

2005

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Deborah Tussey
Oklahoma City University School of Law

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Recommended Citation

Deborah Tussey, *Music at the Edge of Chaos: A Complex Systems Perspective on File Sharing*, 37 Loy. U. Chi. L. J. 147 (2005).
Available at: <http://lawcommons.luc.edu/lucj/vol37/iss1/6>

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Music at the Edge of Chaos:

A Complex Systems Perspective on File Sharing

*Deborah Tussey**

I. INTRODUCTION

The twin developments of digital copying and global networking technologies have drastically transformed the information environment and have produced particularly acute dislocations in the music recording industry. The perceived threat to the industry posed by peer-to-peer (P2P) file sharing has inspired numerous proposals for legislative action, many involving major adjustments to or even abandonment of the copyright regime. Contemporary file sharing arose in the context of a system designed to produce and distribute musical recordings. This article approaches the issue of file sharing regulation¹ by applying complexity theory and related principles of systems analysis to that system.

Systems both occur naturally and result from human design.² Complexity theory provides a conceptual model for a particular category of systems—complex adaptive systems³—and their evolution

* Associate Professor, Oklahoma City University School of Law. Thanks to Sam Lupica and to participants in the 2004 Works-in-Progress IP Colloquium at Boston University and the 2005 IP & Communications Law and Policy Scholars Roundtable at Michigan State University—DCL College of Law, for their comments on earlier versions of this article. The writing of this article was supported by a grant from the Kerr Foundation and Law Alumni Fund.

1. This article focuses on federal regulation through the U.S. copyright regime. International regulation falls outside the scope of the article except insofar as U.S. regulation will inevitably have transborder effects.

2. “[F]or reasons not yet explained, phenomena order themselves largely as discrete systems.” Lynn M. LoPucki, *The Systems Approach to Law*, 82 CORNELL L. REV. 479, 483 (1997). A system is an aggregation of two or more inter-related, interacting elements or components that comprise a unified whole. See MERRIAM-WEBSTER’S COLLEGIATE DICTIONARY 1269 (11th ed. 2003) (expanding the basic definition of “system” to a variety of contexts including, for example, thermodynamic systems; systems of body organs; networks; social, economic, and political organizations; and conceptual systems). This article focuses on complex adaptive systems, which are open, dynamic, nonlinear systems and may be either physical or conceptual.

3. Writers vary somewhat in their use of the terminologies “complex system” or “complex adaptive system” to describe nonlinear, dynamical systems that produce emergent behaviors

over time. Building on chaos theory, complexity theorists in both the hard and soft sciences have sought to identify fundamental characteristics of complex systems as diverse as the global environment, the human brain, nation states and tribal organizations, free market economies and stock markets.⁴ Complexity theory suggests that complex adaptive systems, regardless of their particular subject matters, universally exhibit certain characteristics, of which the most critical is self-organization or emergence. Within such systems, unexpected system-wide behavioral patterns “emerge” from the predictable local interactions of the system’s constituent elements, facilitating adaptation to changes in the surrounding environment.⁵ The most successful systems maintain a state poised between total order and complete chaos—a position “at the edge of chaos”—which provides the system with the flexibility necessary to adapt to change.

Theories derived from the study of computer models⁶ or natural phenomena do not always provide a one-to-one correspondence to human systems.⁷ Nonetheless, complexity theories, in combination with systems analysis,⁸ have produced useful models of evolutionary change

enabling adaptation to changing circumstances. In this article, the terms are used interchangeably.

4. There is considerable overlap between the fields of chaos and complexity theory. Both deal with nonlinear, dynamical systems. As a rule of thumb, chaos theorists may focus more on the divergent behaviors that can result from deterministic rules, while complexity theorists concentrate on the universal patterns of behavior, including chaotic behavior, displayed by complex systems. Complexity theory subsumes chaos theory and the definitional borders between the two remain somewhat hazy. See ROGER LEWIN, *COMPLEXITY: LIFE AT THE EDGE OF CHAOS* 10–13 (1992) (discussing the overlap between chaos and complexity). Some writers tend to use the terms interchangeably. See, e.g., Andrew W. Hayes, *An Introduction to Chaos and Law*, 60 UMKC L. REV. 751, 756 (1992), who introduces his discussion of chaos theory thus: “Chaos is about complexity” For engaging, readable accounts of the development of these fields, see also JAMES GLEICK, *CHAOS: MAKING A NEW SCIENCE* (1987) (discussing the science of chaos); M. MITCHELL WALDROP, *COMPLEXITY: THE EMERGING SCIENCE AT THE EDGE OF ORDER AND CHAOS* (1992) (discussing the development of complexity and chaos theory).

5. The characteristics of complex systems, including emergence and positioning at the “edge of chaos” are fully defined and explored *infra* Part II.

6. The development of computers powerful enough to create artificial complex systems, such as cellular automata, or to simulate real systems like the weather, was critical to the development of complexity theory, and many of its principle tenets derive from computer models. See WALDROP, *supra* note 4, at 63–64 (discussing the impact of computers on the study of complex systems).

7. Some controversy remains over the extent to which science-based theories can be directly applied to subjects such as the rise and fall of social systems. See, e.g., JOHN L. CASTI, *COMPLEXIFICATION: EXPLAINING A PARADOXICAL WORLD THROUGH THE SCIENCE OF SURPRISE* 77–84 (1994) (describing the controversy over the applicability of mathematical catastrophe theory, an aspect of complexity theory, to biological and social systems).

8. While complexity theory offers insight into the behaviors of complex systems, systems analysis provides a methodology for studying them. A systems approach requires that observers

in political, economic, technological, socio-cultural, and legal systems.⁹ Whether one considers the complexity model to be directly applicable or merely a helpful analogy or metaphor, it offers a framework through which the controversy over music file sharing can be viewed with fresh eyes.

The system for producing and distributing music recordings (the music system) can be described as a complex adaptive system in which legal, political, economic, socio-cultural, and technological subsystems converge, interact, and coevolve. Digitization and global networking introduced disruptive perturbations into the workings of this system, requiring an evolutionary response to the new environment. Complexity theory predicts that new models of information creation and

analyze each system holistically by defining and evaluating the functionality of the entire system, rather than reductively by examining only its components. Systems analysis accommodates complexity, providing a comprehensive analysis of system function by defining the system, discovering its goals, and evaluating whether it achieves them. See LoPucki, *supra* note 2, at 481. Complexity theory fundamentally assumes a systems approach. There is considerable overlap between general systems theory and complexity theory.

9. See, e.g., PER BAK, *HOW NATURE WORKS: THE SCIENCE OF SELF-ORGANIZED CRITICALITY* (1996) (applying self-organized criticality to natural phenomena); ROBERT JERVIS, *SYSTEM EFFECTS: COMPLEXITY IN POLITICAL AND SOCIAL LIFE* (1997) (applying complexity theory to social science and political theory); STEVEN JOHNSON, *EMERGENCE: THE CONNECTED LIVES OF ANTS, BRAINS, CITIES, AND SOFTWARE* (2001) (discussing emergence theory); Stuart Kauffman, *AT HOME IN THE UNIVERSE: THE SEARCH FOR LAWS OF SELF-ORGANIZATION AND COMPLEXITY* (1995) (discussing spontaneous order and self-organization and the effect on ecosystems, economic systems, and cultural systems); W. Brian Arthur, *Complexity and the Economy*, 284 *SCIENCE* 107, 107–109 (1999), (discussing complexity theory in the economic context). A number of legal scholars have applied aspects of chaos and complexity theories to legal theory in general and to specific legal disciplines. See Thomas Earl Geu, *The Tao of Jurisprudence: Chaos, Brain Science, Synchronicity, and the Law*, 61 *TENN. L. REV.* 933, 942–75 (1994) (discussing the application of chaos theory to the law in theoretical terms); David G. Post & Michael B. Eisen, *How Long is the Coastline of the Law? Thoughts on the Fractal Nature of Legal Systems*, 29 *J. LEGAL STUD.* 545 (2000) (discussing complexity theory); Mark J. Roe, *Chaos and Evolution in Law and Economics*, 109 *HARV. L. REV.* 641, 641–68 (1996) (discussing chaos theory, path dependence, and modern evolution theory as applied to law and economics); 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, 849–928 (1996) [hereinafter Ruhl, *Complexity*] (discussing the role of complexity in the interaction between law and society); Robert E. Scott, *Chaos Theory and the Justice Paradox*, 35 *WM. & MARY L. REV.* 329, 329–51 (1993) (discussing chaos theory as a viable option for solving the justice paradox). Legal scholars have also applied complexity theory to specific legal disciplines. See, e.g., Susan P. Crawford, *The Biology of the Broadcast Flag*, 25 *HASTINGS COMM. & ENT. L.J.* 603, 603–52 (2003) (applying complexity theory to broadcast flag mandates); David G. Post & David R. Johnson, “*Chaos Prevailing On Every Continent*”: *Towards a New Theory of Decentralized Decision-Making in Complex Systems*, 73 *CHI.-KENT L. REV.* 1055 (1998) (applying chaos theory to cyberspace governance); 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, 933–1002 (1997) [hereinafter Ruhl, *Thinking*] (applying complexity theory to environmental law).

dissemination will naturally emerge over time from the millions of individual interactions among users and providers of content and digital technologies. P2P file sharing is one such emergent behavior. It has fed back into the music system and has produced emergent responses in the form of new online business models.¹⁰ These recent developments suggest that the music system is adapting successfully to the digital environment.

Nonetheless, the current political climate appears to favor legislative intervention, and many proposals are under discussion in Congress, within academia and in the media. This article argues that legislators should approach legal regulation of the music system cautiously to avoid rendering the system unsustainable by depriving it of the flexibility needed to adapt to changing circumstances.

Part II of this article outlines the characteristics of complex adaptive systems.¹¹ Part III demonstrates that the music system displays those characteristics and may be adapting to the P2P phenomenon. There is, to date, little empirical support for claims that the system is at risk.¹² The availability of empirical evidence, however, often bears an inverse relationship to the likelihood of legislative intervention. Consequently, Part IV suggests a few general principles which may be useful to regulators of the music system, noting the importance of personal uses.¹³ Part V then briefly analyzes several proposed models for regulating the music system and concludes that all of them fail to allow the system reasonable time to adapt without further legislative intervention.¹⁴

Part VI proposes that the current regulatory structure be left essentially unaltered for approximately three years.¹⁵ During that period, regulators should monitor the system to assure that system conditions encourage open competition in online distribution. Further, independent observers should perform a comprehensive system analysis to establish whether any legislative intervention is, in fact, necessary. If empirical analysis indicates that legislation is needed, the most successful legislative strategies will be those which recognize that unpredictable, sometimes disruptive, change is not only inevitable, but advantageous to the system. Regulators should employ multiple

10. Notably, Apple iTunes and similar online music services, which are facilitated by flexible digital rights management systems.

11. See *infra* Part II (providing background on complexity theory and complex adaptive systems).

12. See *infra* Part III (applying a systems approach to the music system).

13. See *infra* Part IV (suggesting legislative strategy to regulate the complex music system).

14. See *infra* Part V (applying suggested strategy to current reform proposals).

15. See *infra* Part VI (discussing the wait-and-see approach).

strategies over a period of years to keep the system in balance as it completes the transition to the online environment. In short, the legal regime should nudge the music system toward the edge of chaos where the productive interplay between order and disorder will keep the system poised for long term, sustainable growth.

II. CHARACTERISTICS OF COMPLEX ADAPTIVE SYSTEMS

A brief foray into the basic concepts of complexity theory is an obvious prerequisite to application of those concepts to the music system.¹⁶ Complexity theory posits that complex adaptive systems universally possess certain characteristics: they are composed of multiple, interconnected components; change cascades through them in a nonlinear manner; they evolve and coevolve over time in a pattern of punctuated equilibrium; and they produce emergent behaviors. These qualities make system behavior unpredictable over the long term and, where humans intervene in such systems, their actions are likely to produce unintended consequences. The most robust systems exhibit a property sometimes referred to as self-organizing criticality or positioning at the “edge of chaos”—the ability to maintain a productive internal tension between order and chaos.¹⁷

A. *Multiple, Interconnected Components*

Complex systems contain many diverse components. A market economy, for example, includes a variety of business and regulatory organizations, as well as individual producers, sellers, and consumers. Complex systems often “nest” within each other, which is to say that the components of the primary system under observation are themselves

16. The relevance of these concepts to the music system will become apparent in Part III and the reader’s indulgence is requested.

17. See LEWIN, *supra* note 4, at 44–62 (discussing the edge of chaos). The following discussion is drawn from several sources that use variable terminologies to characterize complex adaptive systems. Compare, e.g., Crawford, *supra* note 9, at 622 (summarizing the characteristics of such systems as irreversibility, stability, bifurcation, and symmetry breaking) with Ruhl, *Thinking, supra* note 9, at 939 (listing the key properties as “the aggregation of a system’s many component parts; . . . the dissipative flow of energy, information, or other mediums through the system; . . . the nonlinear path of system evolution; . . . the diversity of system components and behavior; and . . . self-critical behavior . . .”). See generally WALDROP, *supra* note 4, at 11–12 (discussing complex adaptive systems); JERVIS, *supra* note 9, at 5–21 (describing characteristics of complex systems). To some extent, these variations result from the interdisciplinary nature of complexity studies. Arthur, *supra* note 9, at 108 (observing that “[w]hat economists call multiple equilibria, non-predictability, lock-in, inefficiency, historical path dependence, and asymmetry; physicists call multiple meta-stable states, unpredictability, phase- or mode-locking, high-energy ground states, non-ergodicity, and symmetry breaking”). Despite the variable terminologies, there is general consensus on the essential properties of complex adaptive systems.

complex systems that, in turn, contain other complex systems. For example, the business organizations nested within a market economy are complex systems comprised of individual human beings, each of whom is a complex system consisting of interrelated complex systems including the brain, other organs, nervous and endocrine systems, and so on. Consequently, a particular actor, whether individual or institutional, may be simultaneously involved in many systems.

Complex systems contain rich interconnections among components that facilitate the transfer of information, money, products, energy, matter, or whatever medium flows through the system.¹⁸ While most interactions between system components occur locally between “neighbors,” the interconnections assure that information flows throughout the system, often being modified along the way.¹⁹ Consequently, if a perturbation sparks change at one point, the effects propagate throughout the system and often trigger cascades of further change. In some cases, components of the system may be interdependent, so that change in one component requires or constrains change in others.²⁰ The complicated structure of the system thus contributes to its nonlinear behavior.

B. Nonlinearity

Complex adaptive systems are dynamic and always in process.²¹ In linear systems, as processes occur, effects will be proportional to causes. In nonlinear systems, on the other hand, causes do not produce proportional effects. Single causes may produce multiple effects. A small stimulus may cause a large effect or no effect at all.²² In complex adaptive systems, processes unfold according to predictable local rules, but tend to form feedback loops and respond to certain “attractors” in the system, producing nonlinear behavior of the system as a whole over time.

At the local level, system components interact in accordance with rules that are often simple and deterministic. In the short term, these rules produce relatively predictable behaviors. For example, market

18. Ruhl, *Thinking*, *supra* note 9, at 947.

19. See LEWIN, *supra* note 4, at 12–13 (describing the process of emergence); JOHNSON, *supra* note 9, at 74–78 (describing how local interactions in ant colonies produce emergent behavior).

20. See JERVIS, *supra* note 9, at 21–22 (noting that such interdependence is common in both biological and technological systems).

21. Arthur, *supra* note 9, at 107.

22. See JERVIS, *supra* note 9, at 34–39 (discussing the need to comprehend systems through the nonlinear interactions of their variables).

actors follow rules set by the laws of property and contract, as well as by commercial practices and norms, and the results of their actions in individual cases, and in the short term, are fairly predictable. However, the aggregation of activities following those rules often creates feedback loops.²³ In a rising stock market, for example, the assumption that further rises will occur creates positive feedback that encourages more investment, but the increasing cost of shares produces negative feedback that deters some investors.²⁴ In this way, the effects of an actor's behavior feed back to that actor and affect its future behavior; the effects of change within one system may both feed back within that system and cause change in interacting systems, which then feeds back to the primary system.²⁵ The likelihood of feedback loops appearing in a given system correlates with the degree of interconnectedness in the system. Denser interconnections create more feedback.²⁶

Complexity theorists believe that dynamic systems also respond to "attractors"—states to which the system is inherently drawn and which affect its trajectory over time.²⁷ Systems may contain more than one

23. "Feedback" is information returned to the source of an action, event, or process. MERRIAM-WEBSTER'S COLLEGIATE DICTIONARY 459 (11th ed. 2003). Such information follows a circuitous path referred to as a loop. Ruhl, *Thinking*, *supra* note 9, at 948. For examples of feedback in complex systems, see JOHNSON, *supra* note 9, at 130–162. Positive feedback occurs when change in one direction sets in motion reinforcing pressures that produce further change in the same direction. Network effects, in which the value of a good or service increases as more people use it, are a form of positive feedback. Negative feedback occurs when change triggers forces that counteract the initial change and return the system to something like its original position, attempting to keep the system in a stable condition known as homeostasis. A thermostat that responds to a change in temperature by turning the heating and cooling system on or off to maintain a constant temperature is a negative feedback device. Negative feedback is essential for stability, positive feedback for change and growth. Positive and negative feedback loops may operate simultaneously, or sequentially. For example, an arms race is a positive feedback loop (each side continues to escalate) that may produce a negative feedback effect if the race prevents war and prevents either side from achieving dominance. In some cases, it may be difficult to characterize feedback loops as either positive or negative though a certain "drift" may occur over time, as in the case of natural selection. See JERVIS, *supra* note 9, at 125–128 (discussing positive and negative feedback).

24. See Arthur, *supra* note 9, at 1–2 (discussing asymmetrical results in the marketplace caused by positive feedbacks).

25. For example, in predator-prey relationships, as the number of prey increase, so do the number of predators—a cross-species positive feedback loop. Once predators grow too numerous, the prey population declines, which in a negative feedback loop, leads to a decline in predators. See JERVIS, *supra* note 9, at 125–28 (discussing the impact of positive and negative feedback).

26. See JOHNSON, *supra* note 9, at 134 (explaining feedback loop correlation in the context of interconnected neural networks of the brain).

27. See CASTI, *supra* note 7, at 25–37 (discussing the three main types of attractors); GLEICK, *supra* note 4, at 121–53 (discussing strange attractors). For example, in a watershed system, streams, rivers, and run off, are attracted to the lowest geographical point of the basin, such as a lake. The lake itself exerts no particular force on the river—the force of gravity is the motive

kind of attractor, but the most significant in nonlinear systems are so-called “strange attractors” associated with chaotic behavior.²⁸ A system’s behavioral trajectory over time may oscillate among attractors of different strengths.²⁹ The existence of positive feedback loops and strange attractors in complex systems may produce “chaotic” behavior.

Chaotic, in scientific terms, does not mean truly random as it is often understood in common usage. Instead, chaotic systems are deterministic and obey set rules of interaction which, when followed in the aggregate, result in unpredictable behavior or “deterministic randomness.”³⁰ Systems exhibiting chaotic behavior are “sensitive to initial conditions”—even the slightest change in the initial conditions to which identical systems respond can produce wide divergences in system development.³¹ Certain patterns may recur but never in exactly the same way because initial conditions will have changed. With respect to actors within the system, their actions change the surrounding environment so that the same action taken at a later point in time may not produce the same result.³² Consequently, system behavior is

force—the lake is merely a destination, an attractor, to which the river is brought by the interactions of gravity, rain, and geography. The various trajectories by which water runs into the lake compose its basin of attraction. See KAUFFMAN, *supra* note 9, at 78 (explaining the attractor concept).

28. Some attractors are fixed points, like the state of rest of a pendulum; others are cyclical, like an infinite loop on a computer. Strange attractors produce a system trajectory more like a tangled web in which the system trajectory loops around the attractor but never exactly repeats or overlaps its previous path. See 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, 419-26 [hereinafter Ruhl & Ruhl] (explaining the various kinds of attractors).

29. See LEWIN, *supra* note 4, at 20–21 (comparing the movement among attractors to that of being drawn into and out of a series of whirlpools).

30. *Id.*

31. John Casti describes an illustrative example. A chemist watching a saltwater taffy-pulling machine, which repeatedly performed the same mechanical function, observed that the raisins in the taffy appeared to randomly change relative positions. He surmised that two raisins initially placed very close together might, over time, end up in dramatically different positions, and that it would be impossible to predict their future, relative positions. While the results appear to be random (in that they are unpredictable), the rule of action, taffy-pulling, is deterministic. CASTI, *supra* note 7, at 91–92. The phenomenon of sensitivity to initial conditions is widely known as “the Butterfly Effect.” A butterfly flapping its wings in the Amazon rain forest may, on one occasion, set off a chain of events in the atmosphere that, a month later, produces a snowstorm in New York; on another occasion, the butterfly’s actions may have no effect at all. See LEWIN, *supra* note 4, at 11 (explaining the Butterfly Effect as a feature of nonlinear systems).

