become more problematical. Ant societies are highly differentiated collectives of closely related organisms. As units, they have many of the features of single organisms because they maintain their integrity over time, but they still represent associations of individuals in evolutionary competition. Human societies share some of the same features: they represent consortia of individuals who rely on one another. As such, there is differentiation of function—some of us are carpenters, some teachers, some doctors—and consequent interdependence. But the members of a human society are not as closely related as the members of a beehive or an ant colony, and membership in a human society hence tends to be more ephemeral. The human society does not have the continual integrity to function as an evolutionary unit, though the organization of people into societies clearly has deeply influenced the evolution of human culture.),

with Ruhl, *Complex Adaptive System*, *supra* note 2, at 945 (stating that [b]y limiting observation to an individual ant—its foraging, building, defending, and so on—it is highly unlikely the observer could accurately predict the behavior of the ant colony. The ant colony, unlike an individual ant, is highly adaptive, surviving over time periods far in excess of individual ant lives and in the face of a variety of environmental hazards, any one of which poses death to individual ants. This pattern of adaptive collective behavior emerging from the interconnected parts is found throughout nature and human society.).

<sup>159</sup> KARL POPPER, CONJECTURES AND REFUTATIONS: THE GROWTH OF SCIENTIFIC KNOWLEDGE 34 (5th ed. 1989) (1957).

I found that those of my friends who were admirers of Marx, Freud, and Adler, were impressed by a number of points common to these theories, and especially by their apparent *explanatory power*. These theories appeared to be able to explain practically everything that happened within the fields to which they referred. The study of any of them seemed to have the effect of an intellectual conversion or revelation, opening your eyes to a new truth hidden from those not yet initiated. Once your eyes were thus opened you saw confirming instances everywhere: the world was full of *verifications* of the theory. Whatever happened always confirmed it.<sup>160</sup>

Popper eventually developed a theory he claimed would distinguish between science and pseudo-science, proposing "that *the criterion of the scientific status of a theory is its falsifiability, or refutability, or testability.*"<sup>161</sup> This Article does not propose judging the merits of Ruhl's approach with Popper's theory of falsifiability. However, Holling, his colleagues, and Popper share a view about the limits of theoretical explanation that raises questions about the application of complexity theory (or parts of it)<sup>162</sup> to "an analogical model of law and society as a unified dynamical system."<sup>163</sup>

## 2. Human Capacities: MLA from Ruhl's Law-and-Society Model

In spite of complexity theory's "unifying" features,<sup>164</sup> Ruhl's approach creates an environmental regulatory world lacking

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<sup>160</sup> *Id.* at 34-35 (emphasis in original).

<sup>161</sup> *Id.* at 36-37 (emphasis in original).

<sup>162</sup> See *supra* note 148 (discussing the application of the non-mathematical version of the theory).

<sup>163</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 855-56 n.7.

<sup>164</sup> See Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, 435-36 (arguing that "[c]omplexity theory and its fitness landscape model offers a unifying theoretical perspective" for virtually all social and physical systems).

conceptual space for human "capacities."<sup>165</sup> Moreover, his overextension of the analogy between dynamical systems and the law-and-society system belies his concession that complexity theory does not easily transfer to social systems.<sup>166</sup> His law-and-society model does not satisfactorily account for the intrinsic, important differences among components of complex physical systems and human components in social systems. Complexity theory concepts do not recognize humans as causal actors with cognitive and normative capacities; the sociolegal model translates "human" into an unfamiliar, and perhaps unknowable, kind of "component."

Applying abstract concepts of a theory to a "real situation" requires "a model of the situation in terms the theory can handle."<sup>167</sup> The model should "mediate between theory and the world"<sup>168</sup>—representative models should resemble the situations they purport to represent.<sup>169</sup> Theories produce "representative"

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<sup>165</sup> CARTWRIGHT, *supra* note 29, at 64 (arguing that capacities signify abilities, tendencies, and propensities to do many different kinds of things). Cartwright distinguishes between capacities and dispositions, stressing "that capacities are not to be identified with any particular manifestations. They are rather like 'know', 'believe', 'aspire', 'clever' or 'humorous.'" *Id.*

<sup>166</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 867 (stating that "[t]o be sure, the fit between the interaction of law and society and the analogical model provided so far by dynamical systems theory is not perfect. Two significant complicating factors are present—humans and the coevolving real world."); Ruhl, *Sustainable Development*, *supra* note 2, at 56-57; see also *supra* notes 21, 46-54 and accompanying text.

<sup>167</sup> CARTWRIGHT, *supra* note 29, at 26.

<sup>168</sup> *Id.* at 179.

<sup>169</sup> *Id.* at 193. Helen E. Longino argues that we may also view the theory itself as a model since models often have a particular structure postulated to reasonably depict the structure of phenomena under study. See LONGINO, FATE OF KNOWLEDGE, *supra* note 23, at 114. "This isomorphism permits the mapping of the relations, structures, and processes of the model onto some portion of the world." *Id.* Models may also purport to explain how things "in the domain under study are related." *Id.* Longino calls this an "explanatory model for it functions as a model or schema of how explanations of particular phenomena in a domain are to be structured." *Id.* (citation omitted). Ruhl designs the model to describe how the law-and-society system should be structured and how sociolegal phenomena should be explained. See also *supra* Part I, particularly notes 45-90.

models<sup>170</sup> of real situations by following "language-entry rules' for introducing the terms of [their] own abstract vocabulary and thereby for bringing [their own] laws into play."<sup>171</sup> Theories may also require "interpretative" models that depend upon "bridge principles"<sup>172</sup> to apply abstract concepts to the world.<sup>173</sup> Philosophically, bridge principles describe theories' domain limitations and guide models' construction.<sup>174</sup>

Ruhl is primarily concerned with developing an analogical model of the sociolegal system.<sup>175</sup> He observes phenomena occurring in the environmental regulatory system and concludes that the phenomena (and the system's structure) sufficiently resemble a "unified dynamical system" to warrant the application of complexity theory concepts.<sup>176</sup> He does not provide criteria or "bridge principles" from complexity theory to justify his assumption that the theory provides "a lexicon for describing system interaction, so that we may translate observations of system behavior into models of reality."<sup>177</sup> In the absence of any stated criteria or method for applying complexity theory's concepts, other than his own subjective observations, one needs to carefully consider whether Ruhl correctly assumes that complexity theory applies analogically to the environmental regulatory system.

Helen Longino's work supports assessing a model's (or a theory's) success based upon how well its descriptions "conform" to the phenomena (or objects) of interest.<sup>178</sup> Conformation generally

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<sup>170</sup> CARTWRIGHT, *supra* note 29, at 180.

<sup>171</sup> *Id.* at 26.

<sup>172</sup> *Id.* at 190.

<sup>173</sup> *Id.* at 180-81 (suggesting that theories may also use abstract concepts "to build a representative model in a systematic or principled way," resulting in "interpretative models").

<sup>174</sup> *Id.* at 188.

<sup>175</sup> See *supra* Part I, particularly notes 45-90.

<sup>176</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 855 n.7.

<sup>177</sup> See *id.* at 862; see also *supra* notes 45-46 and accompanying text.

<sup>178</sup> LONGINO, FATE OF KNOWLEDGE, *supra* note 23, at 117 (arguing that "[c]onformation permits sorting representations along a continuum or several continua, rather than dividing them into two exclusive classes, irrespective of how well they suit our purposes, as does the true-false binary").

refers to a "family of epistemological success concepts,"<sup>179</sup> not simply the binary choices "true" or "false."<sup>180</sup> The concepts everyday language uses to describe the relationship between maps and their represented objects—such as fit, similarity, alignment, isomorphism—provide illustrative examples.<sup>181</sup> The point is to modernize the standards used to evaluate models and theories beyond the restrictive, and reductionist, binary "truth table" concepts that preclude an understanding of how models *do* fairly represent phenomena in the world.<sup>182</sup>

*a. Are Humans Analogous to Complexity Theory's "Components"?*

The analogical application of complexity theory does not produce a reasonable representation of phenomena in the sociolegal system. For example, one of Ruhl's hypotheticals illustrates the conceptual cost of applying complexity theory's basic lexicon to the sociolegal system.<sup>183</sup> The hypothetical provides an example of translating observations into models of reality. Ruhl describes a driver, "Betty," who goes to visit her friend, "John."<sup>184</sup> Ruhl traces Betty's traffic route in terms of complexity theory's rules of motion, attractors, initial state, and other relevant concepts.<sup>185</sup>

Each dynamical system has an n-dimensional *playing space*, known technically as a manifold or phase space, which contains all the possible system states.<sup>186</sup> In Betty's traffic world, her playing space is

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<sup>179</sup> *Id.* at 117.

<sup>180</sup> *Id.*

<sup>181</sup> *Id.*

<sup>182</sup> *Id.*

<sup>183</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 862; see also *supra* notes 46-60 and accompanying text.

<sup>184</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 862-63.

<sup>185</sup> *Id.* at 863.

<sup>186</sup> "Phase space is 'an abstract space in which a single point completely defines the instantaneous state of a dynamical system. . . . The dimension of the space depends on the number of variables needed to define the system.'" *Id.* at 862 n.21 (quoting COVENEY & HIGHFIELD, *supra* note 39, at 364).

the local roadway network. Each system also must have a set of *rules of motion*, known technically as vector fields, which tell the system components where and how to go next from wherever they are now. For Betty, her rules are the traffic regulations that exist on the route she takes between her and John's houses. The path that a system takes—Betty's route to John's house—is the system *trajectory*,<sup>187</sup> and the system starting point—Betty's house in our traffic world—is the system's *initial state*.<sup>188</sup> Finally, and most important of all, the final condition of the system's trajectory—John's house for Betty—is the system's *attractor*.<sup>189</sup>

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Hence, phase space is not simply the four-dimension space-time space that we observe in the physical world, but rather an  $n$ -dimensional playing field, with  $n$  being all the relevant variables of system operation, within which the instantaneous state of the system is a single point representing the concurrently instantaneous values of all the variables of the system.

*Id.* (citing Ian Stewart, *Portraits of Chaos*, in *EXPLORING CHAOS: A GUIDE TO THE NEW SCIENCE OF DISORDER* 46-47 (Nina Hall ed., 1991)).

<sup>187</sup> See *supra* note 53.

<sup>188</sup> See *supra* note 52.

<sup>189</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 862-63; see also *supra* notes 49-55; *id.* at 863 n.24 ("Thus, the attractor is '[a] way to describe the long-term behavior of a dissipative system in phase space.'") (quoting COVENEY & HIGHFIELD, *supra* note 39, at 360); *id.* ("The term attractor is somewhat misleading, as it implies the presence of a force of attraction or a goal-oriented state, whereas the term is intended to mean simply that the rules of motion of the system produce a certain behavior that the attractor describes.") (citing COHEN & STEWART, *supra* note 39, at 206-07).

The distinction is aptly described through the example of a lake draining a watershed. As rain falls within the watershed, rules of chemistry, gravity, and physics operate on the water. The result of the water's behavior is the lake—the attractor—but the lake did not itself exert an attractive force upon the water.

*Id.* (citing STUART A. KAUFFMAN, *AT HOME IN THE UNIVERSE* (1995)); see also *supra* note 55.

Note that Betty is a system component and her trip is not described in terms of her choice among various alternatives; the event is explained in terms of the system's "components," "rules of motion," "trajectory," and "attractors." The causal relations among the complexity theory concepts are postulated as equivalent to the conceptual relations among less abstract concepts. The more concrete concepts correspond to the theoretical concepts in that "Betty" = component, "traffic regulations" = rules of motion, "route" = trajectory, and "John's house" (destination) = attractor, where the operator "=" is understood to mean "equivalent to" within the specific context of the hypothetical.<sup>190</sup> The explanation advanced by either set of concepts purports to describe the same phenomena in the natural world—Betty driving to John's house—although communicating the meaning of complexity theory's explanation may require a specialized community of listeners.<sup>191</sup>

Ruhl's contention that complexity theory provides an accurate lens through which to evaluate natural *and* social phenomena conflicts with an understanding of human beings. Humans have the ability, or "capacity,"<sup>192</sup> to reflect, to decide, to know, to teach, to err, to empathize, and the like; they are unable to consider those capacities as conceptually distinct from their understanding of what it means to be "human."<sup>193</sup> Human capacities make it possible

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<sup>190</sup> See HILARY PUTNAM, MIND, LANGUAGE AND REALITY 269 (1975) (arguing that two descriptions are "*equivalent* if they are the same except for the description of the extension, and the two descriptions are coextensive") (emphasis in original).

