Hustle and Flow: A Social Network Analysis of the American Federal Judiciary

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HUSTLE AND FLOW: A SOCIAL NETWORK ANALYSIS OF THE AMERICAN FEDERAL JUDICIARY

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Scholars have long asserted that social structure is an important feature of a variety of societal institutions.[1] Whether analyzing private or public, non-professional or professional organizations, the existing literature consistently asserts how social factors and not necessarily expertise dictate not only directives but also an organization's substantive institutional practices.[2] Extrapolating to law giving institutions—most notably the aggregate outputs of the federal judiciary—we believe social structure, and the formal and informal interactions between judicial actors, at least in part, charts the course of doctrinal development. Specifically, if when considering a given legal decision jurists either formally or informally consider the views of their colleagues then properly conceptualizing the nature and mapping the path of such "peer effects" would appear to be a critical task for the public law scholarship.[3]

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[1] *See e.g.* Brian Colwell, *Deference or Respect? Status Management Practices Among Prison Inmates*, 70 Soc. Psych. Q. __ (Dec. 2007 Forthcoming) (analyzing the social structure of a California prison and determining that social standing among the prisoners derives from interpersonal dynamics); MICHAEL LOUNSBURY & MARC VENTRESCA, SOCIAL STRUCTURE AND ORGANIZATIONS REVISITED (2002); Kenneth A. Frank, Jeffrey Y. Yasumoto, *Linking Action to Social Structure Within a System*: Social Capital Within and Between Subgroups, 104 Amer. J. Soc. 642 (1998); David Knoke, *Networks as Political Glue: Explaining Public Policy Making* in SOCIOLOGY AND THE PUBLIC AGENDA (WILLIAM J. WILSON ED., 1993); DAVID KNOKE, POLITICAL NETWORKS: THE STRUCTURAL PERSPECTIVE (1990); Barry Markovsky, David Willer & Travis Patton, *Power Relations in Exchange Networks*, 53 Amer. Soc. Rev. 220 (1988); REID HASTIE, STEVEN D. PENROD & NANCY PENNINGTON, INSIDE THE JURY (1983) (providing insight into the role of social influence in jury decision making); Edward O. Laumann, Peter V. Marsden & Joseph Galaskiewicz, *Community-Elite Influence Structures: Extension of a Network Approach*, 83 Amer. J. Soc. 594 (1977); ARTHUR STINCHCOMBE, SOCIAL STRUCTURE AND ORGANIZATIONS (1965); EMILE DURKHEIM, DIVISION OF LABOR IN SOCIETY (1893).

[2] Of great interest to the study of legal institutions are the early network based studies of the medical profession and their subsequent extensions. *See generally* J.S. COLEMAN, E. KATZ & H. MENZEL, MEDICAL INNOVATION: A DIFFUSION STUDY (1966) (finding the implementation of new medical technology more closely tracks a network based upon the social connections between doctors than a network based upon expertise). *See also* J.S. Coleman, E. Katz & H. Menzel, The Diffusion of an Innovation among Physicians, 20 Sociometry (1957).

[3] A small but growing segment of the public law literature is devoted to such contextual understandings of judicial decision making. *See* Charles M. Cameron & Craig P. Cummings, *Diversity and Judicial Decision-Making: Evidence from Affirmative Action in the Federal Courts of Appeals, 1971-1999*, Paper Presented at the 2003 Meeting of the Midwest Political Science Association (manuscript on file with

Succinctly stated, if legal outcomes are at least in part socially constituted, then a descriptive effort designed to characterize the relevant social architecture should complement the existing public law literature perhaps helping to bridge the divide between the behavioral, strategic institutionalist and historical institutionalist decision making theories.[4] Of course, acknowledging a role for "judicial peer effects" does not itself produce a social scientific approach designed to isolate the social linkages between jurists. Prior studies relying upon academic ratings[5] or citation counts find institutional authority alone does not explain the prestige and influence across judges.[6] Instead, this literature documents great variance in judicial esteem even across judges with equal formal authority.