32. See GLEICK, *supra* note 4, at 8 (stating that small changes in input could quickly become significant changes in output); JERVIS, *supra* note 9, at 55 (stating that because actions change their environment, identical later behavior does not produce identical results).

historically contingent and changes in the system may be difficult or impossible to reverse.³³

C. *Evolution and Coevolution*

Complex adaptive systems change in response to both their own internal dynamics and outside stimuli. For example, markets respond to changing tastes, costs of raw materials and numerous other factors.³⁴ Apart from relatively infrequent exogenous catastrophes,³⁵ adaptation most often results from coevolution, in which the system responds to changes in other systems with which it interacts, and those systems similarly respond to changes in the primary system.³⁶ The line between a complex adaptive system's "environment" and coevolving systems may often be indistinct since the environment to which a given system responds consists primarily of other systems.³⁷ Co-evolving systems may mutually "tune" themselves to a state of maximum fitness.³⁸

The typical pattern of system evolution is that of punctuated equilibrium in which long, stable periods are followed by swift, often

33. Ruhl, *Thinking*, *supra* note 9, at 948, n.56.

34. See WALDROP, *supra* note 4, at 11 (explaining spontaneous self-organization and factors that spark such adaptation).

35. For example, the complex environmental system that supported diverse species of dinosaurs, according to recent hypotheses, was drastically altered by the entirely exogenous stimulus of an asteroid impact, requiring that the many complex animal and plant systems adapted to the former environment change or die. See LEWIN, *supra* note 4, at 76 (discussing the asteroid hypothesis as an explanation for mass extinction).

36. See WALDROP, *supra* note 4, at 309 (discussing the connection between adaptation and coevolution).

37. In biological evolution, for example, the environment in which a species evolves consists of natural systems including the climate, tectonic activity, and predator-prey relationships. The process of co-evolution is often described by analogy to a "fitness landscape" containing peaks of high fitness and valleys of lower fitness. Because of the diversity of components in each system, there will be conflicting constraints between the possible combinations of adaptive traits within the system—it may be impossible to enhance one trait without degrading another. The peaks and valleys of the fitness landscape represent more and less adaptive combinations of traits. See LEWIN, *supra* note 4, at 57 (discussing the fitness landscape analogy). The objective of an adaptive system will be to ascend the peaks, whether by walking across the landscape gradually, testing out adaptive variations, or jumping long distances. Coevolution of systems means that the landscape within which adaptation occurs is itself constantly changing. A typical example occurs in predator-prey relationships where an adaptation giving the prey an advantage will spur a responsive, "coupled" adaptation in the predator. If the prey becomes faster, ascending a new peak in its landscape, it also changes the fitness landscape of its predator, forcing the predator to become faster, find other prey, or face extinction. Ruhl & Ruhl, *supra* note 28, at 430–31.

38. LEWIN, *supra* note 4, at 62. Fitness may have variable meanings depending on the nature of the system observed. For biological systems, for example, it means the ability to survive and reproduce. See KAUFFMAN, *supra* note 9, at 27 (discussing fitness peaks of different kinds of systems). In the context of this paper, "fitness" refers to long-term sustainability of the system.

drastic change.³⁹ A punctuation typically sets off a period of experimentation with many new forms, followed by a winnowing out of less successful forms and increasing specialization.⁴⁰ As a system changes, it “learns,” not in the sense of conscious accretion of knowledge, but in the sense that its past continues to affect its ongoing evolution. Complex systems have a history in which some paths are chosen and others foregone in a branching pattern of bifurcations.⁴¹ Surviving species, technologies, business models, and the like are simply those variations out of many experiments that prove most resilient in adapting to changing circumstances.

D. Emergence

The characteristic of complex adaptive systems that contributes most critically to such resilience is their ability to produce self-organized, emergent behavior. Complex adaptive systems produce “order for free.”⁴² System-wide patterns or properties “emerge” from the aggregate behavior of system components that are following local rules that have no particular relationship to the emergent properties of the system. The existence of the local rules is essential for emergence to occur because without them every agent would simply follow its own

39. See LEWIN, *supra* note 4, at 100–01 (explaining the idea of punctuated equilibrium). Punctuated equilibrium is typified by the pre-Cambrian explosion of multi-cellular life forms following long ages dominated by unicellular forms. *Id.* at 70–72. Because such patterns are evident only over evolutionary time scales, an individual living during a relatively quiescent period may believe the system to be stable and unchanging.

40. See *id.* at 70–71. In biological systems, such periods of drastic change contribute to adaptation by increasing diversity. See Ruhl, *Thinking*, *supra* note 9, at 950–51. A similar pattern is evident in environmental systems, economies, and technological systems. See, e.g., BAK, *supra* note 9, at 60–85 (observing that punctuated equilibrium is manifested in complex physical systems such as the weather and tectonic movement). Bak asserts that the same pattern is also evident in economies, though largely ignored by general equilibrium economics which assumes perfectly rational behaviors not present in real world economies and discards large fluctuations, such as stock market crashes, as aberrations. BAK, *supra* note 9, at 184–92. With respect to technological systems, early developers of the automobile, for example, experimented with many varieties of engines and body designs. Many of those designs failed to survive, a few persisted, and the industry subsequently focused on more specialized innovations in those systems. LEWIN, *supra* note 4, at 70–71. As the supply of oil dwindles and the adverse economic, political, and environmental consequences of reliance on it mount, automakers have once again begun to experiment with new forms, such as hybrid vehicles, in response to their changing environment. Similarly, the development of computer software appears to follow a cycle of experimentation with different formats, followed by winnowing down to a few interoperable standards, followed by incremental improvements to those standards.

41. See GLEICK, *supra* note 4, at 76–80 (describing mathematical and biological bifurcations).

42. See KAUFFMAN, *supra* note 9, at 71–92 (describing processes of self-organization and movement toward the edge of chaos).

rules, precluding the development of cooperative, shared behaviors.⁴³ However, knowledge of the local rules does not enable prediction of the behavior of the system as a whole. Nor can one simply add the component parts of the system together to predict behaviors because the parts interact to produce system behavior quite different from the behavior of the parts individually. The system is not just more than the sum of its parts; it is different from the sum of its parts.⁴⁴

For example, the complex division of labor that emerges in an ant colony is a collective behavior quite different from the simple behavioral rules followed by individual ants.⁴⁵ Likewise, in free market economies, the aggregate activity of businesses and consumers pursuing their own self-interests produce the emergent property described by Adam Smith as the “invisible hand.”⁴⁶ Emergent properties are not necessarily “good” or “bad” from a normative standpoint. They are simply responses to conditions in the system and its surrounding environment.⁴⁷

Emergent patterns feed back to produce change in local rules and behavior, which may then produce new emergent patterns in a cycle of adaptation.⁴⁸ Consequently, a reductive approach that studies only system components and the local interactions among them is necessary, but not sufficient, to gain an understanding of the system.⁴⁹ An observer must consider the system as a whole. Even then, complex systems defy complete understanding or easy prediction of long-term behavior.⁵⁰

43. See JOHNSON, *supra* note 9, at 181. The local rules themselves originate from many sources depending on the nature of the system. For example, evolutionary adaptation, human system design, social norms, and legal regulation may all be sources of local rules.

44. JERVIS, *supra* note 9, at 12–13. In a linear system, on the other hand, the whole does equal the sum of its parts. JOHN HOLLAND, *HIDDEN ORDER: HOW ADAPTATION BUILDS COMPLEXITY* 15 (1995).

45. See JOHNSON, *supra* note 9, at 73–79. Individual ants simply deposit and react to pheromone trails. But their collective activities, their “swarm logic,” allow the colony as a whole to prioritize between food sources and switch among activities such as nest-building, foraging, and pupae-raising in response to changes in external conditions. *Id.*

46. LEWIN, *supra* note 4, at 13.

47. Tornados and hurricanes are emergent properties of weather systems and are hardly considered a “good” thing by the self-aware, human complex adaptive systems living in their paths. See JOHNSON, *supra* note 9, at 137 (discussing why emergent systems are not intrinsically good).

48. See LEWIN, *supra* note 4, at 12–13 (discussing the idea of stability emerging out of complex systems).

49. See CASTI, *supra* note 7, at 273 (discussing the limits of reductionism as a universal problem solving approach).

50. Per Bak notes that each science has focused narrowly on its own specific field without reference to others because of the impossibility of predicting, or reproducing, emergent phenomena through the usual scientific method of prediction followed by reproducible

E. Unpredictability and the Law of Unintended Consequences

Not surprisingly, systems characterized by multiple interconnected components, nonlinearity and emergence tend to be full of surprises. While local interactions among system components often follow predictable patterns, behavior of the system as a whole over any significant length of time is likely to be unpredictable.⁵¹

Human participation in complex systems adds another layer of complication.⁵² Humans consciously seek to control many systems because they are directly affected by system behavior.⁵³ Societies use law to shape the courses of many social, political, and economic systems. Individuals adjust their behaviors according to the impact they believe that their own actions and the actions of others will have on the system.⁵⁴ Given the nature of complex systems, such adjustments and interventions tend to produce multiple effects, some of them indirect or

experimentation. However, the traditional scientific method leaves untouched vast areas of scientific interest including biological evolution, economics, and history. BAK, *supra* note 9, at 7–8.

51. See JERVIS, *supra* note 9, at 16 (discussing the unpredictability of the outcomes from interaction among individual actors). For example, meteorologists know a great deal about the dynamics of hurricanes, which are outputs of massive, complex weather systems, but forecasters can do no better than to outline an enormous “cone of uncertainty” covering hundreds of miles through some part of which any particular storm might track. Earthquakes and volcanic eruptions, the outcomes of the complex system of plate tectonics, are similarly unpredictable. Following 2004’s disastrous earthquake and tsunami in the Indian Ocean, one commentator suggested that many seemingly unrelated seismic events may be manifestations of a global dynamic system in which the shift in one tectonic plate triggers events halfway around the world. Simon Winchester, *The Year the Earth Fought Back*, N.Y. TIMES, Dec. 29, 2004, at A21. See also Nick Madigan & Kenneth Chang, *Quake Hits California 11 Years Late*, N.Y. TIMES, Sept. 29, 2004, at A12 (reporting on the final occurrence, years after scientists predicted it would occur, of a strong quake in a small town on the San Andreas fault). In October, 2004, scientists frequently altered their forecasts as to whether Mount Saint Helens would erupt or merely let off steam. See Sarah Kershaw, *Bigger Eruption Predicted at Mount St. Helens*, N.Y. TIMES, Oct. 3, 2004, at 129 (reporting on scientific predictions regarding the likelihood of additional volcanic eruptions and seismic activity).

52. See Arthur, *supra* note 9, at 107 (discussing the human elements of economics as the cause for a layer of complication that does not exist in the natural sciences).

53. For example, we suffer the ill effects of violent weather, so we have sought for years, with limited success, to devise weather control strategies.

54. For example, economic actors “adjust their market moves, buying decisions, prices, and forecasts to the situation these moves or decisions or prices or forecasts together create.” Arthur, *supra* note 9, at 107. In international politics, national actors anticipate the strategies of other nations and formulate their own strategies accordingly; strategies adopted by one nation may forestall the adoption of certain strategies by others. See JERVIS, *supra* note 9, at 44–45 (discussing the added complexity introduced when actors alter their strategy in reaction to others, in anticipation of what others will do).

delayed, that ripple throughout the system.⁵⁵ Many effects may be unintended by the actors who trigger them.⁵⁶

Like emergent properties, unintended consequences may be normatively good, bad or neutral. In capitalist systems, economic growth may be the unintended result of the pursuit of self-interest in the marketplace.⁵⁷ Centralized planning in communist systems, on the other hand, imposed arbitrary standards that, followed to the letter, eliminated the flexibility needed to respond to changing circumstances and produced the unintended result of economic stagnation.⁵⁸ Obviously, unintended consequences cannot be avoided simply by imposing strict controls. Complexity theory indicates the traits that render system behavior inherently unpredictable are also essential to system sustainability over time. The most robust systems find, and indeed may inherently seek, a balance between ordered and chaotic behaviors.

F. The Edge of Chaos

Complex behavior occurs primarily at the border between completely ordered and completely chaotic behaviors, a state referred to as “the edge of chaos” or self-organized criticality.⁵⁹ The most robust systems

55. See JERVIS, *supra* note 9, at 10–11, 29–32 (discussing the idea that the effect of a disturbance to a system produces multiple linked effects throughout the system).

56. For example, efforts to simplify patent prosecution may have the effect of stifling innovation. See Sabra Chartrand, *Patents; In a Forthcoming Book, Two Professors Make Suggestions on Reinventing the Patent System*, N.Y. TIMES, Sept. 27, 2004, at C8 (reporting on a study by Professors Josh Lerner and Adam Jaffe showing that simplification of the patent system, intended to encourage innovation, produced a degradation in the patent review process and increasingly aggressive patent enforcement, resulting in anti-innovative exploitation of patents for lawsuits). Efforts to encourage safety by imposing seat belt laws may have the effect of increasing pedestrian fatalities as buckled drivers, confident of their own safety, drive more carelessly. JERVIS, *supra* note 9, at 68–69. The Reagan Administration’s cutoff of funds to abortion centers in developing countries, intended to reduce the number of abortions, paradoxically increased them because the centers were also the only source of birth control—more unwanted pregnancies produced more abortions. *Id.* at 61–62. The Federal Superfund law, designed to reclaim contaminated lands, led unexpectedly to the “brownfields” problem, in which developers avoided abandoned urban industrial sites for fear of liability under Superfund. Ruhl & Ruhl, *supra* note 28, at 424. Edward Tenner offers numerous examples of the unintended consequences of technological development, which he denominates the “revenge effect.” EDWARD TENNER, *WHY THINGS BITE BACK* 5–25 (1996).

57. See JERVIS, *supra* note 9, at 65–66 (suggesting that economic growth may be the unintended consequence of the tension between Protestantism and the individual desire for self-enrichment that generates the “invisible hand”).

58. *Id.* at 63.

59. Theorists developed the edge of chaos construct in the context of the study of artificial intelligence through the use of computer models such as cellular automata. Such models suggested that the complex behaviors essential to life and intelligence occur at a state that resembles a phase transition between a solid and fluid. At this “edge,” the system neither locks into rigid order nor dissolves into chaos, but is both stable enough to store information and

find an internal balance between linear, predictable behaviors and nonlinear, unpredictable behaviors, which has been described as “a ‘no-man’s land’ in which chaos and stability pull in opposite directions.”⁶⁰ This state provides the system with both the stability and the flexibility needed to adapt to changing circumstances.⁶¹ Systems that maintain the right mix of ordered and chaotic behaviors—balancing constraint and chance—survive over the long term.⁶² History affirms that neither rigidly controlled systems, like centralized communist systems, nor anarchic systems, like complete laissez-faire economies, are optimal. Healthy systems find a balance.⁶³

Systems which are “self-critical” or poised at the edge of chaos, if disturbed repeatedly, produce a probabilistic range of responses described as a “power law distribution.” Big responses are rare, small ones are common, intermediate responses occur at a rate somewhere in-

evanescent enough to transmit it. Such systems can be organized to perform complex computations and adapt spontaneously to the world. The concept of self-organizing criticality developed in the context of the study of physical systems but is similarly a concept describing a sort of phase transition from one state to another. Related research suggests that the two constructs describe equivalent states. Experimentation with simulations of genetic networks suggested that, through the evolutionary forces of mutation and natural selection, systems may naturally evolve and coevolve toward this state. WALDROP, *supra* note 4, at 292–310. Per Bak, the chief formulator of the concept of self-organizing criticality, observed that truly chaotic and truly stable systems do not evolve; only those systems at the border evolve. See BAK, *supra* note 9, at 29–30 (defining self-organizing criticality).

60. See LEWIN, *supra* note 4, at 51. Systems positioning themselves in this state may exhibit “homeostatic” mechanisms, that is, processes like negative feedbacks that help the system to maintain stability as it evolves. *Id.* at 117–18 (discussing the Gaia hypothesis, which states that all life on earth functions as a single organism maintaining conditions on the planet in a homeostatic state suitable to its needs).

61. Ruhl, *Thinking*, *supra* note 9, at 947.

In a sense, these systems are drawing as much as possible from the adaptive qualities of nonlinearity without falling all the way into disaster. They are being held back from the edge by the presence of ordered, linear behavioral qualities in the system. A system poised in this manner ‘at the edge of chaos’ is likely to be adaptive and successful—in other words, a complex adaptive system.

Id.

62. The best-known illustration of self-organized criticality involves a physical system: the steady sprinkle of sand grains raining down on a pile of sand on a tabletop. The pile eventually reaches a point where it cannot grow any more—as new sand is added, old sand cascades down the sides and off the edge of the table at the same rate. The sand pile is self-organized in that it has reached a steady state without any extraneous control, and it is in a critical state because the sand grains on the surface are just barely stable. In other words, the sand pile has spontaneously reached a state where order and disorder coexist in balance. BAK, *supra* note 9, at 49–64. Bak considered self-organized criticality to be essential to complex systems and applied the principle to landscape formation, earthquakes, clouds, solar flares, biological evolution, and economics.

63. See WALDROP, *supra* note 4, at 293–294 (discussing the need for economies to find a balance between order and chaos).

between.⁶⁴ Power law distributions have been found in a variety of physical and human systems.⁶⁵

In summary, complex adaptive systems typically display complexity in both structure and behavior. They adapt to changing circumstances over time through nonlinear mechanisms that, though grounded in predictable local rules of interaction, produce in the aggregate entirely unexpected behaviors. The most successful systems achieve a balance between ordered and chaotic behavior that permits them to weather alterations in the surrounding environment. The music production and distribution system can be analyzed as a complex system exhibiting these universal characteristics.

III. THE MUSIC SYSTEM AS A COMPLEX ADAPTIVE SYSTEM

Because complex systems overlap, coevolve, and nest within each other, it can be difficult to define the boundaries of a particular system. System definition is usually based on the observer's goals rather than dictated by any intrinsic property in the system itself.⁶⁶ This article analyzes the complex system through which music sound recordings are produced and distributed. The means by which music recordings are created and disseminated constitute a human-created system by any definition. Within this system, technological, economic, social, legal, and political systems, and all their nested subsystems, overlap and interact with specific reference to sound recordings. Formal law, particularly copyright law, plays a critical role in the workings of this system.⁶⁷ Viewed holistically, the music system exhibits the characteristics typical of all complex adaptive systems.

64. In the case of the self-critical sand pile, when the next falling grain of sand strikes the pile, it is impossible to predict what might happen. The steady sprinkle of sand triggers cascades of all sizes: big avalanches are rare, small ones are frequent. The average frequency of a given size of avalanche is inversely proportional to some power of its size. For any individual grain of sand, it is impossible to predict which outcome may occur. See LEWIN, *supra* note 4, at 61 (describing the sand pile metaphor as a system poised at a critical state); WALDROP, *supra* note 4, at 305 (applying the sand pile analogy).

65. Studies of earthquake distributions show, for example, that fault zones do not build pressure until they slip catastrophically, but rather approach the point of slippage, then undergo a steady succession of slips of various magnitudes that serve to keep the tension at the critical point until, eventually, a major earthquake occurs. WALDROP, *supra* note 4, at 305–306. See also Arthur, *supra* note 9, at 109 (describing the phase transition of financial markets into complex regimes); BAK, *supra* note 9, at 9, 183–98 (describing the operation of power laws generally and their application to price fluctuations and traffic jams).

66. Casti observes that complexity is not an intrinsic property of a system taken in isolation, but rather is a joint property of the system and its interaction with another system, typically an observer or controller. CASTI, *supra* note 7, at 267.

67. The system is a concrete, law-related system because it involves real people, institutions, and products. See LoPucki, *supra* note 2, at 488 (discussing systems analysis as applied to legal

A. Multiple, Interconnected Components

Certainly, the traditional recording industry includes many individual and institutional components, including artists and their managers, agents, recording companies which are typically part of larger entertainment conglomerates, industry associations like the Recording Industry of America (RIAA), performance rights societies, intermediate distributors, advertisers, concert promoters, retailers, and consumers. The music system, however, comprises more than the traditional recording industry. Many cities and regions support local music scenes and independent recording labels.⁶⁸ Production, marketing and distribution often occur outside the formal industry structure as independent artists create and distribute their own works. Consumers contribute to distribution by sharing works and creating new “mixes.”⁶⁹

In this broadly defined system, one can identify many overlapping, interacting subsystems including music-related technologies and their providers, formal music markets, socio-cultural groups and practices, political organizations, legal institutions and regimes.⁷⁰ All of these

scholarship). The article recognizes that the musical compositions which are essential inputs to this system also follow additional distribution paths and that the returns to composers from the sale of sound recordings incentivize the production of music compositions as well as recordings. In copyright law, the musical composition and the sound recording of that composition are separate copyrightable subject matters which receive different levels of copyright protection. See 17 U.S.C. § 101 (2000) (defining the terms musical works and sound recordings); Lydia Loren, *Untangling the Web of Music Copyrights*, 53 CASE W. RES. L. REV. 673, 679–98 (2003) (summarizing the history of and the differing copyright treatments of musical compositions and sound recordings). The creation of “musical works” is, therefore, separate but prerequisite to the creation of music sound recordings and may or may not involve the same artists.

68. See DIANE RAPAPORT, A MUSIC BUSINESS PRIMER 1–6 (2003) (discussing the “ecology” of the music industry); Mihir Parikh, *The Music Industry in the Digital World: Waves of Changes* (Aug. 1999), <http://www.ite.poly.edu/htmls/musicwave02.htm> (discussing the current structure of the music industry).