<sup>191</sup> See *generally id.* at 228. Putnam proposes the Hypothesis of the Universality of the Division of Linguistic Labor: Every linguistic community . . . possesses at least some terms whose associated 'criteria' are known only to a subset of the speakers who acquire the terms, and whose use by the other speakers depends upon a structured cooperation between them and the speakers in the relevant subsets.

*Id.* (emphasis omitted).

<sup>192</sup> See CARTWRIGHT, *supra* note 29, at 64; see also *supra* note 165 and accompanying text.

<sup>193</sup> See CARTWRIGHT, *supra* note 29, at 70 (stating that "[f]or us, there are properties, and all properties bring capacities with them").

[I]n modern science we separate our definition of a property

for humans to produce certain effects. In other words, humans participate in the causal relations occurring in the world in virtue of their capacities. Complexity theory, as applied through Ruhl's model, dissolves human capacities into components whose behaviors are caused by external factors—rules of motion (i.e. vector fields). Self-reflection and deliberation are less important, distracting attention from the "real causal process producing our behavior"<sup>194</sup>—processes occurring at levels to which only the complexity theorist has access.<sup>195</sup>

The hypothetical illustrates that the application of complexity theory to the human system hangs on a theory of reference that unreasonably absorbs human capacities into the theory's explanatory framework. Consider again the explanation for Betty's behavior. As a system component, Betty's behavior is a function of the rules of motion—the traffic rules and regulations.<sup>196</sup> As a human being in the complex sociolegal system, her behavior is also explained as a particular manifestation of free will indicating she obeyed the rules.<sup>197</sup>

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from our characterisation of what kind of change it naturally produces. Still, when we associate a particular principle of change with a given structure or characteristic, we expect that association to be permanent, to last so long as the structure is what it is.

*Id.* at 81 (arguing that separating properties from causal relations produces erroneous understandings).

<sup>194</sup> HELEN E. LONGINO, SCIENCE AS SOCIAL KNOWLEDGE: VALUES AND OBJECTIVITY IN SCIENTIFIC INQUIRY 174 (1990) [hereinafter LONGINO, SCIENCE AS SOCIAL KNOWLEDGE].

<sup>195</sup> See *id.* (arguing that mechanistic, neurobiological explanations for human behavior reconceptualize "[h]uman capacities for self-reflection and deliberation [as] idle epiphenomena . . . processes . . . to which only the scientist or physician have access").

<sup>196</sup> See *supra* notes 186-189, 49-54 and accompanying text.

<sup>197</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 873 (arguing that complexity theory explains "a particular manifestation of human free will [is] expressed as a point on a trajectory that meanders among the attractors of freedoms, rights, and regulations").

Suppose that someone violates a rule. Ruhl's model<sup>198</sup> is conceptually inadequate<sup>199</sup> to reasonably and consistently explain a rule violator's behavior. When a person disobeys the rules of motion—the traffic laws—his behavior is evidently not governed by the vector fields—the rules of motion.<sup>200</sup> But if a system component's behavior is not directed by the rules of motion, such as in the rule violator case, then a different concept is needed to explain the human capacity to decide to break the rule. Moreover, given the violator's case, one is no longer assured that explanations for Betty's behavior are reducible to a function of the rules of motion *even when she obeys* the rules. Ruhl's hypothetical helps illustrate that the postulated causal relations among the theory's concepts<sup>201</sup> do not provide reasonable explanations for human behaviors in a rule-breaking case. The theoretical concepts do not account for human capacities.

Ruhl suggests that complexity theory's attractor concepts<sup>202</sup> provide the solution to the "free will" dilemma; the attractor simply changes if the exercise of free will violates the causal relations among complexity theory concepts.<sup>203</sup> He also opines that *humans*

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<sup>198</sup> See *supra* notes 186-189, 49-54. See generally notes 37-93 and accompanying text (discussing Ruhl's model).

<sup>199</sup> See LONGINO, FATE OF KNOWLEDGE, *supra* note 23, at 119 (arguing that "[w]e rate the adequacy of theories and models by their power to enable us to pursue our endeavors successfully with respect to the domains of which they are representations"). Ruhl's analogical model *should* provide regulatory and policy guidance in the sociolegal domain.

<sup>200</sup> See *supra* notes 186-189, 49-54 and accompanying text.

<sup>201</sup> *Id.* See generally notes 37-93.

<sup>202</sup> See generally notes 55-56 (indicating that the "attractors" concepts correspond to system behavior patterns).

<sup>203</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 874-75.

[L]aw contributes to the resolution of issues of free will in a law-and-society system—contract disputes, gender discrimination, environmental pollution, or whatever else—through the balance of freedoms, rights, and regulations. Those are the law-and-society system's attractors for determining the mix of law-based mechanisms for managing the complications posed by human freedom of will.

*Id.* It is important to recall that freedoms, rights and regulations are important

may be described as a complex adaptive system: "One can also present free will as the manifestation of the fact that each human is a dynamical system consisting of at least some strange attractors, and thus behaves in unpredictable ways."<sup>204</sup> Ruhl's assertions beg the question of whether complexity theory concepts adequately translate observations of sociolegal system phenomena into reasonable representations of behavior.<sup>205</sup> Attractors describe system behavior; they do not provide the causal force Ruhl attributes to rules of motion. "An attractor is simply a model representation of the potential long term behavior of the system, a useful concept for exploring different kinds of long-term behavior."<sup>206</sup> One is left back at the beginning, searching for complexity theory explanations for human deliberative processes causing human actions (particularly those acts that contravene the rules of motion, i.e., laws).<sup>207</sup>

There is an additional but perhaps less abstract argument that illustrates an unacceptable level of conceptual ambiguity—in the context of free will—among complexity theory's terms. Human rule violations are not sufficiently explained as a function of "strange attractors"<sup>208</sup> because violations may be intentional *and* predictable. Humans may break rules for very good reasons. One can easily imagine a subset of all past and future rule violators who communicate their intentions to another human *before acting*. Complexity theory cannot reasonably translate this intentional behavior into its causal framework. The justification for civil disobedience is essentially *normative*; as detailed in subsequent

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attractors on the "law-side" of the law-and-society system. *See supra* notes 70-72 and accompanying text; *see also* Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 875 n.56 (suggesting that "another important area of inquiry with regard to management of free will in the law-and-society system would be describing the balance between the law-based and society-based attractors").

<sup>204</sup> *Id.*

<sup>205</sup> *See supra* notes 46-60 and accompanying text.

<sup>206</sup> Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 419 n.27 (citing COVENEY & HIGHFIELD, *supra* note 39, at 360); *see also supra* notes 55-56.

<sup>207</sup> *See supra* notes 49-54 and accompanying text.

<sup>208</sup> *See supra* notes 39 and 56 for a discussion of strange attractors; *see also supra* notes 202-07.

sections,<sup>209</sup> the unified conceptual framework does not sufficiently account for norm-based, intentional behaviors.

b. *Lucas v. South Carolina Coastal Council*<sup>210</sup>

Ruhl also articulates his free will position through a complexity theory analysis of *Lucas*.<sup>211</sup> However, his discussion of freedoms, rights, and regulations further illustrates the problems with applying complexity theory concepts to human systems.<sup>212</sup> Complexity theory describes the three law attractors<sup>213</sup> in a way that distorts the concepts' legal meanings. Ruhl's complexity-based interpretation of *Lucas* leads him to characterize Fifth Amendment rights against unlawful takings as "freedoms," but the legal right to bring nuisance actions as a "right."<sup>214</sup> The complexity theory analysis of the *Lucas* decision neither supports Ruhl's conceptual distinction between rights and freedoms, nor realistically portrays free will and its critical relationship to human thought and action.

The conflict in *Lucas* was between the government of South Carolina and an individual, Lucas.<sup>215</sup> Justice Scalia traced the origins of the rules governing the dispute to the "historical compact recorded in the Takings Clause that has become a part of our constitutional culture."<sup>216</sup> The "compact" is part of the Bill of Rights, which Justice Story suggests "may often be indispensable, whenever it operates as a qualification upon powers, actually granted by the people to the government."<sup>217</sup> Justice Story also describes the background principles that produced a formal constitutional expression of the common-law right.

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<sup>209</sup> See *infra* Part II.B-C.

<sup>210</sup> 505 U.S. 1003 (1992); see also *supra* notes 61-79 and accompanying text.

<sup>211</sup> See *supra* notes 61-79 and accompanying text.

<sup>212</sup> See *id.*

<sup>213</sup> These attractors are freedoms, rights, and regulations. See *supra* notes 70-72 and accompanying text.

<sup>214</sup> See *supra* notes 61-79 and accompanying text.

<sup>215</sup> *Lucas*, 505 U.S. at 1009.

<sup>216</sup> *Id.* at 1028.

<sup>217</sup> JOSEPH STORY, A FAMILIAR EXPOSITION OF THE CONSTITUTION § 436 (The Legal Classics Library 1992) (1840).

The concluding clause is, that private property shall not be taken for public use without just compensation. This is an affirmance of a great doctrine established by the common law, for the protection of private property. It is founded in natural equity, and is laid down by jurists as a principle of universal law.<sup>218</sup>

Ruhl's distinction between freedoms and rights unreasonably separates human action and human constraint of another into mutually exclusive sociolegal concepts that conflict with the terms' legal meanings. Ruhl's concepts imply that there will never be a conflict of "rights." But many situations will require some observer to determine which person in a conflict acted "in accord with his own subjective free will"<sup>219</sup> by exercising a "freedom," and which person simply constrained another's freedoms by exercising a "right."<sup>220</sup> Ruhl's description of the attractors' meanings commits him to the view that constraining another's freedom does not include acting in "accord with his own subjective free will;" otherwise, the actor would be exercising a right.

Consider carefully Ruhl's use of free will to describe the meaning of freedoms and rights. He limits the role of free will to the concept of freedoms—acting in accord with "subjective free will."<sup>221</sup> On the other hand, free will is apparently not a causal factor for the human actions described as rights—the constraint of another person's freedoms.<sup>222</sup> Ruhl's theoretical distinction between freedoms and rights attractors creates an incoherent *causal* dichotomy between the human decisions causing an act, pursuant to free will, and the decisions that cause human restraint of another. Moreover, the complexity theory explanation is based upon resultant behaviors, which suggests the human's mental

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<sup>218</sup> *Id.* § 394.

<sup>219</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 873.

<sup>220</sup> See *supra* notes 70-72 and accompanying text.

<sup>221</sup> See *supra* notes 70-72.

<sup>222</sup> See *supra* note 71.

processes are causally less important.<sup>223</sup> The explanation simply fails to overcome the conceptual ambiguity that prevents reasonable causal explanations for human behaviors in the law-and-society system. "There is much in human judgment and action that is possible only because of practical skills and competence that remain beyond the reach of theoretical articulation."<sup>224</sup>

The application of complexity theory also misrepresents the relationship between freedoms expressed as formal legal rights and liberty that is not yet formally recognized as law. The law-and-society model is unable to account for Justice Story's historical, sociolegal description of the genesis of the Fifth Amendment protection against unlawful takings.<sup>225</sup> In America's legal system, the concepts of rights and freedoms differ legally based on whether the legislature or the courts has declared specific informally recognized human freedoms off-limits to government interference. The resultant formal expression of a "freedom" is called a legal "right."<sup>226</sup> The sociolegal model overlooks the political, and necessarily human, processes contributing to this transition.

### 3. Conclusion

One of the primary problems with applying unified physical (or metaphysical) theories to social systems is that they lose touch with phenomena occurring in the world. In this case, the sociolegal model struggles through a failed attempt to reasonably incorporate humans into the law-and-society system's theoretical framework; humans cannot be reasonably reduced to objectified components. The law-and-society model assumes the sufficiency of causal

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<sup>223</sup> See LONGINO, *SCIENCE AS SOCIAL KNOWLEDGE*, *supra* note 194, at 174.

<sup>224</sup> Brian Leiter, *Heidegger and the Theory of Adjudication*, 106 *YALE L.J.* 253, 280-81 (1996) (arguing that practical reason proponents should adopt "the 'No-Theory Theory' [which claims that a] judicial decision is not something about which one should expect to have a theory, because one can never produce the needed theoretical reduction of adjudication to explicit rules of decision").