Building on the themes of this largely non-supreme court centric scholarship, this study uses social network analysis to visualize the social structure of the overall federal judiciary. Although network analysts often rely upon survey data to build the connections between actors,[7] in the context of the federal judiciary, there is significant reason to believe that survey based network data would suffer from rampant non-response or other systematic biases. Thus, in order to develop a picture of the social landscape it is necessary to rely upon a proxy measure for social connectivity. We believe the revealed preferences displayed in the aggregate flow of law clerks between judges reflect a proxy for social and professional esteem.[8] While not conclusive, the use of this proxy in a network analysis provides a partial snapshot of the social structure of the federal judiciary.

This study visualizes the traffic of law clerks over the decade long period of the "natural" Rehnquist Court (1995-2004).[9] As operationalized herein, judges who share

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author) (applying a "social economics approach" to the behavior of judges on the U.S. Court of Appeals). Cameron & Cummings cite a number of studies which "cast considerable doubt on what might be called the traditional political science approach to decision-making on collegial courts. *See e.g.* Sean Farhang & Gregory Wawro, *Institutional Dynamics on the U.S. Court of Appeals: Minority Representation Under Panel Decision Making*, 20 J.L. Econ. & Org. 299 (2004); Richard L. Revesz, *Environmental Regulation, Ideology, and the D.C. Circuit,* 83 Va. L. Rev. 1717 (1997); Gerald Gryski, Eleanor Main & William Dixon, *Models of State High Court Decisionmaking in Sex Discrimination Cases*, 48 J. of Pol. 143 (1986). *See also* Christina L. Boyd, Lee Epstein & Andrew D. Martin, *Untangling the Causal Effects of Sex on Judging*, Paper Presented at the 2007 meeting of the Midwest Political Science Association (manuscript on file with the author).

[4] For an very brief introduction to some of these approaches *see generally* Section II (A) *infra*.

[5] *See e.g.* Gregory A. Calderia, *In the Mirror of the Justices: Sources of Greatness on the Supreme Court*, 10 Pol. Behav. 247 (1988) (describing the literature using subjective evalutations.) *See also* Rodney Mott, *Judicial Influence*, 30 Amer. Pol. Sci. Rev. 295 (1936).

[6] See e.g. David Klein & Darby Morrisroe, *The Prestige and Influence of Individual Judges on the U.S. Courts of Appeals*, 28 J. Legal Stud. 371 (1999); William M. Landes, Lawrence Lessig & Michael E. Solimine, *Judicial Influence: A Citation Analysis of Federal Courts of Appeals Judges*, 27 J. Legal Stud. 271 (1998); William G. Ross, *The Ratings Game: Factors That Influence Judicial Reputation*, 79 Marq. L. Rev. 401 (1996); Richard A. Posner, *What Do Judges and Justices Maximize? (The Same Thing Everybody Else Does),* 3 Sup. Ct. Econ. Rev. 41 (1993).

[7] *See* STANLEY WASSERMAN & KATHERINE FAUST, SOCIAL NETWORK ANALYSIS 45-48 (1994) (noting that the questionnaire is the data collection method "most commonly used (especially when actors are people)").

[8] For the argument supporting the use of this proxy *see* Section IIB *infra*.

[9] The "natural Rehnquist court" is typically defined as the period from 1994-2005 where the composition of judges remained unchanged. To synergize this period with clerk hiring calendar, our data is restricted to the 1995-2004 time period. For use of the term in another empirical context *see e.g.* Lori A. Ringhand,

- 3 -

clerks may be both socially connected and held in high regard within the relevant community. In other words, the structural prestige derived from the network analysis of law clerk traffic is not separable into its social and professional components. Undoubtedly, it is such individuals who maximize in both relevant dimensions who are most likely to be able to persuade the aggregate institution to support their specific vision of the law.

The precursor to evaluating the doctrinal consequences that social structure imposes is an effort to characterize its nature. As there is no "pause button" in the external environment, reputation effects, esteem, prestige and influence are in a consistent state of flux.[10] What is needed is a methodology that can capture the richness of this dynamic landscape. Complexity generally, and network analysis more specifically, may help harness this dynamism thereby allowing for unique insight into the role of peer effects in the federal judiciary.

To motivate the use of network analytics, the article begins in Section I with a description of the science of networks as a subset of the larger field of complexity.[11] With homage to Moreno, Milgram, Grannovetter, Watts and Strogatz as well as others, it describes how network analysis,[12] the long standing but recently popularized social science methodology allows for the insightful study of a variety of social systems.