69. “Mixes” are sound recordings produced by combining and/or adjusting sounds from more than one source. See MERRIAM-WEBSTER’S COLLEGIATE DICTIONARY (11th ed. 2003) (defining mix as “to produce (a sound recording) by electronically combining or adjusting sounds from more than one source”). Typically, fans record their own collections of favorite songs from one or more artists. They may also electronically alter the originals. Artists may issue new “mixes” of their own songs. Entire web sites are devoted to the creation and sharing of mixes. See, e.g., Art of the Mix, <http://www.artofthemix.org/index.asp> (allowing users to browse mixes of their own). For a personal account of the changing technologies for making mix tapes and CDs, see Thurston Moore, *The Best 90 Minutes of My Life*, WIRED 13.04, Apr. 2005, at 3, available at <http://www.wired.com/wired/archive/13.04/play.html?pg=3>.

70. LoPucki suggests three principles of system definition for law-related systems: the human participation test, the interaction principle, and the purpose principle. LoPucki, *supra* note 2, at 498–501. Obviously, human beings do participate in the music system. Under the other two tests, the system components must interact more with each other than with components in the surrounding environment, and all persons or things essential to system function must be included. Certainly, all of the subsystems noted above interact extensively with each other, though some

subsystems directly affect the production and distribution of music recordings and each contains diverse components which are also complex adaptive systems.⁷¹ In typical fashion, the subsystems interacting in the music system also participate in other systems.⁷² Each subsystem responds to changes in the others and those changes ramify through the interconnections in the music system as a whole.

The elements of the music system are richly interconnected and both information and money flow through those interconnections. Even prior to popularization of the Internet, the music system contained intricate connections among producers, distributors, and consumers. Content, including advertising as well as music, flowed from artists through studios then downward through controlled channels to consumers; money and consumer feedback flowed back to providers. Channels of distribution included radio, television, and retail and wholesale chains, all of whom distributed musical content in many formats produced by a variety of technology providers.⁷³ The Internet multiplied those connections geometrically and globally, in particular by providing low-cost direct connections between artists and consumers and lateral connections among consumers. Thus, the music system exhibits the complex structure typical of complex adaptive systems. Its behavior is similarly complex.

B. Nonlinearity

Like most nonlinear systems, the music system follows established rules, but the aggregation of system activities creates feedback loops and produces nonlinear behavior. At the local level, the interacting subsystems affecting production and distribution of music recordings all impose rules governing the behavior of system participants. Technology rules include, among other things, technical standards and

also interact with entities outside the music system. All are necessary for the system to function. While the political system might simply be considered the instrumentality for producing laws, it is particularly active and subject to competing influences at present.

71. The technology subsystem includes provider industries, networks, retailers, and consumers of music-related technology. Diverse organizations and individuals participate in the music market, including all of the entities that form the recognized "industry." Many system participants, particularly artists and consumers, form social communities whose practices involve music recording and distribution. The adoption of file sharing as a social norm by consumers is at the center of the current debate. The parties to that debate seek to influence Congress, itself part of a complex political system, to produce laws that favor their interests; the resulting legal regimes, like the copyright regime, are complex systems.

72. Technology providers, for example, develop technologies used to distribute materials other than music, recording studios sell products in addition to sound recordings and consumers buy many other entertainment products.

73. See Parikh, *supra* note 68, at 2 (describing the methods of music distribution).

formats and rights management rules. The market imposes rules of commercial practice. Socio-cultural behavior follows accepted norms and political actors follow rules of governance set out in the Constitution. Copyright law imposes the primary legal rules, although other disciplines, such as contract and property, also play a role.⁷⁴

As actors within the system go about their daily business, all of these rule sets affect their behavior. Although concern over file sharing focuses on its economic impacts, there are significant non-economic forces at play within the system. Actors may be motivated by forces including the creative impulse, sociality and the drive to innovate, as well as by economic self-interest. Unlike the simple rule sets used in computer models and often found in natural complex systems, the rule sets in the music system can be quite complex and may conflict. File sharing, for example, may represent a disconnection between the social norm rule sets and the copyright law rule set.⁷⁵

Feedback loops are clearly in operation within the music system. Music producers receive consumer feedback in terms of cash and information, which in turn affects their future business strategies. New technological formats like MP3⁷⁶ and its successors feed into the system producing demand for portable players like the iPod whose success feeds back into the system and produces increased demand for content available in portable formats.⁷⁷ The digital rights management (DRM) arms race is a classic positive feedback loop as is the explosive growth of P2P systems.⁷⁸

Whether the music system demonstrates the influence of attractors is a more problematic extension of the complex system analogy. Some writers have mapped the mathematics-intensive science of attractors onto human systems, suggesting, for example, that social structures like bands, tribes, chiefdoms, and nation states are attractors in the process of cultural evolution,⁷⁹ or that freedoms, rights, and regulations are

74. See LAWRENCE LESSIG, *FREE CULTURE* 121–24 (2004) (describing law, norms, system architecture, and markets as “modalities of regulation”).

75. Studies have repeatedly shown that consumers do not consider music file sharing to be morally wrong. See, e.g., Amy Harmon, *In Fight Over Online Music, Industry Now Offers a Carrot*, N.Y. TIMES, June 8, 2003, at A11 (describing how the social norm finds file sharing quite acceptable, while copyright law forbids many sharing activities as infringements).

76. MP3 is the short form for the most popular audio compression standard—Moving Picture Experts Group’s MPEG-1 audio layer 3.

77. See *infra* Part III.D (summarizing Apple’s iPod and iTunes products).

78. In the DRM arms race, each attempt by copyright owners to impose electronic restrictions on their product inspires hackers to break the DRM system, which in turn requires copyright owners to develop stronger DRM, which is in turn hacked and so on.

79. LEWIN, *supra* note 4, at 21.

attractors in the environmental law system.⁸⁰ The music system, as defined in reference to commercial sound recordings, is so young in evolutionary terms that attractors based on historical patterns of the system are difficult to define.⁸¹ If it is presumed that the traditional centralized industry structure represents one attractor, it may be that a new attractor favoring decentralized dissemination is only beginning to manifest itself in the long-term evolution of the system.

The analogy to complex systems may be less than convincing with respect to the existence of attractors. However, overall behavior of the music system is clearly nonlinear in the sense that small causes may have disproportionate effects and single causes may have multiple effects of varying magnitudes. Of most relevance to this article is the tinkering of the young programmer who developed the first P2P software and created the Napster phenomenon,⁸² which set off a wave of responses, many of them legal. For example, the RIAA successfully sued and shut down Napster,⁸³ thereby channeling technological development toward decentralized file sharing systems, which proved harder to control through copyright infringement actions.⁸⁴ The initial failure of law suits to stop file sharing inspired a raft of legislative proposals to control the practice⁸⁵ as well as the RIAA's direct law suits

80. See Ruhl, *Complexity*, *supra* note 9, at 862–875 (using complexity theory on attractors in relation to the socio-legal system with particular reference to environmental law and arguing that the attractors in the environmental law system are freedoms, rights, and regulation); J. B. Ruhl, *The Fitness of Law: Using Complexity Theory To Describe The Evolution of Law and Society and Its Practical Meaning for Democracy*, 49 VAND. L. REV. 1407, 1440–1448 (1996) [hereinafter Ruhl, *Fitness*] (applying the science of attractors to law generally).

81. The first sound recordings were made in the late 1800s, and commercial phonographs were introduced in the early 1900s. Loren, *supra* note 67, at 686. In evolutionary terms, a mere century is a very short span compared, for example, to the hundreds or thousands of years involved in the development of social institutions.

82. The lone programmer was, famously, Shawn Fanning, who developed the program to help create a music community. Giancarlo Varanini, *Q&A: Napster Creator Shawn Fanning*, ZDNET, Mar. 2, 2000, http://news.zdnet.com/2100-9595_22-502047.html?legacy=zdnm.

83. See *A&M Records, Inc. v. Napster, Inc.*, 239 F.3d 1004 (9th Cir. 2001) (finding sufficient evidence that Napster engaged in both contributory and vicarious copyright infringement); see also *In re Aimster Copyright Litig.*, 334 F.3d 643 (7th Cir. 2003) (affirming the grant of a preliminary injunction to shut down a centralized file sharing system that employed instant messaging).

84. *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 259 F. Supp. 2d 1029, 1046 (C.D. Cal. 2003), *aff'd* 380 F.3d 1154 (9th Cir. 2004), *vacated and remanded* 125 S. Ct. 2764 (2005). The lower courts found no secondary liability for purveyors of decentralized file sharing software. The Supreme Court later reversed and remanded for review under its newly-announced “inducement” standard. 125 S. Ct. at 2780–83.

85. See, e.g., *Inducing Infringements of Copyright Act of 2004*, S. 2560, 108th Cong. (2004), (expanding significantly the scope of secondary liability for copyright infringement with a specific view toward punishing providers of peer-to-peer technologies); see *infra*, Part V (discussing this and numerous other proposals).

against users.⁸⁶ Suits against users may have discouraged some users from file sharing at all, sent some underground and sent others to legal online services ultimately contributing to the success of Apple iTunes and its imitators.⁸⁷ While these activities follow established legal rules, their outcomes have been unpredictable as change cascades through the system. As is typical of systems exhibiting chaotic behaviors and sensitive to initial conditions, the changes in the music system appear likely to be irreversible.⁸⁸

C. Evolution and Coevolution

P2P is forcing change in all of the subsystems coevolving within the music system. The music system has obviously adapted over time to encompass many new technologies, analog and digital, as well as related changes in cultural behaviors and legal rules. The system and its components are open systems, coevolving in response to internal dynamics and environmental stimuli. The course of that evolution follows the typical pattern of punctuated equilibrium. The system gradually absorbed previous innovations in copying technologies with minor disruption, but the combination of digital copying technologies with Internet connectivity forced the system to a punctuation point requiring rapid, drastic adaptation. The system's past history affected its response. The major labels were entrenched in old, brick-and-mortar business models and proved reluctant to assay the new online environment. Industry inflexibility, in part, provided the window of opportunity for the development and popularization of P2P.

By analogy to the evolution of other complex systems, one should now expect a period of experimentation in the music system, followed

86. See Fred von Lohman, *Is Suing Your Customers a Good Idea?*, LAW.COM, Sept. 29, 2004, <http://www.law.com/jsp?id=1095434496352> (noting that thousands of such suits have now been brought). An industry trade association, the International Federation of the Phonographic Industry, launched the first suits against European file sharers in October 2004. Bernhard Warner, *Music Piracy Lawsuits Launched Across Europe*, CNN.com, Oct. 7, 2004, <http://www.cnn.com/2004/TECH/internet/10/07/europe.music.piracy.ap/index.html>.

87. Surveys differ over the actual impact of the lawsuits on file sharing activities. Compare Pew Internet and American Life Project, *Data Memo*, Jan. 2004, http://www.pewinternet.org/pdfs/PIP_File_Swapping_Memo_0104.pdf (reporting sharp decline in file sharing after initiation of RIAA law suits) and *Data Memo*, April 2004, http://www.pewinternet.org/pdfs/PIP_FilesSharing_April_04.pdf (reporting continued overall decline in illegal downloading as result of suits, but slight short term increase in relation to late 2003 survey) with Thomas Karagiannis, et al., *Is P2P Dying or Just Hiding?*, Nov.–Dec. 2004, <http://www.caida.org/outreach/papers/2004/p2p-dying/index.xml> (describing a study by researchers at the University of California, Riverside indicating that, if measured accurately, P2P traffic has never declined).

88. The popular, metaphoric statement that “the P2P genie is out of the bottle and can never be stuffed back in” is entirely “in tune” with the nonlinear dynamics of complex systems.

by a winnowing out of new business models and technologies, reducing them to a relatively small number of successful forms. Indeed, the system has lately exhibited the behavior most typical of complex adaptive systems—self-organization producing emergent behaviors.

D. Emergence

The aggregation of the local, self-interested activities of actors in the music system has produced new emergent properties, including the growth of P2P file sharing and the responsive development of new business models. The localized interactions of P2P technology providers and consumers, pursuing their own interests, produced the emergent phenomena of vast P2P networks through which music may be transmitted without approval of or payment to the copyright owners.⁸⁹ File sharers opted out of the existing legal and economic rule sets, at least with respect to some of their transactions, and did so in such numbers as to create, in effect, an anti-market based on sharing norms set in opposition to copyright rules and market practices.⁹⁰

Whether file sharing is a “good” or “bad” emergent property of the system has not clearly been established. The emergence of file sharing may, on the one hand, pose a threat to copyright holders and artists’ incentives, though the evidence to date is inconclusive.⁹¹ On the other hand, its development forced the music industry, finally, to quit dragging its feet and move ahead with legal online distribution systems and new forms of offline distribution increasing the dissemination of music. Additionally, P2P technology has a number of beneficial uses that do not constitute copyright infringement.⁹²

Whether file sharing is good, bad, or a mixed blessing, it has fed back down into the system, causing new adaptations. Some are fairly predictable responses to P2P: cooperation on music licensing for the

89. While P2P systems could be said to arise primarily from the technology subsystem, their original purpose was music file sharing and the participation of music consumers was essential to their success so the phenomenon as a whole emerges from the music system.

90. Survey results vary as to the actual number of users engaged in music downloading, but the anti-market is apparently quite large. See, e.g., Felix Oberholzer & Koleman Strumpf, *The Effect of File Sharing on Record Sales: An Empirical Analysis*, March 2004, http://www.unc.edu/~cigar/papers/fileSharing_March2004.pdf (citing data indicating that over 60 million Americans over the age of twelve have engaged in music file sharing.)

91. See discussion *infra* Part II.F (explaining that the music system should be analyzed with empirical research).

92. The Ninth Circuit in the *Grokster* case, for example, found noninfringing uses including sharing of public domain works and works whose copyright owners intentionally made them available for free sharing. The court specifically referred to bands like Wilco who distribute their music directly to consumers. *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 380 F.3d 1154 (9th Cir. 2004), *vacated and remanded* 125 S. Ct. 2764 (2005).

Internet,⁹³ issuance of licenses to legitimate online distributors,⁹⁴ application of digital rights management technology to prevent copying, lawsuits against P2P providers and users and the adoption of file sharing features by legitimate services.⁹⁵ Others are more unusual, including: agreements between universities and legal online providers to provide students with “free” legal music,⁹⁶ experimental marketing alliances to use sponsored downloads to support sales of commercial music on the P2P networks,⁹⁷ digital-only releases⁹⁸ and direct artist-to-consumer distribution over the Internet.⁹⁹ Schemes for using P2P networks profitably and legally are also underway.¹⁰⁰ Two related developments are particularly noteworthy: the success of the Apple iTunes business model for online music distribution and the related development of less restrictive DRM regimes for both downloads and compact discs (CDs).

93. *Songwriters, Music Publishers Announce Deal to Cooperate on Net Music Licensing*, 6 ELEC. COM. & LAW REP. (BNA) 40, 1063 (Oct. 17, 2001).

94. *See, e.g., John Borland, Music Label Widens Door to Net*, <http://news.com.com/2102-1023-965712.html> (last modified Nov. 13, 2002) (describing how a record label expanded what consumers can legally do with music accessed via online services).

95. *See Jon Healey, Music Industry Taking Cues from File Sharing*, L.A. TIMES, July 26, 2004, at C1 (explaining the music industry’s attempt to make legitimate use of file sharing).

96. *See Amy Argetsinger, GWU Students Will Get Free Tunes This Fall*, WASH. POST NEWSBYTES, July 17, 2004, at A01, available at 2004 WL 55866657 (describing the deal between Napster and George Washington University that permits students to download certain music files). Obviously, as Napster is now a for-profit operation, either the University or a donor finances such arrangements. Similar deals have been struck by other music providers. *See John Borland, More Colleges Get Cheap Online Music*, <http://news.com.com/2110-1027-5318591.html> (Aug. 20, 2004) (listing the universities involved in low-cost downloading for students).

97. *See Promo Uses P2P Networks to Sell Songs*, <http://news.com.com/2100-1027-5251479.html> (June 29, 2004) (explaining various deals to sell music online). Warner Brothers recently allowed R.E.M.’s new album to be posted on MySpace.com two weeks prior to its offline release. The web site offered information about the band and allowed fans to buy the album from Amazon, but did not permit downloading. Warner Brothers hoped advance sampling would promote album sales. Frank Ahrens, *Record Labels Aim for Net, Hope to Score*, WASH. POST, Oct. 5, 2004, at E01.

98. Jeff Leeds, *Music Industry is Trying Out Digital-Only Releases*, N.Y. TIMES, Nov. 22, 2004, at C1.

99. *See, e.g., Fred Kaplan, D.I.Y. Meets N.R.L. (No Record Label)*, N.Y. TIMES, July 4, 2004, at B23 (describing a company called ArtistShare that sells musicians self-produced CDs over the World Wide Web and turns the proceeds, minus a small fee, over to the musicians). Many bands unable to get contracts with record labels release their music directly to consumers. Wilco, for example, offered one of its albums online for free after it was dropped by a record label and found that the exposure boosted sales of the album when it was later released by a different label. *See Xenia Jardin, Music is Not a Loaf of Bread*, WIRED NEWS, <http://www.wired.com/news/culture/0,1284,65688,00.html> (Nov. 15, 2004) (describing how the band Wilco used file sharing to reach its fans).

100. *See, e.g., Katie Dean, File Sharing Growing Like a Weed*, WIRED NEWS, <http://www.wired.com/news/digiwood/0,1412,65774,00.html> (Nov. 22, 2004) (describing Weed, a software program that allows fans to download a song free and play it three times, then prompts them to pay for subsequent hearings).

Apple's iTunes, launched in spring, 2003, was billed as a happy medium between free but illegal P2P systems like Napster and subscription services like Rhapsody.¹⁰¹ Apple negotiated legal licenses for hundreds of thousands of songs and now provides downloads in a format of higher quality than standard MP3 files for a relatively low fee per song with no subscription fee.¹⁰² Perhaps most significantly, Apple's DRM system, Fair Play, permits iTunes downloads to be transferred to iPod players, burned on CDs, and accessed on multiple computers.¹⁰³ Unlike its predecessors in legal online music distribution, Apple recognized and enabled a reasonable scope of personal, noncommercial use and sharing. This feature, combined with the broad appeal of the nifty iPod player and an eye- and ear-catching advertising campaign, vaulted iTunes into a dominant position in the legal download market.¹⁰⁴ Apple proved that licensed, value-added pay services could compete successfully with free file sharing networks even in the absence of new, protective legislation or an overhaul of the copyright system. Its rate of growth has continued to accelerate, fueled by the popularity of the iPod.¹⁰⁵

Numerous online music providers, including a new, legal Napster, have now adopted similar strategies.¹⁰⁶ The recording studios

101. See John Borland, *Apple Unveils Music Store*, <http://news.com.com/2100-1027-998590.html> (Apr. 28, 2003) (describing the opening of the Apple store as a way to reach out to new customers).

102. THE BERKMAN CENTER FOR INTERNET AND SOCIETY, *iTunes: How Copyright, Contract, and Technology Shape the Business of Digital Media – A Case Study 8–11* (2004), <http://cyber.law.harvard.edu/home/uploads/370/iTunesWhitePaper0604.pdf> [hereinafter *iTunes White Paper*].

103. For a comprehensive case study of the iTunes Music Store, see *id.* Apple's current terms of use permit unlimited portability to the iPod, use on five computers, unlimited CD burns, but only 7 burns of the same playlist. See *Terms of Sale*, <http://www.info.apple.com/usen/itunes/policies.html> (last visited Aug. 28, 2005) (describing iTunes sale policies). The 7-burn limitation was a recent reduction from a former allowance of 10, but the 5-computer restriction is an increase from a former allowance of 3. John Markoff, *Apple Sells 70 Million Songs in First Year of iTunes Service*, N.Y. TIMES, Apr. 29, 2004, at C10.

104. As of July 2004, Apple controlled an estimated 70% of the legal download market and 45% of the market for portable music players. Laurie J. Flynn, *iTunes Shores Up Its Defenses as Rivals Prepare to Invade*, N.Y. TIMES, July 19, 2004, at C4. By December 2004, Apple controlled an estimated 90% of the high capacity player market and introduced the Shuffle iPod to attack the market for small capacity players. See Michael Marriott, *And Now for Something Slightly Different*, N.Y. TIMES, Dec. 16, 2004, at G1 (describing some of the marketing tactics of Apple and its competitors).

105. See Ina Fried, *iTunes Hits 200 Million Download Mark*, http://news.com.com/iTunes+hits+200+million+download+mark/2100-1027_3-5494390.html (Dec. 16, 2004) (examining the growth of iTunes).

106. Mp3.com offers a helpful directory of online services and their features from which most of the following data is drawn. See mp3.com, *Digital Music Services*, http://www.mp3.com/tech/services_index.php (last visited Aug. 28, 2005) (listing available online music services).

themselves are experimenting with legal, controlled distribution through peer-to-peer networks.¹⁰⁷ Rough consensus seems to be developing around pricing points¹⁰⁸ and the permissible scope of noncommercial personal uses, with policies fluctuating in response to competitive pressures. Unlimited portability to playback devices and CD burns are permitted, as is use on multiple computers.¹⁰⁹ Some services provide additional features such as use of email to share songs, posting of user and celebrity playlists, and creation of mini-albums.¹¹⁰

In the offline market, BMG (now Sony BMG) introduced a new rights-managed CD format to permit legal, limited song sharing. The format allows portability to playback devices, limited CD burns, copying to a computer, and email transmission of temporary copies to friends.¹¹¹ The DRM scheme was hacked almost immediately, but the company claimed to be content to have created a "speed bump" that would deter most users from unauthorized copying.¹¹² While less flexible than MP3 files and offering more limited uses than services like iTunes, the BMG format is a step in the same direction.¹¹³ In both cases, the exact number of uses allowed may be less significant than the recognition that personal, noncommercial uses are essential to market viability.