<sup>225</sup> See *supra* note 218.

<sup>226</sup> See generally DOUGLASS C. NORTH, *INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE* 4-5 (1990) (distinguishing between "formal constraints—such as rules that human beings devise—and . . . informal constraints—such as conventions and codes of behavior").

explanations that are entirely external to components and their capacities. Complexity theory does not provide Ruhl with sufficient explanatory space for human decisions (or other internal, mental and emotional processes) to be regarded as causally responsible for human behavior.

The complexity theory approach suffers from a recurrent problem with conceptual ambiguity.<sup>227</sup> Theoretical concepts should be sufficiently clear to avoid circular explanations and to determine a concept's applicability within the theoretical domain.<sup>228</sup> Complexity theory concepts lack the intrinsic and relational descriptions necessary to meaningfully identify and explain relevant phenomena in the sociolegal world. Moreover, Ruhl does not articulate the methods and criteria necessary to identify the systems that lie within the scope of complexity theory or determine how and under what circumstances the model will produce reliable knowledge claims.<sup>229</sup> Ruhl should stop short of attempting to translate the sociolegal system's concrete occurrences (e.g., rule violators) or abstract concepts—freedom, rights, and regulations—into complexity theory's conceptual framework. The sociolegal model's shortcomings could hardly be

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<sup>227</sup> See LAUDAN, *supra* note 147, at 49-50.

[T]he ambiguity of concepts is a matter of degree rather than kind. Some degree of ambiguity is probably ineliminable . . . . It may even be true that some small measure of ambiguity is a positive bonus, since less rigorously defined theories can often be more readily applied to new domains of investigation than more rigid ones. But granting that, it is nonetheless true that systematic and chronic ambiguity or circularity within a theory often has been, and should be, viewed as highly disadvantageous.

*Id.*

<sup>228</sup> See *id.* at 50 (arguing that the "increase of the conceptual clarity of a theory through careful clarifications and specifications of meaning is, as William Whewell observed more than a century ago, one of the most important ways in which science progresses").

<sup>229</sup> See *id.* at 57-61 (arguing that "[t]he whole point of a methodological rule . . . is to offer a norm for scientific behavior; to tell us what we should, or should not, do in order to achieve the cognitive, epistemic, and practical goals of the scientific enterprise").

more egregious—humans are *the* essential feature of any regulatory system or structure. One cannot meaningfully conceive of an abstract set of concepts, an explanation, *an analogy*, or *even a metaphor*, that fails to account (at least implicitly) for intrinsic human features necessarily characterizing the promulgation, implementation, and enforcement of *all* regulations. Human free will is much more than a “complicating factor” for Ruhl’s model. In the context of law and society, it is a limiting factor that precludes the development of a representative or interpretative model based upon complexity theory.

Human capacities distinguish humans as a unique *kind* of component. The causal relations among social systems’ components—and the sociolegal system in particular—necessarily differ in kind and complexity as a result of human capacities. Applying complexity theory’s concepts (e.g. “rules of motion,” “attractors,” and “trajectory”) to the sociolegal “system” necessarily sacrifices humanity (or “humanness”) to retain conceptual coherence.

### *B. Complexity Theory: Is Democracy Obsolete?*

Ruhl’s mechanical explanation for law’s evolution<sup>230</sup> is socially and morally problematic. He creates a unified system of legal explanation at odds with principles of democracy and deliberative government. Complexity theory’s disregard of human capacities<sup>231</sup> has potentially severe consequences for political liberty and traditional methods of evaluating law’s success. The sociolegal model supplants democratic explanations for changes in law with analysis justified by complexity theory’s unified framework.

#### 1. Complexity Theory’s Consequences for Political Liberty

“And surely nothing of mere earthly concern is more worthy of the profound reflection of wise and good men, than to erect structures of government, which shall permanently sustain the

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<sup>230</sup> See *supra* notes 83-88 and accompanying text.

<sup>231</sup> See *supra* Part II.A.2.

interests of civil, political, and religious liberty, on solid foundations."<sup>232</sup>

Ruhl's mechanistic description of laws as biological species existing on a "fitness landscape"<sup>233</sup> erodes the relationship among laws, government, and individual liberty. The sociolegal model depicts a process of change in law that does not satisfactorily account for humans' central role in changing laws and government. Political liberty ideals lose their significance in complexity theory's law-and-society system. Ruhl's attempt to develop a nonideological, nonnormative basis for regulatory change<sup>234</sup> absorbs political liberty into an unrealistic, non-democratic conceptual framework.

Liberty is often discussed in two distinct, but practically overlapping, forms: "positive" and "negative."<sup>235</sup> John Stuart Mill's treatise<sup>236</sup> focuses primarily upon "negative" freedom—the individual's freedom from unwarranted governmental control.<sup>237</sup> "There is a limit to the legitimate interference of collective opinion with individual independence: and to find that limit, and maintain

<sup>232</sup> STORY, *supra* note 217, § 57.

<sup>233</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1452-53.

[W]e find law in the same boat as species—having to grope around on the fitness landscape searching for higher peaks and trying to avoid the valleys. Complexity Theory explores how an organism—used here broadly to mean laws, species, or components of any system—moves around on its fitness landscape.

*Id.*

<sup>234</sup> See *supra* Part I.A.3.

<sup>235</sup> See, e.g., John Stuart Mill, *On Liberty*, in *UTILITARIANISM AND OTHER WRITINGS* (Mary Warnock ed., 1974) (1859).

<sup>236</sup> *Id.*

<sup>237</sup> See *id.* at 135. Mill explains that the purpose of his essay is to establish that the sole end for which mankind are warranted, individually or collectively, in interfering with the liberty of action of any of their number, is self-protection. That the only purpose for which power can be rightfully exercised over any member of a civilised community, against his will, is to prevent harm to others.

*Id.*; see also LONGINO, *SCIENCE AS SOCIAL KNOWLEDGE*, *supra* note 194, at 171; DEBORAH STONE, *THE POLICY PARADOX: THE ART OF POLITICAL DECISION MAKING* 109 (1995) (defining negative liberty as a "lack of interference with individual action").

it against encroachment, is as indispensable to a good condition of human affairs, as protection against political despotism."<sup>238</sup>

Political liberty also includes the positive freedom to participate in decision-making processes bearing upon political issues, including—either directly or indirectly—the promulgation, implementation, enforcement, and modification of environmental regulations.<sup>239</sup> The freedom to choose to participate in political activities, to run for political office, and to hold particular political beliefs fall within positive liberty.<sup>240</sup> The negative and positive aspects require that political authorities enact normative laws or rules governing the relationship between government power and human behaviors.

"Political liberty presupposes [individual] autonomy and . . . responsibility."<sup>241</sup> Individuals have the right to choose to make independent, deliberative decisions and the responsibility to act on their decisions, under appropriate circumstances.<sup>242</sup> Liberty is intricately connected to the concept of self-determination and the notion that human behaviors generally illustrate the final product of deliberate decisions.<sup>243</sup>

Positive liberty's corollary of deliberative decision-making poses logical and practical problems for the democratic principle of "equality."<sup>244</sup> Ideally, citizens would have control over all decisions affecting their rights and well-being, and their decisions would be based upon the best available information. However, citizens' decision-making attributes, such as intelligence, and interests, such as politics, vary. Accordingly, so too do their social, economic, and political conditions. Moreover, the inability to make reasonable, well-informed decisions is dependent upon political

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<sup>238</sup> Mill, *supra* note 235, at 130.

<sup>239</sup> See LONGINO, SCIENCE AS SOCIAL KNOWLEDGE, *supra* note 194, at 171-72; STONE, *supra* note 237, at 128 (arguing that positive liberty is "the availability of meaningful choice and the capacity to exercise it").

<sup>240</sup> See STONE, *supra* note 237, at 128.

<sup>241</sup> LONGINO, SCIENCE AS SOCIAL KNOWLEDGE, *supra* note 194, at 172.

<sup>242</sup> See *id.*

<sup>243</sup> *Id.*

<sup>244</sup> See STONE, *supra* note 237, at 128-29.

power, wealth, and knowledge.<sup>245</sup> Political connections enable one to actively exercise control over the range of available choices affecting the outcome of a particular political conflict. Lack of wealth interferes with a citizen's ability to devote time and resources necessary to research relevant choices.<sup>246</sup> Finally, the more knowledge one has about the possible conflict outcomes, the better one's decision.<sup>247</sup> Liberty becomes a matter of degree; "those with more power, wealth, and knowledge, have more freedom than those with less."<sup>248</sup>

The law-and-society system significantly curtails "positive" political liberty. Complexity theory reorganizes environmental regulatory debates to focus on a law's "fitness."<sup>249</sup> "Biologists do not ask whether a species has been 'good' for its ecosystem when evaluating the single species' fitness. Similarly, questions of morality and overall public policy have no place in measuring the fitness of a particular law, although the policies underlying laws certainly are normatively designed."<sup>250</sup>

Ruhl translates the process of change in law into complexity theory's biologically-derived concepts of "species," "fitness," and "fitness landscape."<sup>251</sup> However, Ruhl's analytical approach is

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<sup>245</sup> See *id.*

<sup>246</sup> *Id.* at 128.

<sup>247</sup> *Id.*

<sup>248</sup> *Id.* at 129.

<sup>249</sup> See *supra* notes 80-93 and accompanying text.

<sup>250</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1451; see *infra* notes 251-90 and Part II.C.2. One may conclude that the sentence's last clause, "although the policies underlying laws certainly are normatively designed" does not fit with the rest of Ruhl's evolutionary position; the clause certainly does not suggest a "non-ideological, non-normative basis" for regulatory reform; see also *supra* notes 80-93 and accompanying text.

<sup>251</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1453.

[T]he fitness landscape model of Complexity Theory, by unifying the uphill march of natural selection with the downhill error catastrophe made possible by species selection, begins to adjust the neo-Darwinian theoretical features to the reality of evolution. The real point, however, is that whether the species is on the way up or down a peak, marching across a fitness landscape is a pretty inefficient way of searching for higher

definitely not analogical. He argues that "[e]valuating fitness [i.e., whether a law achieves its policy goal] does not permit normative evaluations for laws any more than it does for species."<sup>252</sup> But laws lack several essential features necessary to reasonably translate the process of evaluating law's change into a complexity theory analysis.<sup>253</sup> Laws do not have genotypes or phenotypes and therefore may not be intelligibly described by evolutionary statements such as "variation, heritability, differential fitness, and . . . cumulative selection result in [natural] selection on organisms, and . . . gradual change in populations over time."<sup>254</sup> Moreover, "fitness evaluations" necessarily require organisms existing *from one generation to the next*. Laws are not life forms; there is no reasonable way to delimit a law's "generation." Ruhl errs by characterizing law's normative features in terms of a fitness evaluation,<sup>255</sup> unreasonably speculating that law's evolution is a mechanical function of "fitness landscapes."<sup>256</sup>

Complexity theory's analysis—if accepted by those with political authority—carries a high social and political risk; knowledge *is* power. Governments endorsing complexity theory's claims about fitness evaluation may rely upon the theory to identify issues worthy of consideration and to suggest alternative solutions.<sup>257</sup> Individuals may express their views and take

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fitness peaks. It may be a deadly game also, as the time spent in fitness valleys wandering between peaks is when a species risks extinction. Laws, like biological species restricted to walking their way from peaks to higher peaks, must be pretty lucky to start out on Mount Everest.

*Id.* (citations omitted).

<sup>252</sup> *Id.* at 1451.

<sup>253</sup> Furthermore, the concepts are not uniformly described or used by evolutionary biologists. See KIM STERELNY AND PAUL E. GRIFFITHS, *SEX AND DEATH: AN INTRODUCTION TO THE PHILOSOPHY OF BIOLOGY* 372-77 (1999) (discussing Stuart Kauffman's "NK model's" fitness landscapes).

<sup>254</sup> *Id.* at 37.

<sup>255</sup> See *supra* note 252 and accompanying text.

<sup>256</sup> See *supra* Part I.A.3.

<sup>257</sup> After all, once the theory is accepted it can tell us about and evaluate fitness landscapes. See *infra* Part II.C.2. for additional discussion of these issues in the context of sustainable development and optimization algorithms.

responsibility for their choices, but ultimately, regulatory issues will be resolved by a higher epistemic and moral authority: decision-makers relying upon complexity theory.