Judicial Activism: An Empirical Examination of Voting Behavior on the Rehnquist Natural Court, 24 Const. Comm. __ (2007 Forthcoming).

[10] Actors consistently enter and exit the network and thus within the newly constituted social world their doctrinal legacy may or may not sustain. Although our current effort is not suited to capture the notion of legacy, even a casual observer would recognize that although many jurist's views are forgotten the views of a selected few persist. Federal judges such as Learned Hand, Jerome Frank, Henry Friendly and J. Skelly Wright as well as State Supreme Court justices such as Cornelius Moynihan, Hans Linde, Roger Traynor and Stanley Mosk impose distinctive legacies.

[11] While certainly not part of the mainstream legal literature, complexity has made important contributions to the legal scholarship. *See e.g.* Daniel F. Spulber & Christopher S. Yoo, *On the Regulation of Networks as Complex Systems: A Graph Theory Approach*, 99 Nw. U. L. Rev. 1687 (2005); David G. Post & Michael B. Eisen*, How Long is the Coastline of the Law? Thoughts on the Fractal Nature of Legal Systems*, 29 J. Leg. Stud. 545 (2000) (using fractal structure theory of citation to precedent in judicial opinions); Vincent Di Lorenzo, *Complexity and Legislative Signatures: Lending Discrimination Laws as a Test Case*, 12 J.L. & Pol'y 637 (1996) (employing chaos theory to review legislative responses to alleged lending discrimination); Mark J. Roe, *Chaos and Evolution in Law and Economics*, 109 Harv. L. Rev. 641 (1996) (discussing legal evolution and invoking both path dependence and systems theory); 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 (1996) (discussing both complexity and the general evolutionary model); Lawrence A. Cunningham, *From Random Walks to Chaotic Crashes: The Linear Genealogy of the Efficient Capital Market Hypothesis*, 62 Geo. Wash. L. Rev. 546 (1994) (discussing chaos theory in the context of capital market regulation). For an extensive list of scholarship complied by Professor J.B. Ruhl *see* http://law.vanderbilt.edu/seal/resources/readingscomplex.htm

[12] Formal network analysis or invocation of its core concepts has recently been witnessed within legal and public law literature. *See e.g.* Anthony Paik, Ann Southworth & John P. Heinz, *Lawyers of the Right: Networks and Organization*, 32 L. & Soc. Inq. 883 (2007); James Fowler, et. al., *Network Analysis and the Law: Measuring the Legal Importance of Precedents at the U.S. Supreme Court*, 15 Political Analysis, 324 (2007); Frank Cross, Thomas A. Smith & Antonio Tomarchio, *Determinants of Cohesion in the Supreme Court's Network of Precedents*, San Diego Legal Studies Paper No. 07-67, *available at* http://ssrn.com/abstract=924110 ; Frank Cross & Stefanie A. Lindquist, *Empirically Testing Dworkin's Chain Novel Theory: Studying the Path of Precedent*, 80 N.Y.U. L. Rev. 1156 (2005); David Walsh, On the Meaning and Pattern of Legal Citations: Evidence from State Wrongful Discharge Precedent Cases, 31 L. & Soc. Rev. 337 (1997).

In an effort to justify the use of law clerk traffic as a proxy for social connectivity, Section II of this article reviews two major strains of the extant legal literature. After briefly introducing the larger public law literature, it demonstrates how insights drawn from the scholarship on the law clerk market might, in part, help consider the social structure of the federal judiciary. Concepts such as social influence are fairly difficult to operationalize and, in response, scholars have developed an array of diverse approaches to consider such questions.[13] We believe that a promising addition to the literature would be a graph theoretic approach. Specifically, notwithstanding any allocative inefficiencies present in the judicial law clerk market, it is highly probable that, in the aggregate, judicial reputation significantly impacts the matching of law clerks with their employers. Thus, as applied to the marriage of these two literatures, the network analysis advanced herein relies upon the displayed preferences of both judges and clerks, embedded within law clerk traffic, to provide a partial picture of the overall social structure.

Section III represents this article's core contribution. It begins with a description of the significant data collection effort undertaken to support our findings. Our research team collected available information for every federal judicial law clerk employed by an Article III judge[14] during the full term of the "natural" Rehnquist Court (1995-2004). Holding the United States Supreme Court constant and drawing from a base of nearly 20,000 clerk events,[15] Section III provides a series of network based visualizations of federal law clerk traffic and then concludes with a characterization of the degree distribution the judicial social network.