107. See Katie Dean, *P2P Tilts Toward Legitimacy*, WIRED NEWS, <http://www.wired.com/news/digiwood/0,1412,65836,00.html> (Nov. 24, 2004) (indicating that three major music labels have signed deals to provide content for a new, legal P2P service).

108. Almost universally, the price per song is somewhere below the inexplicably "magic" \$1 limit. Pricing will undoubtedly undergo further changes in response to competitive pressures. For example, RealNetworks slashed its per song and per album fees for a limited time in conjunction with its introduction of reverse-engineered iPod-compatible software. See John Borland, *RealNetworks Slashes Song Prices*, http://news.com.com/2102-1027_3-5312143.html (last modified Aug. 17, 2004) (explaining RealNetworks' pricing campaign).

109. The rules governing allowable CD "burns" may vary per service or per track, but the majority of services provide unlimited burns. There may, however, be limits on burns of the same playlist. The number of computers on which a track can be used varies considerably but almost all services accept multiple access to some degree. See mp3.com, *supra* note 106 (detailing the options available on various music services).

110. See *Licensed Online Music Services See Upside to Limited File-Sharing*, DETROIT NEWS, Jul. 28, 2004, <http://www.detnews.com/2004/technology/0407/28/technology-224808.htm> (describing new features offered by some online services).

111. Frank Ahrens, *BMG Offers Legal Song Sharing*, WASH. POST, Sept. 23, 2003, at E01.

112. See John Borland, *Shift Key Breaks CD Copy Locks*, <http://news.com.com/2100-1025-5087875.html> (Oct. 7, 2003) (describing anti-theft efforts).

113. Microsoft also offers a Media Data Session Toolkit which supports delivery of dual session or second session CDs on which one session is completely secured, but a second session is governed by rules that allow consumers to engage in some activities, such as transfer to a portable device, but not others. THE BERKMAN CENTER FOR INTERNET & SOCIETY, COPYRIGHT AND DIGITAL MEDIA IN A POST-NAPSTER WORLD, UPDATE, 47, <http://cyber.law.harvard.edu/media/files/wp2005.pdf> (last modified Jan. 2005).

All of the developments described above indicate that the system is adapting to the emergent property of P2P file sharing by producing new emergent patterns. The most successful of these adaptations take a middle road between the pay-per-use model promoted by the recording industry and the music-for-free model facilitated by P2P technology. That middle road might not have appeared without the unexpected emergence of P2P and the feedback dynamics of the music system, which generated emergent responses from system actors willing to learn from the P2P experience and experiment with new business forms. These emergent behaviors could not have been anticipated based on knowledge of the rules of interaction governing the system prior to P2P.

E. Unpredictability and the Law of Unintended Consequences

The system's recent behavior has been unpredictable. The development of centralized P2P technology by a then unknown programmer and the rapid growth of the Napster service appear to have been complete, and rather unpleasant, surprises for the music industry. While the music industry attempted to derail the P2P juggernaut, other actors, like Apple, saw opportunity rather than threat and responded accordingly. These responses also produced a number of surprises.

Devotees of the "celestial jukebox,"¹¹⁴ for example, may find it surprising that the most successful business model for online music distribution is not the pay-per-use model, in which users possess no permanent copies of recordings but merely tap into a subscription service when they wish to hear music, paying micro-charges for every play. Many users obviously not only like to have their own copies, but they like to manipulate them in order to produce their own mixes and play-lists in a form of grass roots creativity seemingly unanticipated by promoters of strict pay-per-use models.¹¹⁵ It may be an even bigger surprise that the most successful model is not run by the recording studios, but by a hardware manufacturer and is not content driven, but device driven.

114. The phrase "celestial jukebox" is used rather loosely to describe music delivery systems in which all delivery is made through the Internet and physical copies of music disappear. Some users of the phrase presuppose that music will be streamed on demand, rather than downloaded to the user's hard drive, with a micro-charge imposed for every play. Other descriptions of the jukebox assume that users will, for a price, be allowed to download and manipulate some number of copies.

115. This is not to say that the pay-per-use model does not lurk in our future as the world becomes more and more "connected" and the system continues to adapt, but the recent history of the system suggests that an economically viable delivery system for music must allow some degree of consumer manipulation and content sharing. See *infra* Part IV.F (discussing personal uses).

The RIAA has provided examples of unintended consequences for actors attempting to control the course of system change. It sued to shut down Napster and won, thereby channeling P2P development into more decentralized systems which proved considerably more resistant to legal control.¹¹⁶ As a result of that first unintended consequence, the RIAA found itself compelled to sue individual users, a decision still producing feedbacks in the system, but one that may already have had the additional unintended consequence of reducing congressional support for protective measures sought by the industry.¹¹⁷

P2P file sharing is already a good surprise for consumers and technology providers, and may yet turn out to be a good surprise even for the recording industry, as the videotape market was for the movie industry. Its existence and the responses to it confirm that the intricate concatenation of parts and processes which form the music system is adapting to the transition from analog to digital media in a networked world.

F. The Edge of Chaos

The critical question is whether the system has achieved the productive tension between order and chaos that will make it most resilient and sustainable in the long run. Clearly, a great deal of experimentation with new methods of distribution is occurring and a significant number are proving successful in the marketplace. The fact that successful emergent models take a middle-ground approach offers some hope that the system is successfully “tuning” itself to its new environment. If the system has achieved the equipoise between stable, linear behaviors and nonlinear behaviors typical of self-organized criticality, we would expect to find power law distributions in response to change. Professor Neil Netanel observes, in fact, that file sharing activity follows a power law distribution, in that the large majority of file sharing implicates a very small number of particularly popular works.¹¹⁸ Music sales follow a similar distribution—a relatively small number of hits produce the lion’s share of sales.¹¹⁹

116. See *supra* notes 83–84 (describing the recent litigation involving services such as Napster, Aimster, etc.).

117. See Peter K. Yu, *P2P and the Future of Private Copying*, 76 U. COLO. L. REV. 653, 665–70 (2005) (observing that the industry has become more isolated on Capitol Hill since it began suing consumers).

118. Neil Weinstock Netanel, *Impose A Noncommercial Use Levy To Allow Free Peer-To-Peer File Sharing*, 17 HARV. J.L. & TECH. 1, 55–56 (2003) [hereinafter Netanel, *Impose*].

119. The record companies justify their pricing on the fact that most sound recordings lose money. Consequently, the companies must collect enough profit on the few hits to cover their losses on the large majority of recordings. WILLIAM W. FISHER, III, PROMISES TO KEEP 22

The emergence of successful business models and existence of power law distributions may indicate that the music system is poised at the edge of chaos. Before Congress imposes new legal regulation, it would seem prudent to seek empirical verification to the contrary—proof that the system is in danger of slipping into chaos. The overall performance of the music system should be evaluated.

Systems analysis provides a methodology for evaluation of system performance. All systems have purposes or functions. In theory, an observer can determine whether the system is healthy by determining whether it achieves its goals.¹²⁰ The goals of the system as a whole are distinct from the goals of system participants, whose particular goals may conflict.¹²¹

The music system functions to enable creation of musical sound recordings and to distribute recordings in relatively stable containers such as CDs or MP3 files, or through transmitted performances of the recording. As a necessary subsidiary to distribution, it was historically necessary for producers to market recordings using techniques such as branding, advertising, sampling, and creation of fan communities.¹²² Those goals are distinct from the goals of individual components of the system. The recording studios may primarily seek to garner the highest possible profit from their content; technology providers may seek to profit from popular innovations; artists may seek to earn a living while expressing their own creativity; consumers may seek entertainment at the lowest possible cost. Obviously, these goals will sometimes conflict without jeopardizing the goals of the system as a whole. Whether the music system is healthy can be assessed by determining whether it achieves its goals. At a more reductive level, we might inquire whether particular processes function to support achievement of those goals. Do producers, for example, receive sufficient incentives from the flow of money through the system to assure continued production? Analysts can identify system components and track inputs and outputs through

(2004).

120. See LoPucki, *supra* note 2, at 485–87 (observing that systems analysis regards systems as having purposes or functions).

121. *Id.* at 486. For example, in a capitalist economy, the goal of businesses may be to make the highest profits, while the goal of consumers may be to find the cheapest deal. However, traditional economists argue that the goal of the system as a whole is efficient allocation of resources.

122. See Parikh, *supra* note 68 (depicting a concise view of industry structure and processes). For a more comprehensive treatment, see RAPAPORT, *supra* note 68, at 1–6. See also, FISHER, *supra* note 119, at 39–59, 82–133 (describing traditional industry structures and legal practices and the recent technological developments that challenge them).

the system processes in order to determine whether system goals are being achieved.

As a highly simplified example, assume that Sarah, a singer-songwriter, composes the music and writes the lyrics to a song. The inputs for her creation of the song are likely to include not only her musical skills, time, money, equipment, and so on, but also her familiarity with a large repertoire of music previously created by others. Further assume that after being contacted by a studio talent scout, Sarah's agent lands her a recording contract. Her composition is an output of her creative process, but also now an input into the system for producing and distributing sound recordings.

As part of her recording deal, she probably transfers her copyrights in both the musical composition and the recording to the studio and/or a music publisher. The studio provides the inputs necessary to make and preserve the sound recording (studios, backup musicians, physical media, and the like) including digital technologies, many of which originate from technology providers. Once the recording is made, the studio will orchestrate the advertising and marketing services necessary to promote the song, working with advertisers, radio stations, webcasters, and so on. The output, the sound recording, will be distributed to consumers through chains of online and offline retailers. Licenses concerning performance rights for the recording may be negotiated.¹²³ All of these activities initiate the flow of money back through the system to various participants including Sarah herself. Once released, if not before, the song may also appear on file sharing networks and be distributed through those channels.

The chief concern of observers, and strongest argument favoring the recording industry, is that free distribution through file sharing will so adversely affect sales that insufficient money will flow back through the system to compensate producers for their inputs and provide them with enough profit to encourage further creation. The systemic feedback loop through which the flow of money stimulates new recordings, the incentives loop, will be disrupted. Consequently, Sarah will write fewer songs, the recording studios will produce fewer sound recordings, and so on.¹²⁴

123. For visual representations of the many entities that may play a part in the music business, see Parikh, *supra* note 68, at 2, 4, 7 (modeling current industry and changes introduced by the Internet); RAPAPORT, *supra* note 68, at 2 (describing an artist-centered view).

124. Copyright regulation is primarily based on this assumed relationship between creative expression and economic incentives.

The connection between monetary incentives and creation has always been attenuated with respect to artists, many of whom create for reasons entirely divorced from money and most of whom receive little return from sales of their recordings.¹²⁵ However, intermediaries like recording studios and distributors have historically required profit incentives.¹²⁶ Most empirical researchers to date have focused exclusively on the question of whether file sharing prevents these intermediaries from making sufficient profit to stay in business, thereby threatening the incentives loop.¹²⁷

Recent surveys seek to establish or disprove correlations between declining industry sales and rising file sharing.¹²⁸ Somewhat surprisingly, there is little empirical evidence that either the music system as a whole or the recording industry in particular is jeopardized by file sharing.¹²⁹ Thus far, the surveys differ on the impact of P2P on sales of music recordings; some finding a measurable impact on legal sales, others finding no correlation between file sharing and sales.¹³⁰ Economists disagree over the validity of different survey methodologies, the impact of factors other than file sharing, and the potentially positive impact of sampling on sales.¹³¹ In particular, economists are skeptical of the industry's claims that every free download represents a lost sale since many downloaders would not pay the industry asking price.¹³² After several declining years, music sales

125. Recording artists are estimated to receive, on average, only 12% of the sales price of legal online downloads and CDs. Many receive less as a result of studio deductions for "packaging" and promotional copies. See Nancy Einhart, *The MP3 Economy: How Labels and Artists Divvy Up your MP3 dollar*, BUSINESS 2.0, <http://www.business2.com/articles/mag/0,1640,49472,00.html> (last modified June, 2003) (describing the earnings from music sales); FISHER, *supra* note 119, at 259-62 (describing the various entities and individuals who receive money when a CD is sold).

126. Raymond Shih Ray Ku, *The Creative Destruction Of Copyright: Napster and the New Economics of Digital Technology*, 69 U. CHI. L. REV. 263, 267 (2002).

127. Stan Liebowitz, *Pitfalls in Measuring the Impact of File Sharing*, 51 CES INFO. ECON. STUD. 439, 440 (2005) [hereinafter Liebowitz, *Pitfalls*]. See also FISHER, *supra* note 119, at 31-32 (discussing social costs if exploitation of new technological opportunities).

128. Michael Warnecke, *Economists Spar Over Impact of File Sharing on Record Sales*, 9 ELEC. COM. REP. (BNA) 568 (June 23, 2004).

129. Oberholzer & Strumpf, *supra* note 90.

130. Compare, e.g., Liebowitz, *Pitfalls*, *supra* note 127 (finding that file sharing adversely impacts sales) with Oberholzer & Strumpf, *supra* note 90 (finding no statistical correlation between file sharing and slumps in music sales).

131. See FISHER, *supra* note 119, at 33-34 (providing anecdotal evidence of an increase in overall sales); see also Warnecke, *supra* note 128 (describing the debate regarding the impact of file sharing on sales).

132. One recent study suggested that every 10 downloads may result in 1 or 2 lost sales, but the researchers admitted that their sample was not representative. See Daniel Gross, *Does a Free Download Equal a Lost Sale?*, N.Y. TIMES, Nov. 21, 2004, at C4 (citing a study from the

actually rose in 2004 despite file sharing.¹³³ Further, all of these surveys evaluate only the impact of file sharing on the traditional recording industry, which is to say that they prove little about the state of the music system as broadly defined herein.¹³⁴

There is, then, no empirical evidence establishing that the music system as a whole no longer achieves its goals of producing and distributing sound recordings. Indeed, there is little firm evidence that even the recording studios are in immediate jeopardy as a result of file sharing. The dearth of such negative evidence, when combined with the positive indicators noted above, might logically be read to indicate that the system as a whole is maintaining a healthy equipoise, though some of its constituent parts may suffer losses as the system adapts. One might lay those losses at least partially at the door of those complex adaptive subsystems, the major studios, which seem to have abandoned creativity in favor of calcification. Nonetheless, the file-sharing phenomenon has created a furor, socially and politically, that has inspired innumerable proposals to “fix” the system.¹³⁵ If we intend to intervene legislatively in the workings of the music system, as now seems likely, complexity theory offers some lessons as to the kinds of regulation which may be successful and those which may do harm.

IV. LEGISLATIVE INTERVENTION

Where humans are involved in complex systems, they inevitably attempt to control the future path of the system. The promulgation of laws is one, but not the only, mechanism employed to stabilize systems and make their behavior more predictable. The legal system is often used where other modalities of regulation, such as technology and social norms, are unsuccessful.¹³⁶ Given the dynamic qualities of complex systems, the legal systems regulating them must, of necessity, evolve

National Bureau of Economic Research).

133. See FISHER, *supra* note 119, at 32 (reporting U.S. album sales losses in 2000-2003 ranging from just under 4% to almost 10%). However, CD sales rose in 2004. See Sean Daly, *10 Million iPods, Previewing the CD's End*, WASH. POST, Feb. 13, 2005, at A01 (citing a Nielsen Soundscan report that CD sales were up 2.3 % in 2004, while legal online sales rose 376 %).

134. No surveys have publicized data showing, for example, whether creative inputs to the system are declining because artists must abandon their profession, whether fewer compositions are being written or published, whether fewer new recordings are being made or distributed either by studios or independently, or whether they are being distributed less widely.

135. See *infra* Part V (assessing current legislative proposal from a systems perspective).

136. See LoPucki, *supra* note 2, at 490-91 (observing that formal lawmaking is, or should be, the last resort for regulation of behavior).

over time.¹³⁷ Legal regimes set to regulate complex adaptive systems may themselves display many characteristics of such systems.¹³⁸

While other legal disciplines, notably contract law, play a role in the music system, copyright law is the primary regulatory regime. In the music system, social norms and legal rules are currently in conflict and content owners' technological controls have failed to prevent widespread file sharing. The market is in flux. Consequently, key industry players have turned to Congress requesting that the existing copyright regime, itself a complex system,¹³⁹ be revised.¹⁴⁰

In regulating, Congress should bear in mind the inherent characteristics of complex systems as it considers alteration of copyright rules in the digital environment.¹⁴¹ A central lesson of complexity theory is that the behaviors of complex systems are difficult, if not impossible, for human beings to fully comprehend, much less predict. Legislators should therefore proceed cautiously and should attempt to create rules that promote long-term sustainability of the music system.

This Part suggests some guidelines for regulators who seek to reform or replace the copyright regime in order to regulate music file sharing. Complexity theory and systems analysis suggest generally that regulators¹⁴² should consider the system as a whole; try to foster emergence; establish simple legal rules; expect and allow surprises; take a longer temporal view; and be prepared to tinker repeatedly with the

137. A number of writers have explored in depth the jurisprudential implications of evolutionary science for legal theory. They emphasize the law's responsiveness, slow though it may be, to changes in the political, social, and economic systems with which law interacts. See, e.g., E. Donald Elliott, *The Evolutionary Tradition of Jurisprudence*, 85 COLUM. L. REV. 38 (1985) (discussing evolutionary theories of law); Geu, *supra* note 9; Herbert Hovenkamp, *Evolutionary Models in Jurisprudence*, 64 TEX. L. REV. 645 (1985) (using Darwinian models to explain changes in the law); Roe, *supra* note 9 (putting evolutionary theory in the context of law and economics); Ruhl, *Fitness*, *supra* note 80 (describing how communities coevolve toward the edge of chaos). This Article takes as a given that law changes over time in response to changes in society. Susan Crawford asserts that law is itself an emergent phenomenon produced by the social system. See Crawford, *supra* note 9, at 645 (discussing the theoretical nature of law). It would, then, represent a situation in which an emergent property of a complex adaptive system is itself a complex adaptive system.

138. "Law is best thought of as an element of law-related systems and a technique by which governments can intervene in those systems." LoPucki, *supra* note 2, at 491.

139. The copyright regime can be shown to display the characteristics of complex structure, nonlinear behavior, coevolution, emergence, and unpredictability. Whether it achieves its goals is much-debated question. Extended discussion of copyright as a complex system is reserved for a different article.

140. Regarding recent legislative initiatives, see *infra* Part IV.

141. See *supra* Part II.A-F (discussing complex systems).

142. "Regulators" refers primarily to Congress. Most of the current proposals for copyright reform involve legislative restructuring of the regime. Obviously, courts also influence the development of the regime and these guidelines may be useful in judicial interpretation.

legal regime. Additionally, the history of the music system suggests that personal use is an important component. As legislators consider the many specific proposals for regulating file sharing, adherence to the guidelines proposed below may produce a music system better able to achieve its goal of facilitating the creation and distribution of sound recordings.

A. Consider the System as a Whole

Technological delivery systems and socio-cultural practices like music sharing are important parts of the same music system that encompasses the recording studios and their distribution chains. Regulators should seek to promote the continuing health of all system components by maintaining a balance among them. The technology subsystem should not be crippled, for example, through imposition of technology mandates, in order to preserve existing structures in the market subsystem.¹⁴³ Equally, technology-supported, socio-cultural sharing norms cannot be allowed to destroy incentives to creativity.

The traditional copyright balance of incentives and dissemination is certainly part of this equation, but its utilitarian focus tends to overemphasize markets and undervalue the importance of technological innovation and social norms, as if those considerations were not only outside copyright's scope, but irrelevant to the creation and dissemination of copyrightable works. Economic cost-benefit analyses focused only on music content markets and the current players in them represent the traditional, reductive approach to systems problems. Such an approach inevitably misses or misunderstands important forces at work in the system.¹⁴⁴

143. From a purely economic standpoint, it would be extremely foolish to hamper technology in order to protect content owners. Technology industries have been the chief engine of economic growth in the last decade and contribute a much larger share than content industries, like the movie and recording industries, to the gross domestic product. See Crawford, *supra* note 9, at 635 (observing IT-producing industries' effects on the economy); 2004 *Consumer Electronics Sales to Top 2003 Record*, ELECTRONIC NEWS, Sept. 7, 2004, <http://www.reed-electronics.com/electronicnews/article/CA451197> (reporting that 2003 sales of consumer electronics exceeded \$100 billion and forecasting sales exceeding \$108 in 2004); RIAA, PRESS ROOM, *Research and Data*, <http://www.riaa.com/news/marketingdata/default.asp> (last visited July 7, 2005) (pegging worldwide music sales at \$40 billion, one third of which was attributable to the U.S. recording industry).