In the sociolegal system, political power shifts to complexity theory experts and those with privileged access to such experts.<sup>258</sup> In this respect, Ruhl's formula for environmental regulatory analysis harkens back to the New Deal's reliance on scientific experts.<sup>259</sup> Ruhl has simply created an expert with a more all-encompassing range of knowledge and understanding. Ruhl's experts not only provide fundamental information about environmental regulatory subjects,<sup>260</sup> but also about the proper design and direction of the environmental regulatory system.<sup>261</sup> Complexity theory's implicit mandate to convert "norms, rules and justifications to facts, generalizations, and explanations"<sup>262</sup> will lead environmental regulation into a new age of "scientific management" uprooting traditional views of political liberty.<sup>263</sup>

Ruhl's reconceptualization of laws as species demonstrates the challenge of applying a unifying theory to a political and legal system. The analysis of a law's success cannot be meaningfully separated from its essential relation to public policy and morality.<sup>264</sup> Law's success is a function of legal rules, organizational forms, enforcement characteristics, and norms of

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<sup>258</sup> See FRANKFURTER, *supra* note 30, at 157-58 (arguing that as scientific knowledge grows and the "power which must more and more be lodged in administrative experts, [the power] is prone to abuse unless its exercise is properly circumscribed and zealously scrutinized").

<sup>259</sup> James O. Freedman, *Expertise and the Administrative Process*, 28 ADMIN. L. REV. 363, 364-65 (1976) (arguing that proponents of "the New Deal's regulatory initiatives regarded expertise and specialization as the particular strengths of the administrative process").

<sup>260</sup> See *supra* notes 94-129 and accompanying text.

<sup>261</sup> See *supra* Part I.

<sup>262</sup> RORTY, *supra* note 1, at 180.

<sup>263</sup> Cf. PAUL FEYERABEND, *SCIENCE IN A FREE SOCIETY* 9 (Verso ed., 1985) (1978) (arguing that "[a] free society is a society in which all traditions have equal rights and equal access to the centers of power") (emphasis omitted).

<sup>264</sup> See *supra* note 92 (describing law's analysis as an "independent" function of "fitness landscape" evaluations); see also *supra* notes 80-93, 249-62 and accompanying text.

behavior.<sup>265</sup> Individuals participating in deliberative democratic processes, within the institutional framework,<sup>266</sup> should determine a law's success.

Ruhl's concept of law—gutted of its fundamentally normative character—ceases to be law. The unified law-and-society system approach fails to capture laws' normative features within its concept of fitness landscape. Ruhl's evolutionary theory of law minimizes the deliberative feature of democracy; the participatory process of exchanging ideas about the merits of a law is absent from Ruhl's model. Complexity theory's "explanatory power"<sup>267</sup> does not portray direct or representative democratic processes causing change in law, nor does Ruhl satisfactorily explain human decisions and actions leading to revolutionary change in law and government. The only way to conceive of a non-ideological, non-normative basis for change in law is to eliminate humans and laws as they are currently understood conceptually, which cannot be done.

## 2. "Democracy" in the Sociolegal Ecosystem: Neo-Darwinian "Sex"

We hold these truths to be self-evident: that all men are created equal; that they are endowed, by their Creator, with certain unalienable rights; that among these, are life, liberty, and the pursuit of happiness. That, to secure these rights, governments are instituted among men, deriving their just powers from the consent of the governed; that, whenever any

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<sup>265</sup> See generally NORTH, *supra* note 226, at 33 ("explor[ing] the relationship [between] the behavioral assumptions . . . the characteristics of transacting . . . and the institutional structure of a society" and arguing that property rights "[a]ppropriation is a function of legal rules, organizational forms, enforcement, and norms of behavior—that is, the institutional framework").

<sup>266</sup> See *id.*

<sup>267</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1417; see also *supra* notes 112-13 and accompanying text.

form of government becomes destructive of these ends, it is the right of the people to alter or to abolish it . . . .<sup>268</sup>

Ruhl argues that at the time of the formation of the United States, the common law and the Constitution "form[ed] a sociolegal ecosystem—a system of making rules—which is remarkably adaptive."<sup>269</sup> The modern administrative state, riddled with the end-products of reductionist policies, suppresses the original Constitutional State's complex system qualities<sup>270</sup> and increases the risk of modern catastrophe.<sup>271</sup> Ruhl responds to these regulatory problems by attempting to develop a coherent model of law's process of change.<sup>272</sup> However, his approach substantially undermines traditional understandings of democracy by placing the concept into a neo-Darwinian, mechanical context.

Ruhl claims that democracy is "an agent of change"<sup>273</sup> that allows the system to evolve in a manner that maximizes "fitness."<sup>274</sup> In the sociolegal ecosystem, democracy is neo-Darwinian "sex,"<sup>275</sup> contributing to the system's fitness potential through the structural concepts of "patchiness" and "coupling."<sup>276</sup> Ruhlian democracy potentially improves law's fitness by

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<sup>268</sup> THE DECLARATION OF INDEPENDENCE para. 3 (U.S. 1776).

<sup>269</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1474.

<sup>270</sup> *Id.* at 1480-81.

<sup>271</sup> *Id.* at 1481 (arguing that the current administrative state may appear comfortable due to its "apparent predictability . . . [but] we will face an increasingly ominous threat of a major catastrophe"); *see also supra* notes 37-45, 94-144 and accompanying text.

<sup>272</sup> *See supra* notes 37-46.

<sup>273</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1474.

<sup>274</sup> *Id.*

<sup>275</sup> *Id.*; *see also id.* at 1467 (arguing that the best way to structure the sociolegal system to effectively and efficiently "jump" across "fitness landscapes" is through "sex, that is, the sociolegal version of sexual reproduction—democracy").

<sup>276</sup> *Id.* at 1474; *see also supra* notes 112-13.

optimizing the system's dispersal of lawmaking power and the degree of interrelatedness among lawmaking power "units."<sup>277</sup>

Ruhl again oversteps the boundaries of reasonable analogical argument. Metaphorically, democracy may be likened to raw, erotic and passionate sex, but simple neo-Darwinian copulation—*definitely not*.<sup>278</sup> Democracy and its governing institutions are about *people*. The fundamental principles of democracy—liberty and equality—underlie government's promulgation of formal rules and the cultural development of informal rules encouraging and restraining various behaviors.<sup>279</sup> Social institutions are, ideally, designed to promote and protect individual values of liberty and equality in a just and efficient manner.<sup>280</sup>

Ruhl's discussion of democracy avoids addressing the critical roles of government and normative judgment in regulation. Environmental regulations are often based upon normative concerns expressed as "collective desires, including aspirations . . . or considered judgments. . . . Laws of this sort are a product of deliberative processes on the part of citizens and representatives. . . . This understanding of politics recalls Madison's belief in deliberative democracy."<sup>281</sup>

Complexity theory does not provide a reasonable explanation for the "deliberative processes"<sup>282</sup> that produced the constitutional government or the environmental laws and regulations originating in the 1960s and 70s. The sociolegal model does not satisfactorily explain environmental regulation—such as clean air, endangered species, or public land use—as a fundamentally normative process based upon democratic principles.<sup>283</sup>

<sup>277</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1475. Presumably, an optimization algorithm to maximize coupling and patchiness awaits discovery on complexity theory's horizon.

<sup>278</sup> This Article hesitates to consider the Framers' reaction to Ruhl's "analogy." Perhaps the Constitution was produced by the Big Bang.

<sup>279</sup> See NORTH, *supra* note 226, at 6.

<sup>280</sup> John Rawls, *The Justification of Civil Disobedience*, in CIVIL DISOBEDIENCE: THEORY AND PRACTICE 240, 241-43 (Hugo Adam Bedau ed., 1969).

<sup>281</sup> SUNSTEIN, *supra* note 16, at 57 (citation omitted).

<sup>282</sup> See *id.*

<sup>283</sup> See *id.*

Cass Sunstein identifies several closely related normative influences contributing to the democratic development of environmental regulations.<sup>284</sup> Citizens may perceive law to provide the best practical avenue for fostering a socially conscious state.<sup>285</sup> Social consciousness may include measures intended to safeguard future generations' well-being, for example, by protecting biodiversity, public land resources, and air quality.<sup>286</sup> Regulations may also be designed to provide equal access to valued properties and experiences, such as national parks and wildlife refuges.<sup>287</sup> In this sense, citizens act altruistically, considering the needs of their neighbors and future citizens without attending first to their private desires.<sup>288</sup> The sociolegal model does not distinguish among the various functions and goals of environmental regulation; Ruhl unreasonably and mechanistically analyzes the complete set of environmental regulations as "an undifferentiated whole."<sup>289</sup>

### 3. Conclusion

The sociolegal model depicts a society that is missing a conceptual place for deliberative democracy. In Ruhlian democracy, human norms and judgments are less important than complexity theorists' views. The theory's fundamental flaws, in the context of the sociolegal system, include an underlying theory of government that eliminates individual liberty expressed directly or through representatives in deliberative democratic processes, and the

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<sup>284</sup> See *id.* at 57-58.

<sup>285</sup> *Id.*

<sup>286</sup> *Id.*

<sup>287</sup> SUNSTEIN, *supra* note 16, at 57-58.

<sup>288</sup> *Id.* at 57-60.

<sup>289</sup> *Id.* at 48.

It is impossible to make claims about the precise scope and nature of regulation without knowing a lot about the facts. . . . [I]n spite of these difficulties, regulatory statutes can be distinguished according to function; they should not be treated as undifferentiated wholes; they fall into recognizable patterns; they are often subject, at least in principle, to a powerful defense.

*Id.*

essential role of norms in regulations' justification and evaluation. The law-and-society model amounts to a justification for a non-democratic, analytical approach to issues of environmental regulation. Complexity theory's unifying principles allow Ruhl to ignore many important features of democracy, including leadership, group volitions, competition for political power, and the relations between government power and individual liberties.<sup>290</sup> Ruhlian democracy simply operates on a fundamentally different set of rules and principles than traditional concepts of democracy. The law-and-society system sacrifices government's distinctly human character for coherence among complexity theory's concepts.

### *C. Complexity Theory in Practice: Sustainable Development*

Indeed, unless we choose to decentralize and to use applied science, not as the end to which human beings are to be made the means, but as the means to producing a race of free individuals, we have only two alternatives to choose from: either a number of national, militarized totalitarianisms . . . or else one supra-national totalitarianism, called into existence by the social chaos . . . and developing, under the need for efficiency and stability, into the welfare-tyranny of Utopia. You pays your money and you takes your choice.<sup>291</sup>

Complexity theory's risks to the environmental regulatory system become more pronounced in the practical context of sustainable development. Ruhl's outlook for sustainable development<sup>292</sup> includes the notion that complexity theory's mathematical

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<sup>290</sup> See JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY 269-73 (1st ed. 1942) (arguing that "the democratic method is that institutional arrangement for arriving at political decisions in which individuals acquire the power to decide by means of a competitive struggle for the people's vote").

<sup>291</sup> ALDOUS HUXLEY, BRAVE NEW WORLD xiv (2d ed. 1946) (1932).

<sup>292</sup> Ruhl, *Sustainable Development*, *supra* note 2, at 35-36 (claiming that "sustainable development defines all social problems in terms of three

formulas will eventually be applicable to non-physical systems.<sup>293</sup> The prospect accentuates the fundamentalist flavor of his legal philosophy. Complexity optimization algorithms<sup>294</sup> will someday resolve the epistemic differences among relevant sciences' knowledge claims and knowledge production methods.<sup>295</sup> Equally, if not more, important, complexity theory's algorithms will supplant the normative basis for selecting among alternative scientific theories and methods; the assumption is that the algorithms will provide the best method for solving multi-parameter, multi-dimensional *social* problems.<sup>296</sup>

Ruhl's attempt to describe the practical application of complexity theory provides a final illustration of the "theory's" conceptual and methodological limitations. No matter how effective unifying theories may appear to be, they cannot employ their own methods to justify heightened epistemic status. Moreover, communities' normative judgments—not a mathematician's calculations or a logician's symbolic analysis—select one theory or policy over another.<sup>297</sup> Devoting future time and energy to the development of a unifying legal theory will unnecessarily obscure the social reality of legislative and judicial practice.

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parameters—environment, economy, and equity—and projects them in the dimensions of geographic scale and time”).