Section IV provides some concluding thoughts about emergence, convergence, peer effects and legal change in the federal judicial hierarchy. We believe social structure "matters" for the federal judiciary much like it does for other societal institutions. Namely, if a given judge appreciating his or her position within the hierarchical organizations, understands that his or her colleagues might be persuaded to follow a vision of the law offered by a jurist with greater social importance, than the social architecture driving such convergence is supreme consequential. Thus, our emphasis on social structure is a first-order attempt to contextualize the role of such peer effects for the overall federal judiciary. Although our effort is largely descriptive, the social structure of network visualized herein provides insight into how the actions of a series of micro-motivated judicial actors map to the judiciary's overall macrobehavioral jurisprudential outputs.[16]

I. THE SCIENCE OF NETWORKS: FROM MORENO TO MILGRAM TO WATTS AND STROGATZ AND BEYOND

Built upon a combination of linear algebra, graph theory and traditional statistical approaches, network analysis should help illuminate the social structure of the federal judiciary. Using *nodes* to represent actors and *ties* to represent relations between actors,

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[13] For a discussion of these approaches *see* Section IIA *infra*.

[14] As available clerk information for Senior Status Judges is less far extensive, we choose to omit Senior Status Judges from this study.

[15] Hereinafter, a 'clerk event' is defined as a given clerk employed for a given year. For example, a clerk hired for a two year interval constitutes two clerk events. A permanent clerk employed for *k* years would have *k* law clerk events.

[16] *See generally* THOMAS SHELLING, MIRCOMOTIVES AND MACROBEHAVIOR (1973).

network analysis differs from traditional statistical models as it attempts to determine not only properties of an individual's relationships to his or her peers but also the larger social structure in which that individual operates.[17]   A brief review of the history and approaches in complexity generally and more specifically network analysis should motivate our later move to build a picture of the social landscape using the information embedded in the clerk market.

A. EMERGENCE IN A BROAD CLASS OF COMPLEX SYSTEMS MODELS

Network analysis is a disciplined scientific approach used to understanding the interactions between agents in a complex system.[18]   Although the definition of a "complex system" is awkard and can seem nebulous, nearly all definitions would specify that the system must exhibit *emergent* behavior.[19]   Traditionally, systems display emergence when the micro study of individual actors in a given system yields incomplete information about the entirety of the organization.[20]   Instead, interactions between the components, at least in part, structure the outputs of the system.[21]   As Peter Corning describes "[A]mong other things, complexity theory gave mathematical legitimacy to the idea that processes involving the interactions among many parts may be at once deterministic yet for various reasons unpredictable."[22]   Common examples of emergence include the study of ecosystems where order emerges from the interspecies interactions. Emergent systems do not necessarily have logical or deterministic properties. Thus, their outputs cannot always be deduced or predicted. Consider H_2O phase transformations. Water boils and freezes at very specific temperatures under controlled conditions, but

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[17] *See* STANLEY WASSERMAN & KATHERINE FAUST, SOCIAL NETWORK ANALYSIS 17-21 (1994).

[18] Drawn from core concepts developed within the academy, a host of recent literature has popularized the study of network analysis. The devotion of the Ninetieth Aniversary of Forbes Magazine to network analysis is one of many indications that this is a renassiance period for the science of networks. *See generally* Networks, Forbes (May 7, 2007) (devoting its Ninetieth Anniversary Issue to the "New" Age of Networks).   For a non-exhaustive list of recent popular books in the subject *See also* DUNCAN J. WATTS, SIX DEGREES: THE SCIENCE OF A CONNECTED AGE (2003); MARK BUCHANAN, NEXUS: SMALL WORLDS AND THE GROUNDBREAKING SCIENCE OF NETWORKS (2002); ALBERT-LASZLO BARABASI, LINKED: THE NEW SCIENCE OF NETWORKS (2002); MALCOLM GLADWELL THE TIPPING POINT: HOW LITTLE THINGS CAN MAKE A BIG DIFFERENCE (2000).