144. Congress is empowered, under Article 1, Section 8, Clause 8 of the Constitution to promote the progress of science and useful arts, by securing for limited times to the authors and inventors the exclusive right to their respective writings and discoveries. This mandate encompasses two goals: inducing creation by providing incentives to creators and encouraging dissemination of works to the public in order to facilitate follow-on creation and create an educated citizenry capable of participating fully in the democratic dialogue. The quintessentially utilitarian constitutional provision lends itself readily to economic cost-benefit analysis which

The Supreme Court's deepest insights in the *Sony Betamax* case¹⁴⁵ were its expressed conviction that technological innovation should not be quashed at the behest of copyright owners and its unspoken, but evident, reluctance to criminalize widely accepted social behavior. Subsequent history established the wisdom of the Court's refusal to favor copyright over innovation as the *Sony* doctrine allowed rapid development of useful new technologies and, ironically, of lucrative markets for copyright owners.¹⁴⁶

Regulators must also bear in mind that the music system is a global system. Regulation in this country will have consequences worldwide. There is some indication that, like new business models, global patterns of legal regulation through treaties and directives are emerging.¹⁴⁷ Those forms of regulation, like regulation through laws promulgated in the U.S. Congress, will be most effective if based on a holistic approach acknowledging the inherent dynamics of the system.¹⁴⁸

B. Foster Emergence

In so far as possible, regulators should seek to encourage emergent, bottom-up solutions before imposing top-down solutions. Brian Arthur, a complexity economist, notes with respect to economic regulation: “[G]overnments should avoid both extremes of coercing a desired outcome or keeping strict hands off, and instead seek to push the system gently toward favored structures that can grow and emerge naturally.

often fail to reflect noncommodifiable but nonetheless important expressive interests. This is a common failing of cost-benefit analysis. See Ruhl & Ruhl, *supra* note 28, at 479–480 (criticizing cost-benefit analysis as inaccurate in determining the costs and benefits associated with different laws because it does not account for unexpected effects of those laws).

145. In *Sony Corp. of America v. Universal City Studios, Inc.*, 464 U.S. 417, 440–442 (1984), the Court refused to enjoin Sony from manufacturing and distributing VCRs because they could be used to make infringing copies of movies and other television programming. Borrowing from patent law, the court adopted the staple article of commerce doctrine holding that makers of technologies capable of substantial noninfringing uses could not be found liable for contributory copyright infringement. That doctrine was most recently reaffirmed by the Supreme Court in *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 125 S. Ct. 2764, 2786 (2005). Borrowing again from patent law, the court also adopted a standard for active inducement of infringement in cases, unlike *Sony*, where intent to induce infringement could be established. *Id.* at 2780.

146. See Mark A. Lemley & R. Anthony Reese, *Reducing Digital Copyright Infringement Without Restricting Innovation*, 56 STAN. L. REV. 1345, 1387 n.127 (2004) (discussing the unexpected opportunities for copyright owners coming from radio and VHS).

147. See ITUNES WHITE PAPER, *supra* note 102, at 82–86 (comparing and contrasting the various international approaches to digital media regulation).

148. Susan Crawford suggests that monolithic, global harmonization of copyright law may not be a good adaptive strategy within this broader context. Rather, copyright law that varies from country to country may allow greater variation and experimentation, hence greater adaptability to change. See Crawford, *supra* note 9, at 646–47 (advocating a balanced approach to copyright legislation).

Not a heavy hand, not an invisible hand, but a nudging hand.”¹⁴⁹ Top-down solutions, no matter how well-intentioned, rely on inherently unreliable predictions about future system evolution. They may, in fact, divert it from the optimal path and create a path dependence scenario in which, for example, imposition of an administrative model precludes development of more efficient business models.¹⁵⁰ Not all emergent behaviors may prove desirable, but they have the unarguable advantage of representing responses to actual system conditions. Apple iTunes proves something about sustainability of a certain business model in the current system. If such a model proves successful, legal incentives can be fashioned to encourage it.

C. Use Simple Rules

A number of commentators¹⁵¹ have pushed for simplification of the complex quagmire of current copyright laws. The laws governing music are notable, even among copyright laws, for their incomprehensibility. Industry players have learned to work within a system of which one executive opined, “[i]t’s as if Franz Kafka designed this system and employed Rube Goldberg as his architect.”¹⁵² Consumers and many artists are baffled by it. In a globally interconnected system where direct interactions frequently occur among

149. Arthur, *supra* note 9, at 108.

150. The concept of path dependence, which arises from chaos and complexity theories, suggests that an initial advantage for a technology or standard may, because of sensitivity to initial conditions and historical “lock-in,” have important, irreversible effects even in free markets. If so, the efficiency-maximizing effects of the “invisible” hand may fail to emerge, possibly resulting in market failure. The standard example cited for path dependence is the QWERTY keyboard, claimed to be less efficient than other keyboard configurations, but universally used because, as a historical matter, the large majority of keyboard users learned to type on the QWERTY system. Natural resistance to learning another system created a classic positive feedback loop in which the QWERTY configuration was adopted by a critical mass of users and became the industry standard. Economists differ vociferously over whether irreversible path dependence occurs or whether markets invariably adjust over time to produce more efficient solutions. Brian Arthur, who developed the economic theory of increasing returns, is the leading voice for “positive feedback” economics. *See, e.g.*, W. Brian Arthur, *Competing Technologies, Increasing Returns, and Lock-In by Historical Events*, 99 *ECON. J.* 116 (1989) (discussing increasing returns theory as opposed to diminishing returns); W. Brian Arthur, *Positive Feedbacks in the Economy*, 262 *SCI. AM.* 92–99 (1990) (arguing for the positive feedback theory observed in high-technology economies); *but see*, S. J. Liebowitz & Stephen Margolis, *Path Dependence, Lock-In, and History*, *J. L. ECON. & ORG.* Apr. 1995 (arguing that empirical and theoretical support for path dependency is weak and disputing the QWERTY keyboard example).

151. *See, e.g.*, LESSIG, *supra* note 74, at 292–93 (proposing changes in the rules for copyright terms); JESSICA LITMAN, *DIGITAL COPYRIGHT* 179–182 (2001) (arguing that copyright laws should be simplified in order for the public to understand and obey the laws).

152. Rob Glaser, quoted in Amy Harmon, *Copyright Hurdles Confront Selling of Music on the Internet*, *N.Y. TIMES*, Sep. 23, 2002, at C1.

artists, distributors and consumers, relatively simple rules understandable by ordinary people are desirable as a purely practical matter. Complexity theory teaches that complex, adaptive behaviors can emerge even from simple rules.

Indeed, some theorists argue that too much structural complexity (too much order) not only produces diminishing returns, but may even contribute to system collapse.¹⁵³ They posit a cycle in which society responds to failure of one law by creating more law to patch the problem, thereby adding to the structural complexity of the legal system, which contributes to system vulnerability, causing more laws to fail, and so on.¹⁵⁴ Certainly, Congress has subjected copyright law to considerable patching up over the years, much of it in the form of extraordinarily complex, industry-negotiated “solutions” to problems created by new technologies.¹⁵⁵ Notwithstanding the piling on of such new laws, proposals for abandoning the regime as nonfunctional, at least in digital environments, are increasingly common.¹⁵⁶ Any new rule sets should aim for simplicity in both formulation and administration.

D. Expect and Allow Surprises

Complexity theory indicates that, because of the inherent unpredictability of complex adaptive systems, attempts to regulate them are likely to result in unintended consequences.¹⁵⁷ It also indicates that the most sustainable systems must maintain a balance between ordered and chaotic behaviors. These principles suggest, somewhat paradoxically, that regulators should try to anticipate unintended consequences of any new regulation but, nonetheless, build a regulatory structure that permits some degree of disorder to persist.

153. See Ruhl & Ruhl, *supra* note 28, at 466–68 (observing that, in adaptive systems not regulated by humans, the periodic shedding of overly-complex structures is a significant aspect of adaptation). Human intervention often prevents the functioning of such safety valves in socio-legal systems. *Id.* at 469. Ruhl & Ruhl propose that lawmakers should exercise a form of self-organized criticality and allow some societal problems to develop without resort to law, providing an opportunity for other problem-solving mechanisms to work. *Id.* at 475–77. Kauffman applies the law of diminishing returns to cycles of technological development. KAUFFMAN, *supra* note 9, at 203. See also, JOHNSON, *supra* note 9, at 78 (observing that even natural systems can become unwieldy when their component parts become excessively complicated).

154. See Ruhl & Ruhl, *supra* note 28, at 450–52 (discussing the structural complexity of the federal administrative system).

155. See, e.g., Digital Millennium Copyright Act, 17 U.S.C. §§ 1201–1205 (2000) (prohibiting circumvention of copy protection technologies).

156. See *infra* Parts V.A–E (assessing the current proposals for copyright law from a complex systems perspective).

157. See *supra* Part II.E (discussing the unpredictable nature of the music industry as a complex system).

If straightforward cause-effect relationships did not hold true most of the time, regulation of any kind would be impossible. Even in complex systems, local rules may often produce predictable behavior at the local level, though they cannot predict emergent qualities. Complexity theory simply raises a cautionary flag that regulators must expect the system to throw them a few curves as a natural outcome of system dynamics. In the music system, attempts to control the impact of P2P networks will set off a cascade of change throughout the system, producing unintended consequences of various magnitudes. Regulators should attempt to anticipate the indirect consequences of regulation, while accepting that they simply cannot predict the full complement of responses likely to occur.

A regulatory approach that allows some degree of unpredictability in the regulated system runs counter to the traditional goal of lawmaking to assure predictability and stability. Nonetheless, complexity theory suggests that, in the long term, the most successful regulatory scheme must leave room for surprises, both good and bad. We must accept some indeterminacy in the legal system, just as complexity economists argue that we must recognize indeterminacy in economic systems,¹⁵⁸ and physicists have come to accept indeterminacy in physical systems.¹⁵⁹ Systems that are too ordered and integrated are fragile, not flexible.¹⁶⁰

The idea of maintaining a mix of order and chaos, control and freedom, within a system, is largely consistent with the traditionally porous protection offered by copyright law. Copyright offers only a limited package of rights for a limited amount of time, allowing works eventually to enter the public domain where they may be freely used by consumers or future creators.¹⁶¹ Even during the copyright monopoly, doctrines such as fair use, first sale, and the idea-expression dichotomy

158. See W. Brian Arthur, *The End of Certainty in Economics*, Address at the Conference Einstein Meets Magritte (July, 1994) in *EINSTEIN MEETS MAGRITTE* (D. Aerts, et al, eds. 1999), available at <http://www.santafe.edu/arthur/Papers/Papers.html> (discussing the indeterminacy of the economy because of human behavior and technology).

159. See BAK, *supra* note 9, at 8, 11 (discussing that fields such as quantum mechanics and string theory are highly probabilistic).

160. Jervis notes that such systems "can neither take advantage of unforeseen opportunities nor cope with unexpected difficulties." JERVIS, *supra* note 9, at 294.

161. Copyright owners receive rights to control reproduction, adaptation, distribution, public performance and display, and in the case of sound recording, public performance by digital transmission. 17 U.S.C. § 106 (2000). These rights are limited in duration under 17 U.S.C. § 302 and subject to many exceptions codified in 17 U.S.C. §§ 107–122. The Framers were themselves the beneficiaries of fairly loose copyright laws in what was, at the time, a nation more likely to pirate copyrighted works than to protect them.

provide substantial loopholes for the escape of works into public use.¹⁶² Both the likelihood of unintended consequences and the importance of retaining flexibility in the system reinforce the suggestion that regulation with a light hand is advisable. Such regulation will require patience and ongoing monitoring of system responses.

E. Allow the System Time to Respond

In the era of short attention spans and thirty-second sound bites, complexity theory requires recognition of the importance of longer, evolutionary time scales in system development. Technological innovation has proceeded at light speed over the past decade. The music system as a whole may need more time than has elapsed thus far to cope with the changes wrought by digitization and global networking. Not only law but markets, cultural practices and the political process naturally move at slower paces than technology; the delay in their responses to innovation may serve an adaptive purpose by allowing emergence to occur.¹⁶³

If legislators regulate only in light of present circumstances, without a view toward future developments, they may lock down the music system in ways that render it maladaptive in the long run. For example, successful imposition of draconian DRM schemes several years ago might have precluded Apple from developing its more liberal DRM regime and from negotiating licenses that allow considerably more freedom to consumers than proponents of the pay-per-use world advocate. Because the law responded slowly, windows of opportunity were opened for Napster and its successors and, subsequently, for iTunes and its imitators. We should be wary that the urge to regulate quickly, promoted forcefully by those invested in the past and driven by

162. Fair use, codified as 17 U.S.C. §107, potentially provides protection for some uses, particularly those that foster democratic dialog, such as educational and critical uses. The doctrine functions as an affirmative defense that immunizes certain unauthorized uses of copyrighted works from infringement suits based on a complicated, four-factor balancing test. Application of the doctrine to specific uses is notoriously unpredictable. The first sale doctrine, 17 U.S.C. § 109, limits the copyright owner's control over distribution to control over the first sale of a copy, thereby freely allowing subsequent transfers of purchased copies. The idea-expression dichotomy prevents copyright protection for ideas, methods, processes, and similar abstract concepts, providing protection only for particularized expression. *See* 17 U.S.C. § 102 (2000). All three doctrines serve to make copyrighted works, or certain aspects of them, available for public use.

163. For example, by the time the courts shut down Napster (*see* A&M Records, Inc. v. Napster, Inc., 239 F.3d 1004 (9th Cir. 2001) (granting a preliminary injunction against Napster)), technology had already moved on to decentralized file sharing systems, which are still in operation pending the lower court's review under the new inducement standard announced by the Supreme Court in *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 125 S. Ct. 2764 (2005).

the desire for short-term profit, may outpace the system's own dynamics which would produce better real-world solutions if given time.

Once a regulatory strategy is adopted, flexibility will be required on the part of regulators. They will be able to anticipate some consequences of their interventions, but not others. The only way to learn how the music system will respond to new legal rules is to set it in motion and wait to see what happens. Regulators should expect to employ multiple, sequential strategies to retune the system as unexpected responses to their initial regulation, and unexpected responses to the responses, manifest themselves in the system.

As a final cautionary note, during that process of tinkering with the system, regulators should accept the irreversibility of change. The RIAA currently seeks to protect its old business models and its dominant role in distribution. Those models fit an environment in which the necessity of producing and distributing physical copies of sound recordings imposed costs and geographic constraints that no longer apply in the online environment. In the new environment, there is no particular reason that Congress should abet the recording industry's attempt to maintain the dominant position it held in music distribution prior to the advent of file sharing systems. The industry still serves an important role in the system, particularly with respect to offline distribution of physical copies. However, the recording studios may ultimately have to adjust to a less dominant role, with a greater percentage of distribution controlled through new players like independent online services and direct artist-to-consumer enterprises.¹⁶⁴ Some industry players, such as retail outlets, may become extinct in the new digital environment or they may take new forms.¹⁶⁵ The heady days of old Napster and unlimited music sharing for free and without penalty are also rapidly departing and unlikely to be recaptured though it appears likely that more limited forms of personal use will, and should, survive.

164. In the context of international politics, Jervis refers to this as the "cycle of hubris and nemesis" in which dominant actors in the old environment must adjust to a much smaller role in the new. JERVIS, *supra* note 9, at 144. The Berkman Center study observes that because of the manufacturing and distribution cost savings associated with online music sales, record labels may end up with revenues roughly comparable to those realized under traditional "offline" sales. See iTUNES WHITE PAPER, *supra* note 102, at 88 (forecasting the potential effects on record labels of online music stores).

165. See e.g., Nat Ives, *Musicland Tries to Embrace the Internet and Imulate the Atmosphere of Retail Chains like Starbucks*, N.Y. TIMES, Aug. 24, 2004, at C9 (describing experimental concepts for retail outlets).

F. Permit Personal Use

The phrase “personal use” includes consumption and convenience copying of recordings by users for purposes that include portability to other devices, adaptations such as the creation of “mix” CDs and MP3 playlists and uncompensated sharing of both the original works and the adapted works with others.¹⁶⁶ Traditional copyright allowed such uses partly by design but mostly by default. Recent developments suggest that those uses play an important role within the music system by providing the input and outlet for much musical creativity.

The Copyright Act contains no general exemption for personal use though it offers some protection under doctrines like fair use, first sale, and the idea-expression dichotomy, which generally limit the rights of copyright owners.¹⁶⁷ It does provide one specific exemption for home audio taping under the Audio Home Recording Act,¹⁶⁸ but the act has been held inapplicable to general purpose computers and peripheral music players.¹⁶⁹ Apart from such doctrines, personal uses always existed de facto, assumed though not specifically acknowledged. Even prior to the digital revolution, music consumers commonly taped duplicate copies of recordings or created “mix” tapes of favorite audio tracks that they shared with friends or family. Copyright owners

166. Definitions of “personal use” in copyright vary from restrictive readings allowing a single copy made for the individual’s own use to broader readings which include some degree of sharing with family and friends. For a restrictive reading, see L. RAY PATTERSON & STANLEY W. LINDBERG, *THE NATURE OF COPYRIGHT: A LAW OF USERS’ RIGHTS* 193–99 (1991) (restricting the term to actual use of the work and the making of a single copy which is not a functional substitute for a copyrighted work). Copying of functional works, such as computer programs, would fall within fair use, not personal use. In a more recent article, Patterson argues that personal use so defined is constitutionally required. L. Ray Patterson & Christopher M. Thomas, *Personal Use In Copyright Law: An Unrecognized Constitutional Right*, 50 J. COPYRIGHT SOC’Y U.S.A. 475, 481–84 (2003). For a broader reading, see Michael J. Meurer, *Price Discrimination, Personal Use and Piracy: Copyright Protection of Digital Works*, 45 BUFF. L. REV. 845, 865 n.95 (1997) (including sharing, modification, archiving, browsing, and the creation of derivative works for personal use). This article adopts this broader definition which was also adopted in an earlier article on this subject. See Deborah Tussey, *From Fan Sites to Filesharing: Personal Use in Cyberspace*, 35 GA. L. REV. 1129, 1134 (2001) (defining personal use).

167. Some “personal” uses qualify as “fair” uses under the complex, four factor analysis of 17 U.S.C. § 107, others likely would not. Compare *Sony Corp. v. Universal City Studios, Inc.*, 464 U.S. 417, 454–56 (1984) (holding that noncommercial home videotaping of television broadcasts for purposes of timeshifting was a fair use) with Patterson & Thomas, *supra* note 166, at 504–05 (arguing the 1976 codification of the fair use doctrine melded personal use into fair use with the intention of restricting both fair and personal uses).

168. Audio Home Recording Act, 17 U.S.C. § 1008 (2000).

169. See *Recording Indus. Ass’n of Am. v. Diamond Multimedia Sys., Inc.*, 180 F.3d 1072 (9th Cir. 1999) (holding that the Rio music player did not fall within Audio Home Recording Act).

tolerated such uses because users' copying activities were difficult to detect and had limited market impact.¹⁷⁰ Moreover, providers of copying technologies offered far more attractive targets for infringement suits than individual consumers.¹⁷¹

The development of digital media, combined with network interconnection, altered this state of affairs. Not only could consumers disseminate large numbers of perfect digital copies far outside their own circle of friends through email and file sharing, but they also began to reformat works for use on different digital devices. Because of the vastly increased scale of activity, consumer sharing became more dangerous to copyright owners' markets as the technology simultaneously made it more detectible.¹⁷² The lower court decisions in the *Grokster* case¹⁷³ appeared to limit copyright's usefulness as a weapon against facilitators, inspiring the industry to launch direct suits against consumers.¹⁷⁴

Notwithstanding the lack of explicit statutory recognition, personal uses contribute to achievement of copyright's goals. Personal uses of many kinds of copyrighted works, including music, enrich private lives and public culture and provide the raw materials for new works.¹⁷⁵ They constitute a significant element of what Professor Lawrence Lessig has dubbed "remix," meaning the practice of taking pre-existing ideas and expression and making something new from them.¹⁷⁶ The ability to

170. See Patterson & Thomas, *supra* note 166, at 506 (discussing why personal use was so easily excused by the courts).

171. See Jane C. Ginsburg, *Authors and Users in Copyright*, 45 J. COPYRIGHT SOC'Y U.S.A. 1, 11–12 (1997) (discussing the Supreme Court's jurisprudence of private copying); Pamela Samuelson, *Fair Use for Computer Programs and Other Copyrightable Works in Digital Form: The Implications of Sony, Galoob and Sega*, 1 J. INTEL. PROP. L. 49 (1993) (discussing several Supreme Court decisions involving copyright infringement suits against providers of copying technologies).

172. See Neil Weinstock Netanel, *Copyright and a Democratic Society*, 106 YALE L.J. 283, 299–300 (1996) [hereinafter Netanel, *Copyright*] (discussing reaction to sharing by hand copying in contrast to the reaction to electronic methods of copying).

173. See *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 259 F. Supp. 2d 1029 (C.D. Cal. 2003), *aff'd* 380 F.3d 1154 (9th Cir. 2004), *vacated and remanded* 125 S. Ct. 2764 (2005). The lower courts found no secondary liability for purveyors of decentralized file sharing software. The Supreme Court later reversed and remanded for review under its newly-announced "inducement" standard. *Grokster*, 125 S. Ct. at 2780–83.

174. See Von Lohman, *supra* note 86 (noting that thousands of such suits have been brought).

175. See, e.g., Niva Elkin-Koren, *Cyberlaw and Social Change: A Democratic Approach to Copyright Law in Cyberspace*, 14 CARDOZO ARTS & ENT. L.J. 215, 283–89 (1996) (discussing personal uses in cyberspace); Netanel, *Copyright*, *supra* note 172 (discussing the extension of copyright to the personal use of cultural products).

176. See M. Marshall, *Remix is a Cultural Right, Lessig Says* (Nov. 18, 2004) (on file with author).

share and play with works, as well as to passively enjoy them, contributes to creativity and semiotic democracy.