<sup>293</sup> See *infra* notes 298-323 and accompanying text.

<sup>294</sup> See *infra* note 301 and accompanying text; see also *infra* Part II.C.1-2.

<sup>295</sup> See *infra* Part II.C.1-2.

<sup>296</sup> See *supra* note 292; see also *infra* Part II.C.2, notes 298-323 and accompanying text.

<sup>297</sup> See LONGINO, SCIENCE AS SOCIAL KNOWLEDGE, *supra* note 194, at 12 (arguing that the “development of knowledge is a necessarily social rather than individual activity”); see also THOMAS S. KUHN, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS 184-85 (3d ed. 1996) (1962) (arguing that the importance of normative and scientific values “emerges when the members of a particular scientific community must” choose among new theories, competing scientific methods (e.g. quantitative versus qualitative) and other “incompatible ways of practicing their discipline”).

## 1. A Complex Vision for Sustainable Development

Ruhl foresees sustainable development<sup>298</sup> providing the fundamental information necessary to complete the link between mathematically advanced forms of complexity theory and the law-and-society system.<sup>299</sup> Complexity theory's analytical methods will unify the information produced by disparate disciplines' research in the separate but overlapping categories of ecology, economics, and social equity.<sup>300</sup> Ruhl suggests he discovered a link between his complexity-based theory of law's evolution and sustainable development's practical policies. "I have found complexity theory useful for describing how the framework for the evolution of law must be built: It must be designed around adaptive optimization

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<sup>298</sup> See Ruhl, *Sustainable Development*, supra note 2, at 38-39.

The Brundtland Commission defined the term as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." At the core of this concept is "a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations."

*Id.* (citing WORLD COMM'N ON ENV'T & DEV., OUR COMMON FUTURE 43, 46 (1987)).

<sup>299</sup> Ruhl, *Sustainable Development*, supra note 2, at 56-58; see also *id.* at 59 (arguing that ecosystem management relies upon "an emerging trend . . . to identify interdisciplinary indicators" that meaningfully combine social, economic and ecological data traditionally packaged in separate units).

<sup>300</sup> See Ruhl, *Sustainable Development*, supra note 2, at 57.

A crude algorithm for sustainable development would (1) find the optimum for all three E's at one location and time, taking into account the effects tinkering with any one will have on the other two; then (2) evaluate the effects of the local solution on all other local, regional, and global solutions; then (3) evaluate the effects of the local solution on all future solutions; and finally (4) repeat the process until the system reaches a stable, sustainable equilibrium. The sustainable development algorithm thus must iteratively solve the basic three E's goals, projected across time and space, by accounting for all the feedback and feedforward loops that exist in their coevolving system.

*Id.*

algorithms. Sustainable development must forge such algorithms and the ability to use them. . . ."<sup>301</sup>

The purpose of sustainable development policy "is to achieve a social framework in which economy, environment, and equity all are sustainable in perpetuity over all geographic scales."<sup>302</sup> Sustainable development "defines all social problems"<sup>303</sup> in terms of five interdependent components: economy, social equity, ecology, time, and geographic scale.<sup>304</sup> The time and geographic scale variables are the sustainability policy "dimensions,"<sup>305</sup> the three remaining variables are the policy "parameters."<sup>306</sup> The three parameters of sustainable development present two decision-making problems. Each variable corresponds to underlying phenomena that are in a "constant [state of] flux,"<sup>307</sup> and intervening to improve the conditions defining one parameter value often adversely affects another parameter value.<sup>308</sup>

Sustainable development's purpose will eventually be realized by adopting the fundamental problem-solving technique of complexity theory—the adaptive search algorithm<sup>309</sup>—as a theme for sustainable development.<sup>310</sup> Sustainable development decisions should be based upon fitness landscape analysis<sup>311</sup> optimized by

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<sup>301</sup> *Id.* at 63.

<sup>302</sup> *Id.* at 39.

<sup>303</sup> *Id.* at 35.

<sup>304</sup> *Id.* at 39-43; see also Ruhl, *Co-Evolution*, *supra* note 2, at 177 (asserting that "sustainable development . . . fuses environment, economy, and equity into one policy triad").

<sup>305</sup> Ruhl, *Sustainable Development*, *supra* note 2, at 43-44.

<sup>306</sup> *Id.*

<sup>307</sup> *Id.* at 43.

<sup>308</sup> *Id.*

<sup>309</sup> *Id.* at 46; see *id.* at 44-45 (arguing that the "approach that best responds to [the multi-parameter, multi-dimensional knot] of sustainable development is drawn from complexity theory—the field of research focusing on dynamic systems that are complex, adaptive, and evolutionary").

<sup>310</sup> Ruhl, *Sustainable Development*, *supra* note 2, at 57; *id.* at 37 (asserting that sustainable development is more than just a policy or a philosophy; it is "a non-static set of recipes, a problem-solving technique known as an algorithm").

<sup>311</sup> See *supra* notes 37-45, 249-85.

the application of search algorithms.<sup>312</sup> Ruhl recognizes the current knowledge deficit preventing such comprehensive algorithms, but he strongly suggests that the algorithmic method will replace policymakers' dominant tendency toward a linear, reductivist<sup>313</sup> approach.<sup>314</sup>

## 2. The Epistemic and Normative Consequence of "Unifying" Theories

Ruhl's claim that complexity theory's optimization algorithm is the key ingredient for *the* conceptual framework of law's evolution<sup>315</sup> is not surprising given his goal to develop a "coherent theory of law's process of change."<sup>316</sup> However, Ruhl does not justify the assumption that complexity theory can ever do the epistemic and normative work he claims. Synthesizing the competing claims and theoretical bases of economics, ecology and other sciences into an algorithmic formula is more than just a challenging prospect; it exists (perhaps) as a logical possibility, forever beyond the realm of practical reality.<sup>317</sup>

Ruhl's epistemic aspirations<sup>318</sup> resemble the proclamations of philosophers claiming the higher ground of "epistemological behaviorism."<sup>319</sup> Richard Rorty identifies the crux of the

<sup>312</sup> Ruhl, *Sustainable Development*, *supra* note 2, at 45-46.

<sup>313</sup> *Id.* at 46-47.

<sup>314</sup> *See id.* at 62 (arguing that "we need to bring the environmental side of information and modeling up to the level already achieved for economic and social data, and then move to the next level in which multi-factor information can be generated and modeled").

<sup>315</sup> *See supra* note 301 and accompanying text.

<sup>316</sup> Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 416.

<sup>317</sup> Unless, of course, one wishes to engage in endless speculation about what economics, ecology, and science itself might one day become as the human condition changes to something far beyond our most Utopian imaginations.

<sup>318</sup> *See supra* Part I.C.1.

<sup>319</sup> RORTY, *supra* note 1, at 315; *see also* PAUL FEYERABEND, *AGAINST METHOD* 43 (Verso 3d ed., 2002) (1975) (arguing that

Parmenides' theory of the homogenous and unchanging One illustrates a desire that has propelled Western sciences from their inception up to the present time—the desire to find a unity

problem with epistemological foundationalism as a "quest for commensuration."<sup>320</sup>

By "commensurable" I mean able to be brought under a set of rules which will tell us how rational agreement can be reached on what would settle the issue on every point where statements seem to conflict.<sup>321</sup> These rules tell us how to construct an ideal situation, in which all residual disagreements will be seen to be "noncognitive" or merely verbal, or else merely temporary—capable of being resolved by doing something further.<sup>322</sup>

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behind the many events that surround us. Today the unity sought is a theory rich enough to produce all the accepted facts and law. . . .);

CARTWRIGHT, *supra* note 29, at 34 (describing "fundamentalists" as those who "want laws; they want true laws; but most of all, they want their favourite laws to be in force everywhere"); LONGINO, SCIENCE AS SOCIAL KNOWLEDGE, *supra* note 194. Cf. John Dewey, *The Logical Method of Law*, 10 CORNELL L.Q. 17, 27 (1924) (arguing that "newer rules may be needed and useful at a certain juncture, and yet . . . also become harmful and socially obstructive if they are hardened into absolute and fixed antecedent premises").

<sup>320</sup> RORTY, *supra* note 1, at 317.

<sup>321</sup> Note that this sense of "commensurable" is not the same as "assigning the same meaning to terms." This sense—which is the one often used in discussing Kuhn—does not seem to me a useful one, given the fragility of the notion of "sameness of meaning." To say that parties to a controversy "use terms in different ways" seems to me an unenlightening way of describing the fact that they cannot find a way of agreeing on what would settle the issue.

*Id.* at 316 n.1.

<sup>322</sup> *Id.* at 316. Rorty describes the philosophical conflict stemming from the search for knowledge foundations:

The dominating notion of epistemology is that to be rational, to be fully human, to do what we ought, we need to be able to find agreement with other human beings. To construct an epistemology is to find the maximum amount of common ground with others. The assumption that epistemology can be constructed is the assumption that such common ground exists. . . . To suggest that there is no such common ground *seems* to endanger

Rorty credits Thomas Kuhn with shedding light on the issue of commensurability and pertinent issues bearing upon algorithms.<sup>323</sup> Kuhn questioned whether algorithms could determine how to choose among competing scientific theories.<sup>324</sup> Kuhn argued that value-laden factors, not algorithms and comparative problem-solving, ultimately resolved theory choice and scientific change.<sup>325</sup> Scientists judge theories based on theories' "accuracy, scope, simplicity, fruitfulness and the like."<sup>326</sup> These criteria justify the choice of one theory over another, but scientists often differ in the relative importance they attribute to a particular value, such as accuracy versus scope, and in their method of applying each value to resolve a particular theory choice dilemma.<sup>327</sup> Algorithms are not capable of erasing value-based differences in judgment and replacing the theory choice process with a neutral, epistemically superior framework.<sup>328</sup> For example, complexity theory represents a new set of concepts and conceptual framework; relevant communities will apply normative and

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rationality. To question the need for commensuration seems the first step toward a return to a war of all against all.

*See id.* at 316-17.

<sup>323</sup> *Id.* at 322-33 (citing THOMAS S. KUHN, *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS* (2d ed. 1970) and THOMAS S. KUHN, *THE ESSENTIAL TENSION* (1977)).

<sup>324</sup> *Id.* at 322.

<sup>325</sup> THOMAS S. KUHN, *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS* 153-59 (3d ed. 1996); *see also supra* note 323.

<sup>326</sup> Thomas S. Kuhn, *Reflections on My Critics*, in *CRITICISM AND THE GROWTH OF KNOWLEDGE* 231, 261 (Irme Lakatos & Alan Musgrave eds. 1970).

<sup>327</sup> *Id.* at 261.

<sup>328</sup> RORTY, *supra* note 1, at 327 (arguing that the criteria of theory choice "function not as rules, which determine choice, but as values which influence it") (quoting KUHN, *THE ESSENTIAL TENSION* 326 (1977)); *see also* Kuhn, *supra* note 326 at 268-70 (arguing that language translation processes illustrate the absence of a neutral language to resolve theory choice decisions; "a translation manual inevitably embodies a theory, which offers the same sort of reward, but also is prone to the same hazards, as other theories"); FEYERABEND, *AGAINST METHOD*, *supra* note 319, at 14-19 (arguing that close attention to the history of science illustrates there is no "fixed theory of rationality" governing scientific "progress").

scientific, value-based criteria to determine the legitimacy and adequacy of the theory's content and methods.

Rorty builds on Kuhn's position to argue that epistemological foundationalism amounts to a search for algorithms that govern choices about what constitutes the knowledge of the world.<sup>329</sup> Society cannot get outside itself to construct a neutral language that describes the world as it *is*.<sup>330</sup> The problem with believing in the epistemological power of algorithms and unifying theories is that "the gap between the neutral language and the only languages useful in deciding the issue at hand is too great to be bridged by 'meaning postulates.'"<sup>331</sup> Society is relegated to an epistemological fall-back position that turns on the value-based evaluation of knowledge choices in a socially discursive, normative setting.<sup>332</sup> Knowledge justification is a normative process that guides knowledge content and production practices.<sup>333</sup>

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<sup>329</sup> RORTY, *supra* note 1, at 327.

<sup>330</sup> *Id.* at 178-79.

<sup>331</sup> *Id.* at 324; *see also id.* at 325 (arguing that we "need to give up the notion of 'data and interpretation' with its suggestion that if we could get the *real* data, unpolluted by our choice of language, we should be 'grounding' rational choice").