[19] For more detailed discussion of emergence including applications to a variety of disciplines *see generally* David Chalmers, *Strong and Weak Emergence* in THE RE-EMERGENCE OF EMERGENCE (PHILIP CLAYTON & PAUL DAVIES, EDS. 2006); Tom De Wolf & Tom Holvoet, *Emergence Versus Self-Organisation: Different Concepts but Promising When Combined*, *in* Engineering Self Organising Systems: Methodologies and Applications (Brueckner, S. and Di Marzo Serugendo, G. and Karageorgos, A. and Nagpal, R., eds. 2005); STEPHEN WOLFRAM , A NEW KIND OF SCIENCE (2002); JOHN H. HOLLAND, EMERGENCE FROM CHAOS TO ORDER (1998).

[20] *See generally* Holland *supra* note 19. De Wolf & Holvoet provide a more detailed working definition of emergence. They argue "[A] system exhibits emergence when there are coherent emergents at the macro-level that dynamically arise from the interactions between the parts at the micro-level. Such emergents are novel w.r.t. the individual parts of the system." *See* De Wolf & Holvoet *supra* note 19 at 3.

[21] For an illuminating discussion of emergence and its historical origin *see* Peter A. Corning, *The Re-Emergence of "Emergence": A Venerable Concept in Search of a Theory*, 7 Complexity 18 (2002). *See also* BRIAN GOODWIN, HOW THE LEOPARD CHANGED ITS SPOTS: THE EVOLUTION OF COMPLEXITY (2001); STEVEN BERLIN JOHNSON, EMERGENCE: THE CONNECTED LIVES OF ANTS, BRAINS, CITIES, AND SOFTWARE (2001). The last decade witnessed the creation of an academic journal devoted to exploring the concepts of emergence. *See generally* Emergence *available at* http://emergence.org/index.html

[22] *See* Corning *supra* note 20 at 23.

- 6 -

nothing about the change in temperatures affects the actual water molecules. At 100°C and 0°C precisely the molecules begin to interact differently with one another; and thus, from liquid, new macro-worlds of solid ice and water vapor emerge.[23] An extensive study of the chemical characteristics between these moments of transition would not predict the dramatic transformations that occur at these threshold points.[24] In short, the whole is different from the sum of its parts.

Automobile traffic is another example of a complex system. To characterize the global properties of a traffic system, one could code a set of individual level variables, including the horsepower of the respective vehicles, the disposition of the drivers as well as a host of decisional rules employed by the driver, such as including the leave space, a driver's ideal speed and lane. Even with an understanding of all of these properties, it is ultimately the interactions between actors that structure outputs for the overall system. Namely, whether flow or bottleneck will emerge is a function of the intermingling of individuals, each of whom possess a host of these attributes and decisional rules. It depends upon exactly which agents are proximate to other individuals.

Returning to the matter of inquiry, the federal judiciary exhibits behavior that might be considered emergent. While a judge in a given case may rule in isolation of other judges, in general jurists do not exist in a state of complete social and professional isolation from their peers. The socialization and training of the legal community occurs through various repeated interactions with one's current or future peers at moments and places throughout the hierarchy.[25] In some cases, social interactions begin in law school[26] and in others they begin even sooner. Accordingly, if judicial perceptions and outcomes are at least in part, the by-product of these interactions, then larger interpretative frames, themselves the aggregation of various individual decisions, are assuredly emergent. As such, the federal judiciary is a "complex system" and would benefit from methodologies reserved for the study of complexity.

B. A BRIEF INTRODUCTION TO SOCIAL NETWORK ANALYSIS

One method to study a complex system is network analysis, an approach which maps the social structure by quantifying the interactions between agents.[27] In the early

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[23] *Id.*

[24] In the context of water under standard pressure, these thresholds occur at 32°F and 212°F.

[25] *See e.g.* DUNCAN KENNEDY, LEGAL EDUCATION AND THE REPLICATION OF HIERARCHY: A POLEMIC AGAINST THE SYSTEM (2004).

[26] See ELIZABETH MERTZ, THE LANGUAGE OF LAW SCHOOL (2007). *Id. citing* Christa McGill, *Producing Lawyers: The Effects of Institutional Hierarchy on the Social Structure of Law Schools*, PhD Diss., Duke Univ. (2002).