The iTunes business model offers one solution to the personal use quandary; it legitimates such activities but also limits their scope by licensing them and imposing reasonable technological restraints on copying and sharing.¹⁷⁷ In this way, it mimics the state of affairs that existed under the copyright regime prior to the digital revolution by creating a limited sphere of allowable personal uses conducive to both creator incentives and semiotic democracy. The success of iTunes indicates that personal use has market value.¹⁷⁸ Where competition exists in the market, consumers have rejected draconian copy-protection¹⁷⁹ but embraced more limited forms of copy control. The success of iTunes suggests that any pay service wishing to succeed in the post-Napster environment must provide some scope for personal uses as well as some protection for content owners.

A complex systems perspective ratifies this strategy. Complexity theory indicates that the most viable complex systems achieve a balance between order and chaos. Copyright monopolies and rules generally act as forces of order within the regulated industries, regularizing the flow of works and incentives. Unauthorized noncommercial uses contribute to creative disorder by permitting unanticipated, creative uses of works that would be less accessible, and hence less usable by subsequent creators, in a strictly controlled system.¹⁸⁰ Additionally, personal uses prevent copyright owners from obtaining such rigid control of the music system that the system becomes incapable of adaptation to change. Copyright's refusal, and practical inability, to provide owners with complete control has contributed to the long-term health of the creative systems it regulates. If kept within bounds, personal use poses no threat to the incentives feedback loop and contributes to the inherently messy creative process. The most successful regulations should then permit some degree of unauthorized, noncommercial use.

In summary, the best legislative strategy for regulating the complex music system would balance competing economic, technological, and

177. See *supra* notes 101-05 and accompanying text (discussing the success of iTunes).

178. *Id.*

179. For example, Circuit City's Divx system of copy control for movies was a complete failure ultimately abandoned by the company. See Lindsay Arent, *Ding Dong, Divx is Dead*, WIRED NEWS, June 16, 1999, <http://wired-vig.wired.com/news/business/0,1367,20253,00.html> (discussing the downfall of Divx).

180. Michael Madison has suggested, in the context of fair use analysis, that creativity may be viewed as an "emergent property of a complex system." Michael J. Madison, *A Pattern-Oriented Approach to Fair Use*, 45 WM & MARY L. REV. 1525, 1684 (2004).

social interests, nudge the system toward emergence, provide a flexible framework to accommodate new technologies, permit personal use and give the system time to adjust before and between legislative interventions. The next Part applies these general guidelines to current copyright reform proposals in order to determine whether each proposal is sufficiently in tune with the dynamics of complex systems to be successful.

V. ASSESSING CURRENT PROPOSALS FROM A SYSTEMS PERSPECTIVE

Until recently, most proposals for legal action to “fix” the music “problem” created by file sharing came from two extremes in the debate. High protectionists pursued proposals designed to produce a pay-per-use regime for digital music while low protectionists suggested abandonment of copyright altogether.¹⁸¹ A number of recent proposals seek a middle ground.¹⁸² This Part applies the guidelines just discussed to several current models for regulation of the music system: (1) copyright abandonment, (2) compulsory levies, (3) regulation as a public utility, (4) pay-per-use, and (5) voluntary experiments and speed bumps.¹⁸³ Each proposal starts from the current baseline in which the copyright regime and related anti-circumvention laws apply to online distribution of sound recordings, but enforcement is spotty and content providers employ DRM schemes and restrictive licensing with variable success.¹⁸⁴ Ultimately, all of these proposals share a common failing—impatience.

181. See *infra* Parts V.A, V.D (discussing pay-per-use and copyright abandonment proposals).

182. See *infra* Parts V.B, V.C, V.E (evaluating several alternative proposals).

183. The iTunes White Paper offers the following categories of proposals: (1) no change scenario (current copyright and DMCA regimes continue to govern), (2) speed bumps scenario (technological restrictions create small barriers), (3) technology lockdown scenario (restrictive DRM schemes unilaterally determine users' rights), (4) alternative compensation scenario (state-run taxing program implemented) and (5) entertainment cooperatives scenario (voluntary associations control distribution). ITUNES WHITE PAPER, *supra* note 102, at 6, 7. A year earlier, a Berkman Center study offered slightly different categories: (1) No Change, (2) Take Property Rights Seriously (legal reforms to expand protection of intellectual property), (3) Effective Technology Defense (digital rights management), (4) Utility Model (treating digital information as a public utility), and (5) the compulsory license scenario (alternative compensation schemes). The Berkman Center for Internet & Society, *Five Scenarios for Digital Media in a Post-Napster World*, Research Publication No. 2003-07, Nov. 2003, <http://cyber.law.harvard.edu/home/2003-07> [hereinafter Berkman Center, *Scenarios*]. Peter Yu categorizes recent models as mass licensing (the iTunes model), compulsory licensing, voluntary collective licensing, voluntary contribution, technological protection, copyright law revision, dispute resolution, and alternative compensation. Yu, *supra* note 117, at 657. This article includes most of these scenarios in the categories noted above, which are based not on the methodology of control but on the degree of control sought.

184. See *supra* Part II.D (discussing the emergence of file sharing technology and various

A. Copyright Abandonment

Some commentators urge that copyright protection for sound recordings disseminated online is unnecessary in light of the new economics of digital distribution. Digital networks permit near-costless transmission of content and eliminate the need to distribute physical copies through expensive bricks-and-mortar stores. Consequently, digital networks also eliminate the need to provide incentives for distributors. Since low-cost digital technologies enable artists to produce their own recordings and sell them directly via the Internet, many of the production and promotional services provided by recording studios are no longer necessary. Since recording artists receive economic incentives primarily from alternative forms of compensation rather than from recording sales, there is no need for copyright incentives. Copyright would continue to govern analog distribution of works, but could be abandoned in online environments.¹⁸⁵

Copyright abandonment would certainly permit emergence, simplify the rules for users and produce an unstructured legal environment conducive to new developments. It would support not merely limited personal use, but widespread, uncontrolled sharing. From a systems perspective, copyright abandonment faces two obstacles: one that makes it unwise and another that makes it unlikely.¹⁸⁶

Rejection of substantive legal regulation of online distribution unwisely presumes that market dynamics will inevitably produce good emergent behaviors. Harsh experience teaches that the dynamics of complex systems can produce normatively undesirable emergent behaviors. Free markets, which would provide the only mechanism of change in a no-copyright system, have known defects. The invisible

responses to that technology).

185. Professor Raymond Shih Ray Ku argues that digital distribution eliminates the need to provide incentives for intermediaries because it forces consumers to internalize the costs of copying. Copyright incentives are not necessary to induce creation of music by artists since they make their money primarily through concert ticket sales and the sale of associated goods like T-shirts. Ku, *supra* note 126, at 306–10. *But see* Lemley & Reese, *supra* note 146, at 1378, n.127 (2003) (rebutting Prof. Ku's argument). Tom Bell suggests that copyright owners should be forced to choose either copyright protection or reliance on a combination of technological self-help and common law remedies. Tom W. Bell, *Escape From Copyright: Market Success vs. Statutory Failure in the Protection of Expressive Works*, 69 U. CIN. L. REV. 741, 744–46 (2001). For early alternative compensation proposals, John Perry Barlow, *The Economy of Ideas*, WIRED, Mar. 1994, at 84, available at <http://www.wired.com/wired/archive/2.03/economy.ideas.html> (discussing approaches to regulating digital property); Esther Dyson, *Intellectual Value*, WIRED, July 1995, at 136, available at <http://www.wired.com/wired/archive/3.07/dyson.html> (arguing that digital content should be free).

186. See *infra* notes 187-90 and accompanying text (discussing obstacles faced by copyright abandonment approach).

hand does not always distribute its largesse equitably: markets produce imbalances of power and information; monopolies and oligopolies distort market function; externalities are imposed; markets may fail entirely where transaction costs are high.

A complete laissez-faire approach to the music system poses similar dangers. A single music distributor controlling the dominant technical standard might gain monopoly power, and with it, the ability to use DRM and license restrictions to control pricing and eliminate personal uses. Conversely, the ethos of free sharing might become so entrenched that no online business could succeed and creator incentives would be eliminated. In other words, complete deregulation threatens to produce an imbalance among the economic, technological, and social subsystems. The lesson taken from complexity theory is not rejection of all regulation, but due attention to the possibility of indirect as well as direct effects.¹⁸⁷

The second barrier, which makes copyright abandonment unlikely, is a form of path dependence. Holmes argued that the law follows a path in which its past exerts strong influence over its future.¹⁸⁸ More recently, scholars applying complexity and chaos theories have theorized that law is path dependent in that past regulatory choices foreclose certain options, producing a branching of law's path, and that such foreclosure may be irreversible.¹⁸⁹ Copyright and related laws have regulated the music system for a substantial period of time. Courts have already applied the copyright regime, without hesitation, to online distribution of music and will not reverse course absent explicit direction to that effect from Congress.¹⁹⁰ Since the music industry wields significant political power, Congress is exceedingly unlikely to deconstruct the complicated edifice of copyright law without providing substitute regulations and revenues for current industry players. A copyright abandonment approach is, therefore, the least likely of all

187. See JERVIS, *supra* note 9, at 71–73 (rejecting the argument that regulation is always futile).

188. See Oliver Wendell Holmes, *The Path of the Law*, 10 HARV. L. REV. 457, 457–58 (1897) (arguing that new laws develop as incremental outgrowths of previously established legal principles so that the law's present and future paths depend on its past path).

189. See, e.g., Roe, *supra* note 9, at 643–44 (applying to law principles of sensitivity to initial conditions, path dependence, and modern evolutionary theory); Ruhl & Ruhl, *supra* note 28, at 415–16 (arguing that once a regulatory choice is made, it changes the socio-legal environment. If society later wishes to change the direction of the law, it may take a regulatory turn back towards a foregone option, but cannot retrace its path exactly).

190. For example, neither the parties nor the courts in *A&M Records, Inc. v. Napster, Inc.*, 239 F.3d 1004 (9th Cir. 2001) and *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 125 S. Ct. 2764 (2005) questioned the applicability of copyright law to online music distribution.

possible scenarios. Realistically, the question is not whether the music distribution system will be regulated, but how it will be regulated. Of the outstanding proposals, compulsory levies have recently attracted the most attention.

B. Compulsory Levies

A number of authors have proposed the imposition of compulsory taxes or levies on the sale of software, devices or services used for purposes of copyright infringement.¹⁹¹ The resulting funds would be distributed to copyright owners to compensate them for activities like unauthorized online file sharing. Levies would act as blanket compulsory licenses, allowing users to make and share copies at will.¹⁹² The proposals vary somewhat as to scope, their relationship to copyright, and the means for collecting and distributing royalties, but all trade off a levy for unrestricted file sharing.¹⁹³

191. See *infra* note 196 (discussing proposals for compulsory levies or taxes).

192. See, e.g., FISHER, *supra* note 119, at 199–258 (2004). Professor Fisher proposes that major portions of the copyright and anti-circumvention regimes be replaced by a government-administered system under which revenues collected either through direct income taxation or through levies on equipment and media would be distributed on the basis of frequency of use of particular works. Usage would be tracked through unique registration numbers issued by the Copyright Office. Once this system was established, copyright prohibitions against copying, adaptation, performance, and distribution by users would be eliminated. *Id.* Professor Netanel proposes imposition of a “noncommercial use levy” (NUL) on consumer products and services whose value is enhanced by P2P sharing in return for allowing unrestricted noncommercial file sharing. Collective societies representing copyright owners would distribute funds based on usage. Netanel, *Impose, supra* note 118, at 37–47; see also Jessica Litman, *Sharing and Stealing*, 27 HASTINGS COMM. & ENT. L. J. 1, 41–50 (2005) (advocating a levy with opt-out provision); Glynn S. Lunney Jr., *The Death of Copyright: Digital Technology, Private Copying, and the Digital Millennium Copyright Act*, 87 VA. L. REV. 813, 852–58, 911–18 (2001) (supporting a levy on devices and blank media). Professor Ku proposes a compulsory taxation scheme as an alternative if his preferred position abolishing copyright altogether for digital works fails to generate sufficient incentives for creation. Ku, *supra* note 126, at 312–15.

193. For example, Professor Fisher’s scheme would ultimately replace copyright, Professor Netanel’s scheme would supplement it for certain kinds of digital works, and Professor Ku’s scheme would eliminate it as to digital recordings but retain it for analog recordings as long as recordings were issued in both formats. See FISHER, *supra* note 119, at 246, 247; Ku, *supra* note 126, at 312–15, 321–22; Netanel, *Impose, supra* note 118, at 37–47. In this country, precedent for a levy system is supplied by the Audio Home Recording Act (AHRA) which imposes a royalty on blank digital audio media and digital audio recorders, and allocates the resulting revenues among music copyright owners. 17 U.S.C. §§ 1001–1010 (2000). AHRA has been rarely used because it applies narrowly to a digital audio recording format, DAT, which was quickly replaced by digital CDs. Canada and a number of European countries use compulsory levy systems. John Borland, *Canada Deems P2P Downloading Legal*, C/NET NEWS.COM, Dec. 12, 2003, http://news.com/Canada+deems+P2P+downloading+legal/2100-1025_3-5121479.html (describing the Copyright Board’s application of a pre-existing levy on recording media to MP3 players and declared that downloading, though not necessarily uploading, was legal). A recent report recommends that European countries move away from levies with respect

From a systems perspective, a compulsory levy scheme certainly offers some advantages. It considers the system as a whole and attempts to keep the subsystems in balance by avoiding technology mandates. It preserves incentives for creation by distributing royalties, but also fosters semiotic democracy by legalizing copying and sharing. It produces simple, understandable rules for users who gain “free” use of a tremendous catalog of works without fear of legal liability. Most compulsory levy schemes anticipate evolution over time in the sense that they provide some mechanism for adjusting royalties.

On the other hand, compulsory levy proposals are top-down solutions, which may both preclude emergence of new, desirable business models and severely hamper models that have already emerged. It is difficult to imagine iTunes thriving in a compulsory levy environment. Who would pay to download rights-managed music after paying the levy for the right to free use of music? Levy proposals seem particularly vulnerable to the law of unintended consequences since their designers cannot possibly anticipate the many effects such an alteration in the legal rules will cause in the system as a whole. For example, though levies do not directly impose or prohibit specific technologies, the mere existence of the levy may indirectly channel technological development.¹⁹⁴ While levy systems provide simple rules for users, they require complicated administrative oversight to adjust royalty rates and distributions.¹⁹⁵ Those rules will be anything but simple, and adjustments are likely to prove increasingly difficult over time without markets to guide price setting.¹⁹⁶

to digital information. Bert Hugenholtz, Lucie Guibault & Sjoerd van Geffen, *The Future of Levies in a Digital Environment: Final Report* (2003), available at <http://www.ivir.nl/publications/other/DRM&levies-report.pdf>. The report recommends that levies not be applied to general purpose computers and digital media, favoring instead the use of digital rights management. *Id.*

194. See Lemley & Reese, *supra* note 146, at 1409 n.256 (observing that “[i]f a levy is charged on each device that can be used to download digital content, there will be a strong incentive to use a single device that serves just that purpose . . . rather than to combine general-purpose devices that serve other purposes as well but would require the payment of multiple levies.”).

195. For example, Professor Fisher’s proposal requires periodic adjustments by a new branch of the Copyright Office using sophisticated techniques to determine the appropriate rates and distributions. FISHER, *supra* note 119, at 199–258. Professor Netanel’s proposal requires that the levy amount be determined (and periodically adjusted) through negotiations between associations representing the industries upon which the levy is imposed and associations representing holders of rights in different categories of works. In the absence of agreement, a Copyright Office tribunal would set the rates. Netanel, *Impose*, *supra* note 118, at 44.

196. See ROBERT P. MERGES, CATO POLICY ANALYSIS NO. 508, COMPULSORY LICENSING V. THE THREE “GOLDEN OLDIES” PROPERTY RIGHTS, CONTRACTS, AND MARKETS, Jan. 15, 2004, <http://www.cato.org/pubs/pas/pa-508es.html> (arguing against compulsory licensing in favor of

Compulsory levy systems are likely to prove less flexible over time than solutions emerging naturally through competition. Like copyright abandonment, levies face some path dependence barriers, though they offer alternative regulatory structures and sources of compensation for copyright owners.¹⁹⁷ Moreover, the music industry has been noticeably cool to such proposals.¹⁹⁸ Levies do, however, offer a significantly more flexible regulatory scheme, and one more congenial to the studios, than proposals based on a public utility model.

C. Public Utility

Under this model, the music system would be regulated, probably at the federal level, in the same way as essential utilities like gas and water.¹⁹⁹ The exact nature of the proposed regulation varies,²⁰⁰ but an administrative agency might, among other things, control revenue distribution, regulate prices and prevent price discrimination, prevent industry consolidation, require equal treatment of all webcasters by record companies, and require online distributors to acquire content from multiple sources.²⁰¹ The utility model faces considerable

private negotiation); *see also* Yu, *supra* note 117, at 704–12 (discussing a compulsory licensing regime). In response to this problem, Professor Lessig has suggested temporary imposition of an alternative compensation scheme during the technological transition from physical storage to on-demand, online delivery, leaving the current copyright system in place for future use once the technology has settled down. LESSIG, *supra* note 74, at 302–03.

197. A voluntary levy system might avoid some of these disadvantages by trying levies out as experimental business models rather than imposing them as the single comprehensive solution to the file sharing problem. *See infra* notes 220–26 and accompanying text (discussing voluntary licensing schemes).

198. *See* Elaine McArdle, *Up on Downloading: HLS Professors Propose Solutions to Music Industry Crisis*, HARV. L. BULL., Summer 2004, at 18 (discussing proposals for the copyright system, including the entertainment industry's approach).

199. *See* Berkman Center, *Scenarios*, *supra* note 183, at 103 (discussing the Utility Model scenario).

200. The public utility regulatory model has changed in recent decades. Under the traditional model, a federal administrative agency managed an industry sector using strategies that included controls over the packages of services offered, prices, entry into the industry, and cross-subsidization. Starting in the 1970's, this model was replaced with a more limited model in which agencies encouraged firms to develop differently priced and featured service packages and sought to stimulate competition within the industry by reducing restrictions on entry, requiring "unbundling" of packages, and requiring interconnection services among competitors. FISHER, *supra* note 119, at 174–76. Professor Fisher discusses the factors that make certain industries targets of more active government control and argues that those factors might apply to the entertainment industries. *Id.* at 177–86.

201. *See* Berkman Center, *Scenarios*, *supra* note 183, at 12–14 (discussing the Utility Model Scenario); FISHER, *supra* note 119, at 186–96. Some proposals denominated by their creators as "utility" models actually sound more like compulsory levies or blanket licenses. *See e.g.*, David Kusek, *Music Like Water*, FORBES.COM, Jan. 31, 2005, http://www.forbes.com/columnists/free_forbes/2005/0131/042.html (arguing that music should be

resistance to two notions which are implicit in its approach: (1) the equation of access to sound recordings with access to essentials like water and power, and (2) the insertion of government control into artistic enterprises.²⁰²

From a systems perspective, the utility model might, if managed properly, balance the various interests involved in the music system. However, administrative agencies are always subject to capture by the regulated industries which would put that balance at risk. Oversight of administrators might be required, adding additional superstructure to what is bound to be a centralized, top-down, heavy-handed regulatory scheme. Emergence would not be allowed to occur naturally; simple rules would be exceedingly unlikely; creative disorder would be minimized; and the likelihood of unanticipated consequences from persistent governmental intervention maximized. Given the predominant trend toward de-regulation of industries like the airline industry, which are considerably more critical to the public interest than musical entertainment, the public utility model is an unlikely contender in the regulatory sweepstakes. It is, to a large extent, inconsistent with the inherent characteristics of complex systems. The public utility model offers a regulatory mirror image of the pay-per-use model favored by the music industry. It proposes a top-down, tightly controlled system run by a government agency as compared to a top-down, tightly controlled system run by a recording industry oligopoly.

D. Pay-per-use

This category comprises initiatives intended ultimately to produce the pay-per-use version of the celestial jukebox. Recording industry control springs from a combination of expanded copyright entitlements, restrictive digital rights management complemented by contractual restrictions on users and enforced by anti-circumvention laws, technology mandates requiring that copy controls be built into consumer technology and strict legal enforcement of all of the above against both direct and secondary infringers. The combination would expand copyright owners' power over works beyond the bounds permitted by traditional copyright law, allowing control of and charges for every use of a copyrighted work.²⁰³

priced in the same manner as utilities).

202. See FISHER, *supra* note 119, at 180–81 (discussing obstacles in regulating online entertainment).

203. The Clinton Administration promoted the pay-per-use model in an influential white paper that proposed expanded intellectual property rights as a means of safeguarding the interests of content owners sufficiently to encourage them to participate in the new online environment.

The anti-circumvention provisions of the Digital Millennium Copyright Act (DMCA)²⁰⁴ constituted a major step forward for the pay-per-use model. While enforcement efforts to date primarily target circumvention of restrictive DRM systems,²⁰⁵ the DMCA also provides the framework for business models like iTunes, offering legal recourse against those who circumvent Apple's more permissive DRM limitations.²⁰⁶

Defunct legislative initiatives in the pay-per-use mold include the Peer-to-Peer Privacy Prevention Act,²⁰⁷ a patently unwise measure that would have immunized content owners who exercised electronic self-help including direct interference with the computers of suspected copiers, and the Consumer Broadband and Digital Television Promotion Act,²⁰⁸ which would have required copy control technologies in all digital media devices. The most controversial recent initiative in this vein is the "Induce" Act,²⁰⁹ which would drastically expand secondary liability for copyright infringement in order to provide legal recourse against providers of decentralized P2P technologies.