<sup>332</sup> *See id.* at 171 (arguing that considering "knowledge as a matter of conversation and of social practice, rather than as an attempt to mirror nature, we will not be likely to envisage a metapractice which will be the critique of all possible forms of social practice"); LONGINO, FATE OF KNOWLEDGE, *supra* note 23, at 128-29 (arguing "that scientific knowledge is produced by cognitive processes that are fundamentally social. An adequate normative theory of knowledge must then be a normative theory of social knowledge, a theory whose norms apply to social practices and processes of cognition.").

<sup>333</sup> *See* LONGINO, FATE OF KNOWLEDGE, *supra* note 23, at 143 (arguing that knowledge content and knowledge production practices should be justified according to "central normative notions [of] epistemic acceptability and conformation . . . These involve both traditional evidential norms and the community norms of effective critical interaction (criticism, for short)."); RORTY, *supra* note 1, at 320.

Normal science is as close as real life comes to the epistemologist's notion of what it is to be rational. Everybody agrees on how to evaluate everything everybody else says. More generally, normal discourse is that which is conducted within an agreed-upon set of conventions about what counts as a relevant contribution, what counts as answering a question, what counts

Ruhl suggests epistemic justification for environmental regulatory decisions is not a social process. His reliance upon the future of complexity theory leads to the position that the adequacy of a knowledge claim about a sustainable development policy decision is a function of complexity theory's algorithmic method. He assumes that complexity theory will bridge the various scientific disciplines' disparate explanations for phenomena resulting in a unified whole.<sup>334</sup> Sustainable development research practices will produce the algorithmic language necessary to unite the disciplines' knowledge claims under the complexity theory roof.<sup>335</sup> At a minimum, optimization algorithms will supersede all competing strategies attempting to identify, integrate and reconcile the knowledge claims relevant to sustainable development policies.

Ruhl's claims about the power of algorithms are necessarily dependent upon a "method of commensuration."<sup>336</sup> Ideally, complexity theory concepts and meta-principles<sup>337</sup> will guide the objective assimilation, evaluation and commensuration of all knowledge claims relevant to sustainable development's three parameters<sup>338</sup> and the two dimensions of time and geographic scale. Ruhl's complexity theory advocacy unreasonably bypasses the position that theory choice is a normative matter, not just a logical, mathematical, or scientific process.

Ruhl's theoretical strategy unravels in two related respects. First, social and scientific values will necessarily be an integral part of the communal decision whether to accept optimization algorithms over alternative methods as a guide for sustainable

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as having a good argument for that answer or a good criticism of it.

*Id.*

<sup>334</sup> See *supra* notes 6-7, 31-93, 298-314.

<sup>335</sup> See *supra* notes 298-314.

<sup>336</sup> RORTY, *supra* note 1, at 320. "The idea of commensurability is built into the notion of 'genuine cognition,' so that what is 'only a matter of taste' or 'of opinion' need not fall within epistemology's charge, and conversely, what epistemology cannot render commensurable is stigmatized as merely 'subjective.'" *Id.*

<sup>337</sup> See *supra* note 319 and accompanying text.

<sup>338</sup> These parameters are equity, ecology, and economy. See *supra* notes 302-08.

development policies and practices. Second, social and scientific values will necessarily influence the communal decisions that determine the relative importance of theories and knowledge claims produced under the three parameters of sustainable development.

Ruhl acknowledges that the "optimization of sustainable development . . . poses normative issues,"<sup>339</sup> but he sidesteps the important epistemic and normative issues<sup>340</sup> outlined above. He assumes the superior epistemic value of knowledge gleaned from optimization algorithms, understood in the context of a unifying theory. "The point of the algorithmic approach is to allow those normative decisions to be as fully informed as possible in terms of the effect of different choices on the overall performance of the system."<sup>341</sup> Ruhl's statement is an important epistemological *and* normative claim. He is claiming that the algorithmic method will provide us with the *kinds of knowledge* ("the effect of different choices" produced via fitness landscape analysis)<sup>342</sup> necessary to

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<sup>339</sup> Ruhl, *Sustainable Development*, *supra* note 2, at 56 n.77.

The optimization of sustainable development thus poses normative issues, such as how much government control is desired, how much intervention in individual family planning decisions will be tolerated, how much income disparity is acceptable, and so on. The point of the algorithmic approach is to allow those normative decisions to be as fully informed as possible in terms of the effect of different choices on the overall performance of the system.

*Id.*

<sup>340</sup> See *supra* notes 315-38.

<sup>341</sup> See *supra* note 339.

<sup>342</sup> Ruhl, *Sustainable Development*, *supra* note 2, at 45.

[A] fitness landscape [can be constructed] for any system of connected interactions. The presence of such conflicting constraints in the system may make the fitness landscape flat or rugged and multi peaked. Much of the work in complex systems research is aimed at understanding systems' fitness landscape "search algorithms." These algorithms are the problem-solving computations and adaptations that systems apply in evolving across fitness landscapes; their objective is to stay in optimum positions at all times.

make sustainable development decisions. Moreover, the algorithmic approach provides the *best available knowledge* ("as fully informed as possible") for deciding among competing choices bearing upon sustainable development policies.

Ruhl's response to normative concerns is disheartening.<sup>343</sup> Bearing in mind that sustainable development "defines all social problems"<sup>344</sup> in terms of the three parameters and two dimensions, he implies that decisions about the "correct" amount of government control over citizens and families will be potentially guided by optimization algorithms.<sup>345</sup> Eventually, the algorithms will describe the fitness landscapes on the social policy horizon and weigh competing alternatives for a given policy in terms of their future impact upon the fitness landscape; no other analyses will be necessary.<sup>346</sup>

### 3. Conclusion

Ruhl's algorithmic vision is clouded by logical and practical problems. If sustainable development defines all social problems, and optimization algorithms will eventually solve sustainable development problems, then why must there be a choice of norms among the sustainable development alternatives<sup>347</sup> generated by complexity theory's superior epistemic method? Perhaps Ruhl envisions a day when humans will *not* make any normative decisions because the algorithmic optimization method will determine the best choices for *each human* to make in order to

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*Id.*; see also *id.* at 46 (stating that "[w]hen we map the interrelations and conflicting constraints of sustainable development's five components, we create such a fitness landscape"); *id.* at 54 (noting that "[o]ptimization across a fitness landscape involves using optimizing search algorithms not only to control for direction, but also to test the fitness of different system component combinations and adapt to the results continuously").

<sup>343</sup> See *supra* notes 315-46 and accompanying text.

<sup>344</sup> See *supra* note 292.

<sup>345</sup> See *supra* notes 292-314, 339 and accompanying text.

<sup>346</sup> See *supra* notes 292-339 and accompanying text.

<sup>347</sup> See *supra* notes 339-42 and accompanying text.

maximize his or her own "fitness landscape."<sup>348</sup> The new society will resemble a *Brave New World*<sup>349</sup> with a significant dose of Orwellian control. If a human is caught deviating from the government's algorithmic determination of his "best" fitness landscape, then he will be summarily incarcerated for "unreasonably" threatening the "public good." His deviant behavior would potentially harm the rest of the populace willfully complying with the government's algorithmic "fitness" recommendations.

Ruhl's reformulation of law's potential epistemic scope, understood as a function of complexity theory, renders obsolete debate about Mill's "practical question, where to place the limit—how to make the fitting adjustment between individual independence and social control."<sup>350</sup> In the context of environmental law and regulation, Ruhl develops the prototypical answer to Mills' quandary through his complex systems ideology and the function of the optimization algorithm in sustainable development policy. In the unified law-and-society system, complexity theory's province expands to include matters traditionally viewed as non-scientific and essentially normative. If Ruhl is correct, we are entering a world in which Mill's concerns about individual liberty are on the brink of revolutionary resolution. Complexity theory will provide the fundamental mechanism—an optimization algorithm—necessary to fairly identify when government is justified in exercising power over individuals or groups in order to "prevent harm to others,"<sup>351</sup>

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<sup>348</sup> It is important to recall that people are also complex adaptive systems. See *supra* note 204 and accompanying text.

<sup>349</sup> HUXLEY, *supra* note 291.

<sup>350</sup> Mill, *supra* note 235, at 130.

<sup>351</sup> *Id.* at 135.

The object of this essay is to assert one very simple principle, as entitled to govern absolutely the dealings of society with the individual in the way of compulsion and control, whether the means used be physical force in the form of legal penalties, or the moral coercion of public opinion. That principle is, that the sole end for which mankind are warranted, individually or collectively, in interfering with the liberty of action of any of their number, is self protection. That the only purpose for which

including future generations. Guided by complexity theory's lights, political authorities are no longer as challenged by what Mill called "the principal question in human affairs"<sup>352</sup>—what rules of conduct should be imposed by law and which human behaviors mark the bounds of legitimate government interference.<sup>353</sup>

Perhaps "this is not our fate."<sup>354</sup> Instead, we should wave goodbye to all-encompassing, unifying theories once and for all; their long-term social and political consequences are not particularly desirable. In fact, the pursuit of such preeminent theories is quite dangerous, leading to a world governed by those who control the "superior" knowledge production method and justify its government-sponsored use as the most effective method for solving social problems. Platonic Queens and Machiavellian Princes may not produce *good* offspring.

#### D. Conclusion

The epistemological and normative consequences of complexity theory's application to the unified sociolegal model extend well beyond the specifics of sustainable development. The law-and-society system argument presupposes that complexity theory provides the epistemological foundation necessary to explain law's change through time, the behavior and structure of law, and the subjects of environmental regulation.<sup>355</sup> The model is premised upon the unifying principles that will eventually produce the tools necessary to coherently and accurately assess the fitness landscape

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power can be rightfully exercised over any member of a civilized community, against his will, is to prevent harm to others.

*Id.*; see also *supra* Part II.C (discussing sustainable development and algorithms).

<sup>352</sup> *Id.*

<sup>353</sup> *Id.*

<sup>354</sup> See Bob Dylan, *All Along the Watchtower*, on JOHN WESLEY HARDING (Columbia Records 1967) ("No reason to get excited,' the thief, he kindly spoke, 'There are many here among us who feel that life is but a joke. But you and I, we've been through that, and this is not our fate, So let us not talk falsely now, the hour is getting late.'").

<sup>355</sup> See *supra* Part I.B.

*governing* choices for regulatory reinvention; deliberative democratic processes diminish in importance.

Ruhl's account of law's evolution creates a bifurcated regulatory world separating the experiential, normative world of mere appearances and the real world accessed and explained only with complexity theory. His conceptual drift to a novel worldview is fueled by the analytical isolation of laws—formal rules—from the informal constraints, enforcement characteristics and human organizations<sup>356</sup> forming the world of environmental regulation. The theoretical and practical meanings of "law" and "society" are insufficiently distinct to justify their normative separation in the sociolegal model. Ruhl's separation of laws from "social mores and ethics"<sup>357</sup> creates an artificial concept of law that subtly destroys the foundation of the non-physical version of complexity theory.

The practical problems with Ruhl's theory demonstrate that "theoretical knowing, or cognition, is parasitic upon circumspection, or practical know-how."<sup>358</sup> Complexity theory will not produce objective knowledge to adjudicate the value-based conflicts necessarily characterizing the formation, interpretation, and implementation of *all* environmental regulations.<sup>359</sup> Regulatory

<sup>356</sup> See generally NORTH, *supra* note 226, at 36-60.

<sup>357</sup> See *supra* notes 50-54 and accompanying text.

<sup>358</sup> Leiter, *supra* note 224, at 280. See generally *id.* at 267-68 (arguing that all-encompassing theories will never adequately explain "practical know-how," in part, due to

the sheer magnitude of what is contemplated by asserting the primacy of theory: One must be able to produce a lexical ordering of rules describing the whole network of semiautomatic ways we have of coping with everyday events and things . . . . The complexity is staggering; but what is worse is that it is not apparent that we could ever fully capture in theoretical form what we do with practical ease. . . . At some point . . . "in-principle" reductions become suspect when they have no successful instantiations. Show us a theoretical reduction of practical know-how to explicit rules, the Heideggerian might say, and then we will take the challenge seriously.).