The pay-per-use model is inconsistent with most of the regulatory guidelines for complex systems suggested above.²¹⁰ It attempts to turn the clock back, preserving dominant players in the old industry at the

See INFORMATION INFRASTRUCTURE TASK FORCE, INTELLECTUAL PROPERTY AND THE NATIONAL INFORMATION INFRASTRUCTURE: THE REPORT OF THE WORKING GROUP ON INTELLECTUAL PROPERTY RIGHTS (1995) (explaining the Clinton Administration copyright proposals). Professor Jessica Litman notes that most of the assumptions on which the white paper was based have proved incorrect, including the assumption that the Internet would never develop either infrastructure or worthwhile content unless copyright owners' interests were protected. See Litman, *supra* note 192, at 3–4 (addressing government responses to the digital music phenomenon).

204. Digital Millennium Copyright Act, 17 U.S.C. §§ 1201–1205 (2000).

205. See, e.g., *Universal City Studios v. Corley*, 273 F.3d 429, 443 (2d Cir. 2001) (affirming the grant of an injunction to prevent a web site owner from posting movies on the website).

206. iTUNES WHITE PAPER, *supra* note 102, at 41.

207. H.R. 5211, 107th Cong. (2002).

208. S. 2048, 107th Cong. (2002).

209. The Inducing Infringement of Copyrights Act of 2004, S. 2560, 108th Cong. (2004). The bill pitted the recording industry against technology companies who feared that the bill would vitiate the Supreme Court's pro-innovation holding in the Sony Betamax case and expose many technology companies (other than file sharing companies) to liability. See John Borland, *D.C. Showdown Looms Over File Swapping*, Oct. 7, 2004, http://news.com.com/D.D.+showdown+looms+over+file+swapping/2100-1025_3-5400128.html (discussing the political debate surrounding the Induce Act). The act did not pass in the 2004 session (bill status for S. 2560 available at <http://thomas.loc.gov>) and legislative action in the 2005–2006 session of Congress may have been forestalled by the Supreme Court's explicit adoption of an inducement standard in *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 125 S. Ct. 2764, 2780–83 (2005).

210. See *supra* Part III (describing the music system as a complex adaptive system).

expense of the development of new business models. It promotes a restrictive top-down system that would alter the existing balances between innovation, incentives, and cultural sharing by shifting power heavily in favor of copyright owners and crippling technological innovation and semiotic democracy.²¹¹ Technology mandates are a particularly ill-advised invitation to path dependence which chill innovation and commit society to technologies that may prove inefficient or detrimental.

Pay-per-use would not only preclude future emergent solutions, it could potentially destroy those that have already emerged. It has been suggested, for example, that adoption of the Induce Act might outlaw technologies including web browsers, CD burners and the iPod,²¹² not only limiting users' ability to create and share music but also obliterating Apple's business model, which relies on the combined sales of the iPod device and online music downloads for profitability. Pay-per-use does establish a simple rule for users—"pay for every use"—though actual implementation of that rule in transactions may be complicated.

Given the high concentration in the recording industry, the pay-per-use model would produce a tightly controlled, ordered system. While such a system may survive in the short term, it lacks flexibility for the long term because it leaves no room for creative disorder. The pay-per-use model would eliminate the freedoms which traditional copyright preserved in the form of fair and personal uses. Over-protection of individual works neglects the role they play in the larger system as not only valuable outputs, but also essential inputs for later creation. Since some potential creators will be unable to pay for every access to prior works, elimination of fair and personal uses will decrease the availability of inputs for the creative system as a whole. Total control, if capable of achievement, will produce anything but a system "at the edge of chaos." Rather, it substitutes the fist in the iron glove for the nudging hand. Such complete control over music distribution has never been permitted by the copyright regime or necessary for the music industry to thrive. Nonetheless, much of the music industry remains wedded to this model.

The recent history of the music system suggests that, even with the interference of Congress, the industry may be unable to achieve

211. See Lemley & Reese, *supra* note 146, at 1387–89 (discussing adverse impacts on innovation).

212. Press Release, Elec. Frontier Found. *Will the Inducing Infringement Act Kill the iPod?*, (June 24, 2004), available at http://www.eff.org/news/archives/2004_06.php.

complete control over the system. DRM schemes will be cracked notwithstanding the imposition of stiff legal penalties. New business models and technologies like P2P will emerge. Even drastic measures like the Induce Act may not succeed in destroying unauthorized sharing altogether. The fears, common several years ago, that the combination of DRM, restrictive shrinkwrap contracts and anti-circumvention sanctions would rapidly produce a pay-per-use universe have thus far failed to materialize. The music system has proven remarkably resilient in the face of technological change and resistant to attempts to impose complete control over distribution. Such resistance may be intrinsic to the system. Complex systems inevitably contain too many variables to be completely controlled. Even complex adaptive systems, though, can lose flexibility over time and over-regulation may hamper them.

Pursuit of the pay-per-use model might distort the natural course of system evolution, producing unwanted consequences along the way. Restrictive regulation might cripple innovation to such an extent that society is deprived of unexpected benefits it would have otherwise enjoyed, including the development of lucrative new markets. The markets for videotape sales and rentals would not have developed, for example, if the copyright industries had succeeded in banning the VCR.²¹³ The commanding position of the United States in the global information economy might be jeopardized. If Congress restricts technological innovation at the behest of United States copyright owners, technology developers in other countries may take advantage of our withdrawal, and American developers may simply move their operations offshore.²¹⁴ While the United States may use treaties and conventions to ward off those effects, such a cumbersome strategy is likely to be of only limited effectiveness.²¹⁵

213. See Lemley & Reese, *supra* note 146, at 1387–89 (observing that economic evidence indicates that the unexpected “spillover” effects of new technologies often exceed their immediate value).

214. For example, Sharman Networks, one of the primary providers of file sharing software (KaZaA), is an Australian company, incorporated in Vanuatu, which operates globally. Yu, *supra* note 117, at 19. The company currently faces copyright infringement charges in both the U.S. and Australia. Mike Corder, *Kazaa's Next Field Of Battle: Australia; The Maker Of The Popular File-Sharing Software Is Being Sued There By The Recording Industry*, PHILA. INQUIRER, Nov. 26, 2004, at D03.

215. The U.S. has been an active supporter of protectionist initiatives in the World Intellectual Property Organization (WIPO) which has produced several treaties protecting copyright owners. WIPO Copyright Treaty, Dec. 20, 1996, available at <http://www.wipo.int/treaties/en/ip/wct/index.html>; WIPO Performances and Phonograms Treaty, Dec. 20, 1996, available at <http://www.wipo.int/treaties/en/ip/wppt/index.html>. However, in response to pressure from less developed countries, WIPO has recently signaled that it may take a more balanced approach to IP protection. Press Release 396, WIPO, *Member States Agree to*

High protectionists argue that expanding copyright entitlements and strong enforcement have historically worked to maximize creation and dissemination and will continue to do so. For example, Paul Goldstein, in *Copyright's Highway*, states:

The digital future is the next, and perhaps ultimate, phase in copyright's long trajectory The main challenge will be to keep this trajectory clear of the buffets of protectionism and true to copyright's historic logic that the best prescription for connecting authors to their audiences is to extend rights into every corner where consumers derive value from literary and artistic works.²¹⁶

There is little empirical evidence that stronger rights produce more incentives to creation.²¹⁷ Moreover, reliance on "copyright's historic logic" is linear thinking. Complexity theory teaches, to the contrary, that complex systems may follow unpredictable, bifurcating trajectories.²¹⁸ Copyright law's past trajectory toward expanded property rights, while favored by path dependence, is not necessarily the best path for the regime in the new digital environment. The regime may have reached a bifurcation point at which its path, while building on the past, will diverge into new territory. File sharing, artist-direct distribution and other new business models may prove to be better adaptive strategies for the music system than pay-per-use and the copyright regime may be capable of adaptation to those strategies.²¹⁹ Certainly, a wide variety of new business models and moderate regulatory measures have been proposed which offer hope that both systems can be nudged toward a healthy balance.

E. Experiments and Speed Bumps

This category encompasses a number of proposals recommending either new, voluntary business models, referred to herein as "experiments," or new legal and technological enforcement mechanisms, referred to herein as "speed bumps." They have two

Further Examine Proposal on Development, (Oct. 4, 2004), available at http://www.wipo.int/edocs/prdocs/en/2004/wipo_pr_2004_396.html. See also Yu, *supra* note 117, at 26–32 (describing the international challenges faced by the U.S. in its attempts to regulate file sharing).

216. PAUL GOLDSTEIN, *COPYRIGHT'S HIGHWAY: FROM GUTENBERG TO THE CELESTIAL JUKEBOX* 216 (rev. ed., Stanford Univ. Press 2003).

217. See *supra* Part III (discussing the music system as a complex adaptive system that has not yet been significantly studied).

218. See *supra* Part II.B (defining complex systems as nonlinear in nature).

219. See, e.g., Litman, *supra* note 192, at 26–27 (suggesting that peer-to-peer sharing is a more efficient distribution method than the traditional distribution chains and should be encouraged (within limits) rather than criminalized).

premises in common: (1) their proponents anticipate multiple approaches to regulation of the music system, and (2) they presume that while complete elimination of noncommercial file sharing is either undesirable or unachievable, file sharing must be kept within bounds in order to secure incentives for creators.

Different proponents have formulated a variety of experimental models. Professor William Fisher proposes a voluntary entertainment cooperative as an alternative to compulsory levies.²²⁰ The cooperative would collect subscription fees from users through internet service providers and then distribute the fees to member copyright owners. Those owners would then forego copyright infringement actions against subscribers.²²¹ Professor Jessica Litman adds the voluntary element of an opt-out provision to an otherwise compulsory levy.²²² However, copyright owners who elected to opt-out of the levy would be limited to a single DRM scheme to protect their works.²²³ The Electronic Frontier Foundation proposes a voluntary collective licensing scheme in which music users would pay a low, monthly subscription fee to a music industry collection society which would then redistribute the funds to copyright owners. The fee would confer a blanket license on subscribers immunizing them from infringement suits.²²⁴ In an article critical of compulsory levy proposals, Professor Robert Merges has expressed a strong preference for voluntary collective licensing and suggests that collective rights organizations are likely to emerge naturally from the online market.²²⁵ Voluntary open licensing models, such as that provided by Creative Commons, are already in use.²²⁶

220. See FISHER, *supra* note 119, at 252–58 (contrasting aspects of hypothetical Entertainment Cooperative to the current copyright system).

221. *Id.*

222. Litman, *supra* note 192, at 38–42.

223. *Id.*

224. Electronic Frontier Foundation (“EFF”), *A Better Way Forward: Voluntary Collective Licensing of Music Filesharing*, http://www.eff.org/share/?f=collective_lic_wp.html. The EFF proposal applies principles already established under copyright law as to the licensing of performance rights through collective rights societies like the American Society of Composers, Authors and Publishers (ASCAP), Broadcast Music, Inc. (BMI), and the Society of European Stage Authors and Composers (SESAC). The EFF proposes use of anonymous monitoring and sampling techniques in order to determine the relative popularity of shared works and distribute the pool of money accordingly. It also suggests that fees might be included in internet service providers’ charges or university student fees. The EFF would take the voluntary licensing route first, then consider compulsory licensing if the music industry refused to participate voluntarily.

225. MERGES, *supra* note 196, at 10–11.

226. Open licensing, pioneered for open source software, allows the licensor to specify that her works may be used freely for certain purposes, but not others. See Creative Commons, <http://creativecommons.org/about/licenses/> (describing various kinds of open licenses offered by Creative Commons).

Several commentators have suggested experimental means by which artists might directly extract or receive payments from users by, for example, releasing only samples but withholding the full work until payment is received (the ransom model), tipping, or using an honor system.²²⁷

As a possible complement to these experimental schemes, some commentators have proposed legal and technological “speed bumps.” These proposals would make file sharing more difficult and enforcement more effective, not with the expectation of eliminating file sharing altogether, but with the hope of keeping it within reasonable bounds. The BMG CD and Apple’s iTunes software offer examples of DRM schemes expected to limit, but not eradicate, file sharing. Professors Mark Lemley and Anthony Reese have proposed a dispute resolution system which they anticipate would provide broader enforcement of less drastic administrative sanctions against file sharers, resulting in a greater deterrent effect.²²⁸ They indicate that such a scheme might be used in conjunction with voluntary levies, selective criminal enforcement, and new business models.²²⁹ Professor Charles Nesson’s “speed bumps” proposal envisions some combination of new business models, digital rights management and electronic self-help, enhanced legal penalties, and shifting of responsibility to internet service providers to block file sharing.²³⁰ The proposal aims to increase users’ incentives to engage in authorized downloading by making it cheap and high quality, while decreasing the ease and quality of illegal file sharing.²³¹

Both the experimental and speed bumps proposals assume that the copyright regime will continue to govern the music system. As a general rule, these proposals assume, probably rightly, that copyright owners who do not join voluntary cooperatives or collective licensing

227. Yu, *supra* note 117, at 50–52.

228. Lemley & Reese, *supra* note 146, at 1410–25.

229. *Id.* The proposal rejects imposition of liability on facilitators of user infringement because of its adverse impact on technological innovation. *Id.* The authors propose creation of a streamlined, inexpensive system of direct administrative sanctions against users themselves that the authors suggest would lower the costs of enforcement and increase the likelihood that file sharers would actually be caught and punished. *Id.*

230. Berkman Center for Internet and Society, *Slowing the Stream: Development of a Speed-Bump Approach for Protecting New Releases in the Digital Media Environment*, Apr. 16, 2004, http://cyber.law.harvard.edu/events/Speedbumps/Speed-bumps_conference.html (Copy on file with author). Nesson’s proposal would allow copyright owners to use spoofing (flooding P2P networks with bogus files) and interdiction (competitive downloading, which effectively blocks access to a work) to prevent easy file sharing.

231. See McArdle, *supra* note 198, at 17–23 (describing both the Fisher and Nesson proposals).

organizations will continue to use DRM technologies and contractual restrictions to protect their content. They accept, however, that DRM technologies will regularly be circumvented, producing a “speed bump” that may deter some, but not all, unauthorized copying.²³²

These proposals suggest that regulation of the music system may be achieved not through a comprehensive, centralized administrative regime, but rather through some combination of decentralized private initiatives and moderate public mechanisms for copyright enforcement. While a detailed critique of each proposal is well beyond the scope of this paper, several observations, from a systems perspective, are pertinent. Most of the proposals seek some balance between technological innovation, economic incentives, and semiotic democracy. None would cripple one subsystem of the music system to preserve another, but most would impose certain constraints on some subsystem(s) in order to achieve that balance. Because the proposals accept speed bumps as an alternative to total control, the protection offered to copyright owners would be, as it has been historically, somewhat porous, allowing some free dissemination of works to the public, while providing enough protection to preserve creators’ incentives. Some personal uses would continue much as they always have, either illicitly or under license. Existing, successful business models, like iTunes, would not be adversely affected.

Not all of the proposals produce simple rules for users, although voluntary cooperatives and blanket licenses would simplify rules for users by allowing them to opt out of copyright rules for most practical purposes. Many proposals do recognize that there will be no one-size-fits-all final solution to file sharing regulation, which accords with what we know of the unpredictable dynamics of complex adaptive systems and the necessity of patient monitoring over time as emergence occurs. The proposals attempt to nudge the system toward desirable emergent behaviors. New business models, DRM technologies, and enforcement schemes will produce changes in the operation of the system, some of them unforeseen, which may, in turn, require future adjustments.²³³ The

232. The iTunes White Paper, for example, points out that FairPlay, Apple’s digital rights management system for iTunes, does not prevent the creation of unencrypted copies through CD burning, ripping, compressing, or exploitation of the “analog hole” (that is, by making analog copies of the sounds produced from a digital source). The study notes that, despite the anti-circumvention provisions of the DMCA, circumvention technologies remain available to users and predicts that even if DMCA enforcement were more comprehensive illicit copying would continue. The study suggests that DRM alone will not prevent piracy, but may supplement other measures for controlling copying. ITUNES WHITE PAPER, *supra* note 102, at 41–44.

233. For example, an accelerated dispute resolution regime to resolve infringement suits might prove to have unexpected procedural defects which would require correction, as did the Uniform

multi-faceted approach might allow sufficient adaptive flexibility in the system, dependent on the exact combination of measures implemented.

Purely voluntary models have few disadvantages from a systems perspective.²³⁴ They add new options to the mix of emerging business models and will stand or fall on their own merits, just as genetic mutations are favored or discarded through natural selection. The music industry, however, has given such proposals a less than enthusiastic reception, which promises to keep them marginalized for the foreseeable future. Speed bump proposals for enhanced enforcement appear more likely to win industry approval.²³⁵ Some combination of moderate DRM and enforcement schemes with new business models offers the greatest hope, over time, of maintaining an appropriate balance among the interests of users, content owners, distributors, and technology providers.

In summary, each of the proposed models for regulation of the music system has advantages and disadvantages from a systems perspective. Political realities seem likely to preclude adoption of the copyright abandonment, compulsory levy, or public utility models. Most proposed legislation follows the pay-per-use model, yet that model is clearly at odds with what we know about the behavior of sustainable complex systems. The most suitable form of regulation appears to lie in some combination of new business models, public regulation through law, and private regulation through technology.

All of the proposed models assume that legislative intervention is necessary now or in the near future. Consequently, they fail to allow the system time to adapt to its new environment. Yet, as previously noted, there is little empirical evidence to date that the music system as a whole has abandoned equipoise for chaos or even that the recording industry is eminently threatened by P2P.²³⁶ Rather, there is considerable evidence that the system is responding to P2P by generating new, successful business models that given time, may replace illicit file sharing.²³⁷ This evidence suggests that the music system will, in time,

Dispute Resolution Procedure (UDRP) for resolving domain disputes. Lemley & Reese, *supra* note 146, at 1412. Lemley and Reese note that the UDRP lacks such features as an administrative appeal, a fair system for assigning panelists, and a penalty for overreaching by complainants, and suggest that a system for infringement dispute resolution could be designed to avoid such problems.

234. Peter Yu suggests, however, that collective licensing initiatives may present the same practical, administrative difficulties as compulsory levies and may prove more expensive than anticipated. Yu, *supra* note 117, at 48.

235. McArdle, *supra* note 198, at 20–23.

236. See *supra* Part II.F (describing how complex systems balance at the edge of chaos).

237. The industry itself now estimates that legal online sales grew tenfold in 2004 and rapid

adapt itself to the digital environment without the necessity of legislative action. While intriguing, and often elegant, the proposals for substantial regulatory reform are simply premature.

VI. THE WAIT-AND-SEE ALTERNATIVE

This Part proposes that, rather than imposing one of the models discussed in Part V above, Congress should let the music system run under its current regulatory configuration for approximately three more years. During that period, independent observers should monitor conditions in the system and Congress should make only minor adjustments intended to set system conditions to encourage beneficial emergent patterns.

As a general rule, legal regulation of behavior should be a last resort used only when technology and social norms fail to produce a desired result.²³⁸ In the case of file sharing, social norms and technology produced the undesirable, and illegal, result of widespread, uncompensated copying. The growth of iTunes and its emulators, however, suggests that norms and technology may be converging in support of the current legal rules.²³⁹ The apparent dissonance between social norms and copyright law is new only in terms of the increased scale of unauthorized sharing. If moderate DRM schemes, consumer education, and the sheer market attractiveness of legal online services and portable devices like the iPod can reduce the scale of unauthorized sharing, significant legal intervention may be unnecessary.

The many regulatory proposals discussed in Part V may be solutions in search of a problem, springing from the unproven intuition that file sharing must surely cause a decline in sales which must, in turn, cause a decline in production. This, like most human intuitions, is linear, assuming simple cause and effect relationships which often do not

growth is expected to continue in 2005. See International Federation of the Phonographic Industry, *IFPI:05, Digital Music Report*, at 3, <http://www.ifpi.org/site-content/library/digital-music-report-2005.pdf> (reporting that, in 2004, the number of legal music sites quadrupled, the available music catalog doubled, and consumer attitudes became more favorable toward buying music from legal sites). The report notes that record companies received significant revenues from digital sales in 2004 and projected that those revenues could rise to as much as 25% of total revenues over the next 5 years. That such optimism proceeds from a recording industry association is encouraging. A recent survey concludes that nearly half of American downloaders over the age of twelve now pay for downloads, a doubling of the estimate made only one year previously. Press Release, Ipsos Group, *Popularity of Fee-based Music Downloading Takes Off* (Feb. 10, 2005), <http://www.ipsos-na.com/news/pressrelease.cfm?id=2550>.

238. See LoPucki, *supra* note 2, at 490–91 (explaining the advantage of physical control over behavior as opposed to legal regulation).

239. See *supra* Part III.D (explaining the emergence of P2P technology and the resulting uses).

prevail in complex adaptive systems. Intuition indicates that law must respond quickly to match the accelerating pace of technological change. Complexity theory suggests, counterintuitively, that law's slowness to respond is a good adaptive strategy because it permits emergence to occur.

While sound recordings were in common use by the early twentieth century, they were not copyright-protected until 1972,²⁴⁰ with no apparent ill effects on the growth of the recording industry or, for that matter, on related industries like broadcast radio. If, as the copyright industries hoped, Congress had effectively quashed all forms of digital copying with the DMCA, P2P might never have emerged. If lawsuits or legislation had quickly and effectively killed P2P, the iTunes business model might never have emerged. Delay provided the window of opportunity for these potentially beneficial developments.

Napster exploded on the scene in 1999²⁴¹ and was finally shut down in 2001, at which point the new generation of decentralized P2P networks blossomed.²⁴² In total, P2P has only been working through the system for five years, a very short time for a complex system to adapt to a major technological change. Even so, the system took a mere three years to produce an effective response to P2P in the form of the iTunes business model. There is no reason not to allow that business model an additional three years to show whether popular, easy to use, high quality, legal online services can significantly cut the demand for illicit P2P. The new model need not entirely eradicate unauthorized file sharing, but must merely reduce it to levels which, in combination with the new markets being opened, assure sufficient incentives for the production of sound recordings.²⁴³

240. Act of Oct. 15, 1971, Pub. L. No. 92-140, 85 Stat. 391 (codified as amended at 17 U.S.C. §§ 1, 5, 19, 20, 26, 101 (2000)).

241. *Napster, BMG in Music Pact - Facts About Napster*, CNNMoney, Oct. 31, 2000, <http://money.cnn.com/2000/10/31/bizbuzz/napster/>.

242. See *A&M Records, Inc. v. Napster, Inc.*, 239 F.3d 1004 (9th Cir. 2001) (upholding preliminary injunction based on finding that Napster was likely to be found guilty of both contributory and vicarious copyright infringement).

243. As the Ninth Circuit observed:

The introduction of new technology is always disruptive to old markets, and particularly to those copyright owners whose works are sold through well-established distribution mechanisms. Yet, history has shown that time and market forces often provide equilibrium in balancing interests, whether the new technology be a player piano, a copier, a tape recorder, a video recorder, a personal computer, a karaoke machine or an MP3 player.

Metro-Goldwyn-Mayer Studios, Inc. v. Grokster Ltd., 380 F.3d 1154, 1167 (9th Cir. 2004), *vacated and remanded*, 125 S. Ct. 2764 (2005).

During the three-year wait-and-see period, Congress, with the assistance of independent observers,²⁴⁴ should monitor the state of the system and make minor legal adjustments only if necessary to nudge the system toward conditions conducive to emergence. While little hard data currently exists about the state of the system as a whole, surely the most significant condition that must be maintained is open competition. Just as competition among species in the same ecological niche produces evolutionary adaptation, competition in online music distribution is essential if the system is to produce new, sustainable business forms. Competition in the music system is a factor in two related areas: (1) direct market competition among online music distributors, and (2) competition in DRM development.

At the moment, the legal online market is competitive.²⁴⁵ It encompasses a large number of would-be distributors²⁴⁶ and the availability of free P2P networks forces those distributors to offer features that entice users away from P2P. Nonetheless, Apple controls a large percentage of the legal download market as a result of the popularity of the iPod,²⁴⁷ which dominates the market for digital music players, though many competitors have recently introduced alternatives.²⁴⁸ While the markets are so new that competitors may make inroads into Apple's current lead, careful antitrust monitoring to ensure competition will be crucial in the transition from offline to online music delivery. As long as the legitimate markets remain competitive, even if the P2P anti-market ultimately dwindles, consumers will retain

244. Congress should make use of independent survey organizations, including university research organizations, many of which have already produced surveys on narrower file sharing topics.

245. However, if the major recording studios, which control the offline markets, also take over the online markets, competition will suffer. The offline music distribution system has become significantly less competitive in recent years as mergers reduced the industry to four key players. See Reuters, *EU Approves Sony-Bertelsmann Music Tie-Up*, July 19, 2004, http://news.com.com/2100-1027_3-5275405.html (indicating the four major studios are now Vivendi Universal, Sony-BMG, Warner, and EMI). Price fixing on CDs may have been standard practice. An antitrust case alleging CD price-fixing by the majors and their retail outlets was settled. See *In re: Compact Disc Minimum Advertised Price Antitrust Litigation Settlement*, available at <http://www.musiccdsettlement.com/english/default.htm>, for documentation of the settlement including the final judgment and order. The four major record labels recently became the subject of a New York payola investigation. Jeff Leeds, *Spitzer's List for Scrutiny Said to Include Record Labels*, N.Y. TIMES, Oct. 22, 2004, at C1.

246. See mp3.com, *Digital Music Services*, http://www.mp3.com/tech/services_index.php (providing a comparison chart of different music providers including MSN and Wal-Mart).

247. See Flynn, *supra* note 104 ("With 70 percent of the market for legal music downloads . . . Apple's nearest competitors . . . do not attract anything close [to] the traffic on the iTunes network.").

248. See Marriott, *supra* note 104 (comparing music players from Rio, Creative, and Virgin Electronics to the iPod).

the power to reject unwanted limitations on their ability to make use of recordings. Those limitations will be imposed through DRM supported by license restrictions.

The DRM “arms race” should be allowed to continue during the proposed interim period. Arms races are classic positive feedback loops in which new technological developments by one side invite developments by the other side, which in turn generate responses in a continuous cycle that improves the sophistication of the technologies.²⁴⁹ Content owners may view such cycles as economically wasteful. However, from a systems perspective, the positive feedback loop of the DRM arms race produces two beneficial effects. It creates a negative feedback effect that prevents content owners from gaining, or users from eliminating, all control over distribution, keeping the system balanced between extremes of total control and total chaos.²⁵⁰ The race also produces more sophisticated, more flexible DRM systems, like those introduced by Apple and BMG.²⁵¹ While competition among developers has, thus far, prevented the emergence of a uniform, interoperable standard for music downloads and players, it has also prevented complete dominance of the field by a single provider.

Online services currently employ a variety of non-interoperable, proprietary DRM schemes. Proprietary schemes inhibit consumer use by preventing portability among devices, imposing costs on both consumers and competing technology providers.²⁵² Given Apple’s dominant market position in the legal online market, its proprietary standard creates entry barriers for competitors in the markets for portable devices and music downloads.²⁵³

249. JERVIS, *supra* note 9, at 126.

250. See JERVIS, *supra* note 9, at 126 (noting the dual positive and negative feedback effects of arms races in the international political context).

251. In a related development, Grouper Networks recently announced development of a file sharing system that would limit sharing to relatively small groups of users and allow them to share music by streaming each other’s files without making permanent copies. Nick Wingfield, *New File-Swapping Software Limits Sharers to a Select Few*, WALL ST. J., Oct. 4, 2004, at B1. Such a system emulates some of the social and educational benefits of pre-digital mix-tape sharing and its limited impact on copyright owners.

252. While some file formats, like the MP3 format available on most P2P services and the Advanced Audio Coding (AAC) format used by iTunes, are open standards, they are incorporated into proprietary DRM schemes such as iTunes FairPlay or Windows Media Audio. ITUNES WHITE PAPER, *supra* note 102, at 44–47. The iPod will play MP3 or AAC formats but will not play the Windows Media Audio (WMA) format used by most other legal download services. Apple’s FairPlay files can only be played on the iPod. WMA, the Microsoft standard used by most other online services, is also proprietary but has been more freely licensed than FairPlay. *Id.* at 11, 45.

253. See *id.* at 45–47 (noting that the proprietary format also supports price discrimination).

Historically, digital markets display strong propensities toward format standardization as the combined result of network effects and efficiencies produced by interoperability.²⁵⁴ Like all systems markets, they are prone to “tipping,” a form of path dependence in which one standard gains an initial edge in the market and consequently becomes much more popular than its rivals.²⁵⁵ It seems likely that, in the next few years, the market will converge on a single standard for online delivery. If, in time, Apple both gains a market monopoly and controls a proprietary standard, it may eventually have sufficient market power to dictate more restrictive terms of use to consumers, including abrogation of personal and fair uses.²⁵⁶

Open standards relieve some of the negative consequences of network effects and should be encouraged. The voluntary creation of a private standard setting organization, including all online music providers, which could establish standards for interoperability of devices and file formats in the download market, might avoid the ill effects of an Apple monopoly. Private standards would evolve over time through the natural workings of the market as technologies improved, unlike mandated government standards that tend to fossilize once adopted and whose bureaucratic enforcers are particularly prone to capture.²⁵⁷ Apple currently appears disinclined to participate in any

254. Microsoft's dominance of the market for operating systems is the paradigm in the software market. Its dominance resulted from network effects (as more and more users adopted Windows, the more important it became for other users to adopt Windows in order to achieve interoperability). Users who learned on the Windows interface were disinclined to switch to any other interface, regardless of the technical advantages of the alternatives. Networks are, of course, systems and network effects are a form of positive feedback, which challenges classical economics' assumption of declining returns to scale. Mark A. Lemley & David McGowan, *Legal Implications of Network Economic Effects*, 86 CAL. L. REV. 479, 484 (1998). Lemley and McGowan note an increasing returns effect in complementary goods; for example, developers write more software for operating systems with larger user bases. *Id.* at 491–492. Complexity economists formulated the theory of increasing returns (colloquially described as the principle that “them that has, gets,” wealth attracts more wealth), which provides an analytical explanation for network effects. See, e.g., Arthur, *supra* note 9, at 107–08 (describing the network effect which contributed to America Online's early dominance of the market for internet service providers).

255. Lemley & McGowan, *supra* note 254, at 496–97.

256. A competitor has filed a complaint against Apple in France alleging that Apple's refusal to license its copy protection technology is anti-competitive. Ina Fried, *Virgin: Apple's Not Playing Fair with iPod*, Aug. 5, 2004, <http://news.com.com/2100-1027-5298642.html>. Apple has already unilaterally changed its terms of use, reducing the allowable number of playlist burns, but increasing the number of computers on which downloads may be used. Markoff, *supra* note 103. In the current market, consumers finding such a change unacceptable can seek a different online distributor.

257. See Lemley & McGowan, *supra* note 254, at 516–18 (discussing private standard setting in networked markets) and 541–544 (discussing the drawbacks of government standard setting).

such voluntary endeavor, but if its competitors do it sufficient damage in the marketplace, it may eventually reverse course. Certainly, the recording industry, in its licensing relationships with online distributors, should encourage the use of open standards, which can only grow the markets for its content.

In the absence of voluntary standard setting, reverse engineering²⁵⁸ should be permitted. Courts traditionally addressed the problem of competition in software markets by allowing reverse engineering for the limited purpose of achieving interoperability. Since products compatible with the industry standard could, as a result, be produced by a variety of competitors, the markets benefited from network effects, interoperability, and competition.²⁵⁹ The key reverse engineering cases²⁶⁰ were, however, decided prior to adoption of the DMCA.²⁶¹ It is unclear whether the narrow reverse engineering exception of the DMCA permits reverse engineering of DRM to allow different devices to gain access to music files.²⁶² Congress should clarify the DMCA to permit

258. Reverse engineering is the process of taking a competitor's finished product and taking it apart, working backward to determine how it was made. *Id.* at 524.

259. *Id.* at 525–26.

260. *See, e.g., Sega Enterprises, Inc. v. Accolade, Inc.*, 977 F.2d 1510 (9th Cir. 1992) (establishing that reverse engineering of software constitutes fair use where it is the only way to gain access to unprotected ideas and functional elements of the program for a legitimate purpose such as achieving interoperability).

261. 17 U.S.C. §§ 1201–1205 (2000).

262. *See* 17 U.S.C. § 1201(f) (2000) (allowing circumvention of copy control technology “for the sole purpose of identifying and analyzing those elements of the program that are necessary to achieve interoperability of an independently created computer program with other programs”). The iTunes White Paper suggests that the DMCA’s reverse engineering exemption is unlikely to apply to attempts to produce compatible players because music files may not qualify as “computer programs.” iTUNES WHITE PAPER, *supra* note 102, at 45. In *Sega* and following cases, the reverse engineering defense encompassed attempts to make programs interoperable with particular hardware. *See, e.g., Sony Computer Entertainment, Inc. v. Connectix*, 203 F.3d 596, 609 (9th Cir. 2000) (permitting reverse engineering for purposes of allowing video games to be played on computer rather than game console). Courts have recently refused to use the DMCA to preclude reverse engineering for purposes of hardware interoperability where software was used merely as a lockout device to give hardware manufacturers control over essential supplies. *See Lexmark Int’l, Inc. v. Static Control Components, Inc.*, 387 F.3d 522, 551 (6th Cir. 2004) (permitting reverse engineering to provide printer cartridge compatibility). Courts might not reach such a result where DRM is used to protect copyrighted music files. A conflict has already erupted between Apple and RealNetworks (“Real”) over reverse engineering. RealNetworks produced software, called Harmony, that allows Real users to play their downloads on the iPod, as well as other devices. Real claimed that Apple is a monopolist in the market for online music downloads and that Real was entitled to reverse engineer Apple’s DRM to gain device interoperability; Apple accused Real of hacking its proprietary system. Laurie J. Flynn, *Apple Attacks RealNetworks Plan to Sell Songs for iPod*, N.Y. TIMES, July 30, 2004, at C3. Apple subsequently altered its iPod software to prevent some iPods from playing songs purchased from Real. John Borland, *Apple Fights RealNetworks’ “Hacker Tactics,”* C/NET NEWS.COM, Dec. 14, 2004, http://news.com.com/Apple+fighters+RealNetworks+hacker+tactics/2100-1027_3-

such reverse engineering in order to assure continued competition in online music distribution.²⁶³

Recent market developments suggest that as long as the music distribution system remains competitive, market demand will assure preservation of a reasonable degree of personal use. Thus, encouragement of competition through antitrust monitoring, open standards, and allowance of reverse engineering to assure interoperability will also safeguard personal use. If those measures fail, more specific protections for users may become essential. Personal use, in some form, might be explicitly protected by specific amendment to the Copyright Act,²⁶⁴ or by judicial acknowledgement that it is implicitly protected under the Copyright Clause.²⁶⁵ Alternatively, courts might interpret fair use more broadly to include noncommercial, personal uses or Congress might amend the DMCA to allow enforcement only where the anti-circumvention technology permits reasonable personal uses. Such measures might be part of legislative strategies to be implemented if, in the interim period, empirical study supports the recording industry's claims that the music system has fallen out of balance and legislative intervention is necessary to preserve the incentives loop.

A thorough system analysis would provide empirical support, or refutation, of those claims. To date, no one has undertaken analysis of the music system as a whole. Such an analysis, by an independent entity or entities, would document the components of the system, its inputs and outputs and the channels through which recordings, information and money flow, and make some attempt to quantify the level of activities within each channel and throughout the system. Ideally, analysts should compare the state of the system at different points on its recent time line, perhaps on an annual basis since just prior to the Napster explosion. One suspects the data would reveal that, in response to new technologies, the system has simply begun to cut new channels for music production and distribution, some of which bypass the recording studios.

5490604.html. In this situation, Real actually seeks access to Apple's device, not its music files.

263. The references in 17 U.S.C. § 1201(f) to "enabling interoperability of an independently created computer program with other programs" might, for example, be expanded to include "or enabling playback of lawfully obtained copyrighted works on portable playback devices."

264. I suggested such a measure several years ago when the implementation of the pay-per-use model seemed imminent. See Tussey, *supra* note 166, at 1183–89 (suggesting federal adoption of a limited personal use privilege). I now suggest it only as a fall back position if market competition fails to produce the desired effects.

265. Patterson & Thomas, *supra* note 166, at 512–13.

The analysis should address broader questions as well as seeking verification that illegal downloads substitute for industry sales. What other factors might contribute to the rise and fall of music industry revenues? Are artists' livelihoods threatened? Surely analysts could measure whether self-identified recording artists and composers are abandoning their professions or whether their incomes are falling. Surveys can query artists directly about the impact of file sharing on their incentives.²⁶⁶ Data from the recording industry, independent labels, and other producers should indicate whether more or fewer sound recordings are being produced and whether more or fewer offline and online sales are occurring, not only in industry channels, but in the new channels being cut directly between artists and consumers.

Some of the studios' revenues may have simply been redirected, rather than lost to the system as a whole. Growing licensing revenues from online services may counterbalance losses in direct sales and preserve the studios' profit margins. Analysis may reveal, as the copyright abandonment school suggests, that monetary incentives are unnecessary to sustain production of digital sound recordings. Or, to the contrary, it may establish a clear link between file sharing and substantial lost sales which causes the system as a whole to produce fewer sound recordings. Such an analysis would be a daunting task, but not necessarily an impossible one, and would provide a truer picture of the health of the music system.

In the interim, copyright owners are not without legal and technological recourse. They can continue to sue direct infringers, enforce license restrictions, apply DRM, and rely on the DMCA to prosecute circumvention aimed at content theft rather than device interoperability. The Supreme Court has now adopted a more stringent inducement standard which may enable successful prosecution of P2P technology providers.²⁶⁷ These tools may yet prove to be sufficient to preserve even the studios' incentives.

If, at the end of the suggested three years, analysis substantiates that stronger measures are required, the empirical results, in conjunction with the guidelines proposed above, would help legislators target and

266. A recent survey, for example, indicates that while most artists believe file sharing should be illegal, the large majority do not consider it a major threat. Pew Internet & American Life Project, *Artists, Musicians, and the Internet*, Dec. 5, 2004, at ii, http://www.pewinternet.org/pdfs/PIP_Artists.Musicians_Report.pdf. The survey also reports that most artists believe that the Internet has made it possible for them to make more money.

267. See *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 125 S. Ct. 2764, 2780–83 (2005) (holding that one who distributes a device with the object of promoting copyright infringement by its use is liable for users' infringements).

frame legislation.²⁶⁸ Of the many regulatory models currently on the table, some combination of voluntary experimentation with business models and moderate technological and legal speed bumps is most likely to nudge the system toward any necessary course correction while producing the fewest unintended consequences.

Whatever measures they adopt, legislators should be prepared for subsequent tinkering with the regulatory system as unexpected consequences and emergent properties manifest themselves. New technologies will come and go producing new responses within the system, social norms will continue to change, new markets will develop and old ones will disappear. The prospect of continued legislative involvement is not entirely welcome in a copyright regime that is notoriously subject to the influence of content owners.²⁶⁹ It is, however, an inevitable adjunct of regulation of any complex adaptive system.

VII. CONCLUSION

There are several advantages to the approach to file sharing regulation advocated in this article. First, it provides a framework within which regulators must weigh policies favoring innovation and semiotic democracy along with more traditional copyright concerns for incentives, since technologies, socio-cultural practices, markets, and legal regimes are all critical components of the music system. Regulators must seek to preserve the health of the system as a whole. Second, it counsels against the ad hoc, knee jerk legislative responses so often evident in copyright legislation, which produce laws like the Audio Home Recording Act,²⁷⁰ whose initial targets have long vanished, but which remain on the books offering fodder for litigators seeking to block new technologies. Third, it encourages high and low protectionists to rethink extreme approaches and seek a middle ground

268. For example, if analysis shows that the settlements currently being reached between the RIAA and individual file sharers are effective, Congress might establish an administrative dispute resolution system and calibrate its penalties accordingly.

269. See JESSICA LITMAN, DIGITAL COPYRIGHT 35–69 (2001) (detailing the drafting methodology for the various copyright revisions). Professor Litman did groundbreaking work on the legislative history of the Copyright Act in a series of earlier articles. Jessica Litman, *Copyright Legislation and Technological Change*, 68 OR. L. REV. 275 (1989); *The Exclusive Right to Read*, 13 CARDOZO ARTS & ENT. L.J. 29 (1994); *Revising Copyright Law for the Information Age*, 75 OR. L. REV. 19 (1996).

270. 17 U.S.C. §§ 1001–1010 (2000) (imposing a levy on digital audio recording media). AHRA was designed to respond to digital audio tapes, a technology which was quickly replaced by compact disks. The recording industry attempted, unsuccessfully, to use AHRA to prohibit sales of the Rio, the early portable music player. See *Recording Indus. Ass'n of Am. v. Diamond Multimedia Sys., Inc.*, 180 F.3d 1072 (9th Cir. 1999) (holding that the Rio music player did not fall within AHRA).

which balances order and chaos, stability and change, keeping the music system poised at the edge of chaos where it is most sustainable.²⁷¹

Even if we view complexity theory as no more than a useful analogy, the extension of the analogy to the music system suggests that Congress should employ a holistic approach, exercise patience, and nudge the system toward conditions that will foster emergence, preserve personal use, and maintain flexibility in the face of future change. The music system displays the characteristics of a complex adaptive system and its recent pattern of emergent behaviors indicates that it is successfully adapting to the digital environment. New legal regulations—particularly those which propose drastic overhauls of the copyright regime—are not immediately necessary. Leaving the system to run in its current regulatory configuration for several years would allow emergent business models, like iTunes, sufficient time to prove their worth as competitors to P2P file sharing and would permit completion of a thorough system analysis.

The lessons drawn from complexity theory generally counsel in favor of a cautious regulatory approach and may apply to other classes of copyrighted works since many copyright industries can be viewed as complex systems for producing works. Application of these lessons must be sensitive to context since the particular conditions in various systems may differ and the impetus toward regulation may be more or less urgent depending on those conditions.²⁷² Unlike complex systems which may directly threaten human welfare, copyright systems rarely pose an immediate threat to lives or livelihoods and would-be regulators should avail themselves of the luxury of time to observe each system. It seems likely, moreover, that studies of different copyright industries will reveal that, just as complex systems in general share certain universal characteristics, copyright industries in particular share many common traits and will often be amenable to regulation through broadly applicable legal rules.

271. See Peter K. Yu, *Intellectual Property and the Information Ecosystem*, Mich. St. U. C. of L. Legal Stud. Res. Paper Series, Res. Paper No. 02-16, at 15-18, available at <http://ssrn.com/abstract=578575> (suggesting a systems approach to intellectual property issues).

272. There are significant differences, for example, between the structure, processes and products of the music system and those of the movie system.