<sup>359</sup> See RORTY, *supra* note 1, at 163 (criticizing the foundationalist view that the way to know more about the objects of our beliefs is to find within "the activity of a quasi-visual faculty, The Mirror of Nature . . . a special privileged class of representations so compelling that their accuracy cannot be doubted").

change, which must include changes in agency culture, should be pursued without attempting to incorporate the illusory certainty Ruhl seeks through a unifying theory (and its algorithms). Human beings are responsible for designing and implementing policies—imperfection and uncertainty are necessary features of the process. Regulatory coherence and consistency—admirable goals never to be fully realized—should be pursued with a context-specific approach that recognizes the importance of human deliberation, responsibility, and democracy.<sup>360</sup>

### III. ENVIRONMENTAL REGULATORY REFORM SANS COMPLEXITY THEORY

The answer to the defects of democracy is not denial of the democratic idea. . . . We shall equally avoid blind attachment and romantic impatience only if we recognize the essentially provisional nature of all political arrangements. Such an attitude will treat government not only as a mechanism for day-to-day adjustments but also as an hypothesis in action, to be modified by the experience which it adduces.<sup>361</sup>

Defining the problem with environmental regulation as a function of a poorly structured and maladapted regulatory whole distorts the relative influence of particular laws and specific agency practices on regulatory problems. Environmental regulatory

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<sup>360</sup> *Id.* at 348-49 (providing the following advice to “defenders of hermeneutics” engaging in philosophical argument with “defenders of ‘unified science.’”

[The] defenders of hermeneutics should just say that, as a matter of brute fact rather than of metaphysical necessity, there is no such thing as the “language of unified science.” We have not *got* a language which will serve as a permanent neutral matrix for formulating all good explanatory hypotheses, and we have not the foggiest notion of how to get one. (This is compatible with saying that we *do* have a neutral, if unhelpful, observation language.) So epistemology—as the attempt to render all discourses commensurable by translating them into a preferred set of terms—is unlikely to be a useful strategy.).

<sup>361</sup> FRANKFURTER, *supra* note 30, at 128-29.

reform analysis requires the differentiation of particular statutes—or groups of statutes—from the regulatory whole. Context-specific assessment strategies are necessary to identify potential targets for statutory reform and agency reorganization. The contextual approach necessarily attends to the issues at the heart of particular environmental conflicts by investigating the kinds of problems and the kinds of substantive knowledge affecting a subset of the regulatory whole.

Constitutional and democratic principles, not complexity theory's unifying foundation, should provide the justification for environmental regulatory reform. Fortunately, Ruhl provides several laudable reform proposals that may be detached from their complexity theory roots.<sup>362</sup> Although his purported justification is to combat the evils of reductionism with a complex system response, the proposals owe their virtues to constitutional origins. Unencumbered by the gravity of a unifying theory, Ruhl's proposals serve as starting points for future work and research directed toward improving environmental law and regulation. This Article supplements his suggestions with a few thoughts emphasizing the substantive knowledge necessary for agency reorganization, statutory and regulatory change, and future environmental regulatory decisions.

#### A. *Ruhl's Proposals for Environmental Regulatory Reform*

Ruhl proposes three fundamental structural adjustments to the environmental regulatory system "to reverse the reductionist funnel that has produced our regulatory state."<sup>363</sup> The goal is to optimize system sustainability with a unified approach to regulatory reform justified by complexity theory principles.<sup>364</sup> The

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<sup>362</sup> See *infra* Part III.A.

<sup>363</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 917.

<sup>364</sup> *Id.* at 917 (arguing that the "the entire package could produce a redirection away from the regulations attractor toward a more balanced orbit around freedoms, rights, and regulations spheres. The aim is to return us to a sufficiently coupled system . . . to promote maximal system adaptability."); see also *id.* at 917-18 (acknowledging that "each of these proposals has been made

plan is based upon "three interlocking components."<sup>365</sup> Ruhl suggests that "common law, rights-based solutions"<sup>366</sup> should be the primary means for governing the exercise of freedoms. Congress should also participate directly in more substantive decision-making processes bearing upon regulatory issues; agencies would serve as "Congress's research and monitoring arm."<sup>367</sup> Finally, Congress and the judiciary should become less deferential and sharply curtail agency discretion.<sup>368</sup>

The first proposal suggests common law principles should play an important role at all levels of regulatory reform. Ruhl translates the Legal Realists' "vision [for the common law] into the lexicon of dynamical systems theory"<sup>369</sup> to produce the best available mechanism for enhancing system adaptability.<sup>370</sup> The common law offers "system structure and process" advantages over other rigid alternatives.<sup>371</sup> The common law changes slowly and incrementally,<sup>372</sup> decides conflicts "whole and decides them in their context,"<sup>373</sup> and functions at less abstract levels than agency decision-making processes.<sup>374</sup>

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in some form elsewhere in the literature, [but] none has been made for the reasons I offer, and the three rarely appear as the unified package [that] I propose is necessary to reverse course").

<sup>365</sup> *Id.* at 917.

<sup>366</sup> *Id.* at 917-20; Ruhl, *The Fitness of Law*, *supra* note 2, at 1487.

<sup>367</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 917, 921.

<sup>368</sup> *See id.* at 917, 923-26.

<sup>369</sup> *Id.* at 918.

<sup>370</sup> *See id.* (arguing that "the rights-based attractor of our law-and-society system is adaptive, and the common law is the best approach for keeping us there").

<sup>371</sup> *See id.* at 920.

<sup>372</sup> *See id.* at 919.

<sup>373</sup> *See* Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 919.

<sup>374</sup> *See id.* at 919-20. Ruhl argues that

the common law operates at the component interaction level, whereas the administrative state functions on the upper surface, taking on the problems the lower levels' interactions toss up like ping pong balls. . . . The common law thus is more likely to "see the component interactions before the administrative state does and to adapt to them more efficiently."

*Id.*; *see also* Ruhl, *The Fitness of Law*, *supra* note 2, at 1472 (contending that the common law "through its system of patched jurisdictions and various loose and strong couplings . . . offers reasonable expectations of evolving towards the

Ruhl also proposes reinvigorating the nondelegation doctrine and requiring congressional action on critical environmental regulatory issues.<sup>375</sup> Agency responsibilities would be limited to day-to-day operations of government, providing Congress with assistance upon request.<sup>376</sup> Reinforcing the nondelegation doctrine promotes system adaptability because Congress "is more dynamically in tune with the law-and-society system than one can imagine any modern agency being."<sup>377</sup>

However, Ruhl's proposal to enhance congressional activities in environmental affairs is contingent upon the implementation of several congressional reform measures.<sup>378</sup> Congress should enact *effective* laws prohibiting campaign financing by special interests.<sup>379</sup> Congressional reform should also address "committee structure, term limits, third party access, and the like . . . if we expect Congress to take back some of the responsibilities it has frittered away to agencies and exercise them adaptively."<sup>380</sup>

Ruhl argues that the "new-look" Congress should substantially enhance judicial review of administrative discretion.<sup>381</sup> Congress should reverse the *Chevron*<sup>382</sup> and *Chadha*<sup>383</sup> doctrines

region of [optimal] complexity—to the edge of chaos"); *id.* at 1487 (arguing that "greater reliance on common law mechanisms of lawmaking" will promote system sustainability).

<sup>375</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 920-22.

<sup>376</sup> *Id.*

<sup>377</sup> *Id.* at 922.

<sup>378</sup> Ruhl, *The Fitness of Law*, *supra* note 2, at 1487.

<sup>379</sup> *Id.*

<sup>380</sup> *Id.*

<sup>381</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 923-26.

<sup>382</sup> *Chevron, U.S.A., Inc., v. Nat' Res. Def. Council, Inc.*, 467 U.S. 837 (1984); see also Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 925 (arguing that "*Chevron* creates an anti-majoritarian force within agencies and allows them to move policy away from the actual policy intended by Congress"); Ruhl, *The Fitness of Law*, *supra* note 2, at 1487.

<sup>383</sup> *Immigration and Naturalization Serv. v. Chadha*, 462 U.S. 919 (1983); see also Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 925-26 (arguing that "reversing the *Chadha* doctrine's prohibition of the legislative veto mechanism would allow Congress to police agency action more directly and thereby take advantage of its superior dynamical responsiveness"); Ruhl, *The Fitness of Law*, *supra* note 2, at 1487.

that unreasonably increase environmental regulatory agencies' decision-making authority. Reversing *Chevron* and *Chadha* would force Congress to make legislative decisions explicit, reduce agency power to legislate, and increase agency accountability to *the people* through their elected representatives.<sup>384</sup> Congress should also adopt less restrictive standards of judicial review for agency decisions than the Administrative Procedure Act's "arbitrary and capricious" and "substantial evidence" standards.<sup>385</sup> Ruhl urges Congress to shift the evidentiary burden of proof and require agencies to justify their discretionary decisions by a preponderance of the evidence or a similar standard.<sup>386</sup>

### B. *Environmental Regulatory Reform Unburdened by Complexity Theory*

Separated from the normative and epistemological burdens of the unifying theory, Ruhl's proposals<sup>387</sup> are easily justified on democratic and constitutional grounds—he provides the evidence and basic arguments connecting the proposals to the Constitution. Moreover, the nature of the proposals warrants incremental implementation<sup>388</sup> rather than across-the-board change encouraged by unifying theories. The separation of powers doctrine provides a basic constitutional justification for Ruhl's proposals. The purpose

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<sup>384</sup> See Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 924-26.

<sup>385</sup> See 5 U.S.C. § 706(2)(A), (E) (2000) (requiring that courts limit substantive review of agency action to determining whether the agency's decision was "arbitrary [or] capricious" or "unsupported by substantial evidence").

<sup>386</sup> Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 923.

<sup>387</sup> See *supra* notes 366-68 and accompanying text.

<sup>388</sup> See NORTH, *supra* note 226, at 89 (arguing that "the single most important point about institutional change, which must be grasped . . . is that institutional change is overwhelmingly incremental"). See generally Cynthia R. Farina, *The Consent of the Governed: Against Simple Rules for a Complex World*, 72 CHI.-KENT L. REV. 987, 1036-37 (1997) (arguing for an implementation of the "Founders'" tools, "theory, practical wisdom, and conscious experimentation" to seek solutions to the problems of the regulatory state; society should not set its sights on "a single legitimating savior, [but instead, pursue a process] of incremental experimentation and improvement in the multitude of 'ordinary' political and administrative processes and structures").

of this Article is only to highlight the proposals' plausibility as justifiable on constitutional and democratic grounds, not to argue the position in detail.

Agencies' excessive political power infringes upon the constitutional authority and responsibilities of the congressional and judicial branches.<sup>389</sup> Agencies are sometimes beholden to special interest groups<sup>390</sup> and they often act without reasonable political accountability.<sup>391</sup> The agencies write the regulations interpreting federal statutes *and* governing their own regulatory responsibilities; "it is not good that he who makes the law should administer it."<sup>392</sup> Congress rarely evaluates the agencies' implementation of statutory goals through agency regulations. Environmental regulatory agencies have morphed into powerful political entities that slipped under the Constitution's radar.

James Madison's democratically motivated cautions about "factions"<sup>393</sup> and "self-interested"<sup>394</sup> governance provide a philosophical vantage point from which to re-examine agency decision-making processes.<sup>395</sup> In *The Federalist No. 10*, Madison noted that the range and scope of factional influence, and its degree of harm to democratic society, fluctuates "according to the different

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<sup>389</sup> See *supra* notes 140-42, 375-86 and accompanying text.

<sup>390</sup> *Id.*

<sup>391</sup> *Id.*

<sup>392</sup> JEAN-JACQUES ROUSSEAU, *THE SOCIAL CONTRACT* in SIR ERNEST BARKER, *SOCIAL CONTRACT: ESSAYS BY JOHN LOCKE, DAVID HUME AND JEAN-JACQUES ROUSSEAU* 231 (Oxford University Press 1960) (1762); *THE FEDERALIST* No. 10, at 79 (James Madison) (Clinton Rossiter ed., 1961). "No man is allowed to be a judge in his own cause, because his interest would certainly bias his judgment, and, not improbably, corrupt his integrity. With equal, nay with greater reason, a body of men are unfit to be both judges and parties at the same time." *Id.*

<sup>393</sup> *THE FEDERALIST*, *supra* note 392, at 78-79 (asserting that by a faction I understand a number of citizens, whether amounting to a majority or minority of the whole, who are united and actuated by some common impulse of passion, or of interest, adverse to the rights of other citizens, or to the permanent and aggregate interests of the community).

<sup>394</sup> SUNSTEIN, *supra* note 16, at 16.

<sup>395</sup> See, e.g., Ruhl & Salzman, *Red Queen*, *supra* note 2, at 761 n.11 (quoting Richard B. Stewart, *Madison's Nightmare*, 57 U. CHI. L. REV. 335, 342 (1990)).

circumstances of civil society."<sup>396</sup> He argued that a republican form of government provides greater protection to the Constitution than a pure democracy by reducing the impact of factions and the likelihood of officials acting in their self-interest.<sup>397</sup> Representatives are drawn from a sufficiently large group of citizens over a sufficiently large geographic area "to guard against the cabals of a few."<sup>398</sup> Madison contended that the constitutional design produced a national government and state governments that counteracted factional influence and fairly apportioned responsibility for the public good.

Ruhl draws attention to Congress's failure to oversee the promulgation of agency regulations to ensure the protection of democratic principles and statutory purposes.<sup>399</sup> Ruhl's argument for increased congressional action over core subjects of environmental regulation parallels some of Madison's concerns about "factions." Regulatory agencies exercise broad political power over issues directly affecting the public good without sufficient levels of *practical* accountability to citizens' elected representatives.<sup>400</sup> Congressional inaction betrays the public trust and contravenes its constitutional responsibility to reasonably uphold the separation of powers doctrine.

For several decades, agency expertise has been mistakenly justified by the reductionist philosophy Ruhl slays quite well.<sup>401</sup> The expertise label arguably imbues agencies with excessive power over natural resource decisions.<sup>402</sup> Agencies often act as epistemic

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<sup>396</sup> THE FEDERALIST, *supra* note 392, at 79; cf. SIR THOMAS MOORE, UTOPIA (Robert M. Adams trans. & ed., W.W. Norton & Co. 1975) (1516) (stating that "[w]herever they take root in men's minds, these two evils, greed and faction, are the destruction of all justice—and justice is the strongest bond of any society").

<sup>397</sup> See THE FEDERALIST, *supra* note 392.

<sup>398</sup> *Id.* at 82.

<sup>399</sup> See *supra* note 375.

<sup>400</sup> See Ruhl & Salzmann, *Red Queen*, *supra* note 2, at 761 (arguing that regulatory agencies are motivated to promulgate new rules favoring special interest groups).

<sup>401</sup> See *supra* notes 37-45, 94-129 and accompanying text.

<sup>402</sup> See Freedman, *supra* note 259, at 369-74 (arguing that in 1976 the public attitude toward agencies was one of increasing skepticism. Freedman suggested

governors, a far cry from Ruhl's suggestion that they should conduct "research and monitoring"<sup>403</sup> functions as Congress's agents. Environmental regulatory agencies' authority undermines the democratic process of producing and evaluating knowledge claims relevant to policy decisions. Agencies' decision-making power has simply outgrown its constitutional and democratic justifications.

Ruhl's proposal to shift the burden of proof to agencies is also justified by the separation of powers doctrine.<sup>404</sup> Until Congress proscribes agency authority, the judiciary should incorporate Ruhl's "common law" proposal<sup>405</sup> and aggressively hold environmental agencies' accountable for their substantive decisions.<sup>406</sup> Responsible adjudication entails cognitive and normative functions. The contextual nature of judicial proceedings provides ample opportunity for the judiciary to compel increases in the level of transparency and accountability characterizing agencies' decision-making processes.

Freed from complexity theory's illusory foundation, Ruhl's proposals<sup>407</sup> provide reasonable starting points for environmental regulatory reform. But Ruhl also notes that reform measures will fail in the absence of greater attention to the acquisition and

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the following reasons for increased skepticism: "Traditional distrust of experts," "[a]bsence of genuine 'expertise,'" and "[i]nadequacy of expertise to resolve questions of public policy Congress delegated to agencies.").

<sup>403</sup> See *supra* note 367 and accompanying text.

<sup>404</sup> See *supra* notes 381-86 accompanying text.

<sup>405</sup> See *supra* notes 370-74 and accompanying text.

<sup>406</sup> See *supra* notes 381-86; see generally Jonathan T. Molot, *Reexamining Marbury in the Administrative State*, 96 NW. U. L. REV. 1239, 1337 (2002). Molot defends

judicial power based on the judiciary's structural role and institutional attributes. As the lone constitutional actor without a formal role in legislation or law execution, the judiciary is uniquely situated to place needed limits on government administration and to ensure that political officials comply with the constitutionally prescribed lawmaking procedures and the constitutional separation of powers.

*Id.*

<sup>407</sup> See *supra* Part III.A.

assimilation of knowledge.<sup>408</sup> He emphasizes the importance of developing interdisciplinary knowledge that bridges the gaps among claims produced by ecologists, economists, sociologists, and other relevant fields.<sup>409</sup>

Ruhl also identifies the unfairness characterizing mainstream methods for cost-benefit and risk-analysis.<sup>410</sup> His cautions point to the critical democratic problem with economic analyses relied upon by special interests—or by agencies themselves—to justify regulatory decisions. Mainstream economic analyses governing environmental regulatory decisions erroneously assume that natural resources are “boundless.”<sup>411</sup> Traditional views of the “environment as a subsystem of the economy”<sup>412</sup> should be replaced—or at least complimented—with an economics founded on the principle that the “human economy is a subsystem of the

<sup>408</sup> Ruhl, *Sustainable Development*, *supra* note 2, at 58-63.

<sup>409</sup> See, e.g., *id.* at 57-62.

<sup>410</sup> See Ruhl & Ruhl, Jr., *The Arrow of Law*, *supra* note 2, at 479-80 (contending that cost-benefit analysis of regulatory proposals should be avoided because it may enhance social inequity); Ruhl, *Complexity Theory as a Paradigm*, *supra* note 2, at 914-16 (arguing that “risk-benefit” analysis is a misguided reductivist idea).

<sup>411</sup> Douglas A. Kysar, *Law, Environment, and Vision*, 97 NW. U. L. REV. 675, 678 (2003) (arguing that

environmental law does not suffer from a lack of well-designed, well-studied policy tools to achieve its goals, but rather from a lack of urgency among policymakers and the public concerning the necessity to achieve those goals. Such urgency simply does not follow from a preanalytic [economic] worldview in which nature is assumed to be boundless.).

<sup>412</sup> *Id.* at 728; see also *id.* at 676-77 (arguing that

because mainstream economic accounts generally fail to recognize absolute limits imposed by nature on the ability of humans to appropriate and utilize natural resources, they also fail to provide an adequate conceptual basis on which to make the political judgments required by tradable permit schemes. Just as cost-benefit analysis seems incoherent under the moral absolutism of 1970s-era environmental statutes, setting aggregate limits to annual sulfur dioxide emissions appears nonsensical, or at least not urgent, within a theoretical model that recognizes no ultimate constraints to economic growth.)

(citation omitted).

environment."<sup>413</sup> Environmental regulatory reform should include re-examining mainstream economic assumptions that obstruct well-informed natural resource policy decisions. Douglas Kysar appropriately suggests that the "famous Lockean proviso that private ownership of resource use is collectively maximiz[ed] only so long as 'there is enough, and as good left in common for others' arguably has become an issue of actual, rather than mere philosophical, concern."<sup>414</sup>

Congress should re-enter the natural resources game and sufficiently fund comprehensive research about the environment's ecological conditions to explore the very challenging task of developing context-specific, environmental "baselines."<sup>415</sup> This is a long-term proposition carrying considerable conceptual and practical challenges. Oliver Houck summarizes the normative and epistemic issues precluding a simple solution to the problem of designing environmental laws and regulations to produce the best knowledge for policymakers.

Specificity, then, becomes the greatest challenge to any law seeking to protect biological diversity and ecosystems. On one level, it is a question of wrestling potentially limitless questions of scale, time, baselines, and scientific complexity to the ground. On another level, it is a question of standards sufficient to wrestle the most powerful economic forces in the country, if not to the ground, to something closer to a draw.<sup>416</sup>

If Congress follows Ruhl's regulatory reform proposals and funds policies to increase the knowledge reservoir and level of detail about ecological phenomena, we should witness the

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<sup>413</sup> *Id.* at 728.

<sup>414</sup> *Id.* at 698.

<sup>415</sup> See *id.* at 717-27 (advocating adopting "natural resource depletion quotas" to help address population and consumption levels).

<sup>416</sup> Oliver A. Houck, *On the Law of Biodiversity and Ecosystem Management*; 81 MINN. L. REV. 869, 883 (1997).

invention and application of new technologies for environmental applications—in the field and in the lab. Agencies will emphasize research over administration as they transform into Congress's "research and monitoring arm."<sup>417</sup> The environmental regulatory system will develop through new institutional arrangements placing a premium on knowledge and reducing agency responsibility for critical environmental policy decisions.

Agency organizations should be redesigned to facilitate integration of agency and non-agency information networks to improve access to information bearing upon environmental regulation and policy. The design and construction of comprehensive information networks may yield an opportunity for Ruhl's complex adaptive systems philosophy to impact regulatory practices.<sup>418</sup> The physical network systems should be structured to optimize the acquisition, productive integration, and targeted dissemination of ecological, economic, and social knowledge to relevant agencies and organizations (including universities). Congress should authorize the development of an environmental regulatory information network consistent with government's responsibility to responsibly decide natural resource issues.

### C. Conclusion

Environmental regulatory agencies' organizational structures should be superseded by more adaptive, less centralized, and far more politically accountable organizations dedicated to research and monitoring. Ruhl's proposals (*sans* complexity theory) serve as an important starting point for reforming the environmental regulatory system. The justifications for change should emanate from the democratic principles that fueled the formation of the Constitution; we should democratically identify and discuss

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<sup>417</sup> See *supra* note 367.

<sup>418</sup> See Ruhl, *Sustainable Development*, *supra* note 2, at 62-63 (discussing the "[President's Committee of Advisors on Science and Technology call] for 'next generation' National Biological Information Infrastructure to create a 'fully-digitally accessible, distributed, interactive research library system'" ) (citation omitted).

regulatory alternatives without appealing to "unifying" principles from complexity theory. Douglass North's "general points" should serve as important reminders on the path to an improved environmental regulatory apparatus. First, "the institutional framework will shape the direction of the acquisition of knowledge and skills."<sup>419</sup> Second, "that direction will be the decisive factor for the long-run development of society."<sup>420</sup> The institutional framework will develop and evolve only if Congress and the judiciary emphasize the need for freshly ordained agencies that serve the people as researchers and monitors, rather than as judges and legislators.

CONCLUSION: COMPLEXITY THEORY'S LAW-AND-SOCIETY  
SYSTEM—"CONCEPTUAL REDUCTIONISM"?

Well-intentioned efforts to develop unifying theoretical foundations for environmental regulatory reform are destined to fail. Holling, Gunderson, and Ludwig's straightforward confessions<sup>421</sup> provide rare insight into the human fascination with discovering a solution to all unanswered questions. Perhaps only great minds have the capacity to challenge the world's disparate and often inexplicable phenomena with "unifying" theories. Unfortunately, this approach leads to the "pitfall of overstretched generality"<sup>422</sup> and necessary retreat to humble positions honoring human limitations. Retreat in this instance need not signal defeat. The goal to improve the human condition through the design of a just environmental regulatory system is actually furthered by such noble, but ill-fated, efforts. We benefit even in the absence of a unifying theory that explains phenomena in the environmental regulatory system. Our responsibility now is to direct our attention to incremental, context-specific strategies designed to usher in a renaissance of environmental law. Contextual strategies have the potential to induce changes in public consciousness and promote

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<sup>419</sup> NORTH, *supra* note 226, at 78.

<sup>420</sup> *Id.*

<sup>421</sup> See *supra* notes 153-58 and accompanying text.

<sup>422</sup> See *supra* note 155.

regulatory reform. A renaissance in environmental law and policy will begin with seemingly insignificant, small victories motivated by fundamental democratic principles.

Complexity theory served a useful purpose, but it is time to stop diverting time and energy to the dream of a "unifying" theory. Complexity theory will never succeed where all others have failed—attempting to reduce norms to facts, rules to generalizations, and justifications to explanations.<sup>423</sup> In the context of the sociolegal system, complexity theory may survive the charge of "substance-based" reductionism, but "conceptual reductionism?" That's another story.

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<sup>423</sup> RORTY, *supra* note 1, at 180; *see also supra* note 145.