[27] The origins of network science are closely linked to the development of graph theory. Leonhard Euler, who major contributions include the first theorem in graph theory, developed his work in an effort to solve the Konisberg Bridge Problem. In reduced form, the Konigsberg bridge problem asks whether it is possible to traverse the town of Konigsberg, while both crossing each of its seven bridges only once and closing the circuit by returning to one's point of origin. Euler demonstrated this was not possible. With reference to the Konisberg Bridge problem, mathematicians ask whether "there exists any *Eulerian path* on the network." *See* MARK NEWMAN, ALBERT-LAZZLO BARABASI & DUNCAN J. WATTS, THE STRUCTURE AND DYNAMICS OF NETWORKS 2 (2006). For more on the life and work of Leonhard Euler *see* C. EDWARD SANDIFER, THE EARLY MATHEMATICS OF LEONHARD EULER (2007). For more information on graph theory *See e.g.* FRANK HARARY, GRAPH THEORY (1999); GARY CHARTRAND, INTRODUCTORY GRAPH THEORY (1985).

6

twentieth century, researches such as Jacob Moreno used network analysis to compile sociograms which diagramed social relationships and identified individuals who held structural positions that were indicative of leadership.[28] Following this early work, Stanley Milgram did much to advance the popularity of network analysis. Through his study of communal relationships in society in the 1960's, the "small worlds" or "six degrees of separation" conception entered the popular lexicon.[29] In his experiment, Milgram sent letters to a sample of people in Kansas and Nebraska and asked the subjects if they would attempt to send these letters to a stockbroker in Boston, Massachusetts.[30] On average, the letters which reached the target only passed through the hands of 6.5 people, and thus Milgram argued the social world was quite small, with only six degrees separation between a random selection of people.[31]

The logic supporting the original Milgram experiment was fairly straightforward. If every individual each knows 150 people and each of those 150 people know 150 others, the exponential function exceeds the total population of world before the sixth order of magnitude. Such a hypothesized network is a random network where the interrelations between an individual's second degree friends are not modeled. Mark Granovetter realized that world's social connections do not emerge randomly.[32] People cluster, organize in cliques; thus, if two people are strong friends the likelihood that they have shared friends is fairly high.[33] This commonality between connections of people in similar groupings would not allow the macro-network to exhibit the exponential growth suggested by Milgram's theory. Since Milgram's experiment and subsequent

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[28] It is hard to understate the contribution of Jacob Moreno to the development of social network analysis. Along with Kurt Lewin and Fritz Heider, the first half of the twentieth century witnessed dramatic developments in the science of networks. For example, Moreno developed the "sociogram" an apparatus that allows social relationship to be drawn using analytic geometry. *See* JACOB MORENO, WHO SHALL SURVIVE? (1934). Kurt Lewin extended Moreno's work arguing the structural properties of social space could uncovered using a host of mathematical techniques including graph theory, topology and set theory. *See e.g.* KURT LEWIN, FIELD THEORY IN SOCIAL SCIENCE (1951).

[29] *See* Stanley Milgram, *The Small World Problem*, 22 Psych. Today 61 (1967). Milgram is often credited with coining "six degrees of separation." However, many attribute the term to Hungarian author, Frigyes Karinthy whose volume of short stories invoked such concepts. *See* FRIGYES KARINTHY, EVERYTHING IS DIFFERENT (1929).

[30] Milgram, however, did not provide the subjects with address of the stockbroker; he instead insisted individuals send the letter to someone they thought would be socially closer to the man in Boston.

[31] *See* Jeffery Travers & Stanley Milgram, *An Experimental Study of the Small World Problem*, 32 Sociometry 425 (1969) (where authors vary the starting populations and "provide a first technical report on the small world method."); C. Korte & Stanley Milgram, *Acquaintance Networks Between Racial Groups*, 15 J. of Personal & Soc. Psych. 101 (1970) (replicating the small world experiment between different racial groups).

[32] Mark S. Granovetter, *The Strength of Weak Ties*, 78 Amer. J. of Soc. 1360 (1973).

[33] *Id*. Granovetter argued that this empirical fact did not completely undercut widespread interconnectivity only that widespread societal links are an artifact of one's weak connections. In his seminal article "The Strength of Weak Ties," Grannovetter provided an addendum to Milgram's theory. *Id*. *See also* Mark S. Granovetter, *The Strength of Weak Ties: A Network Theory Revisited*, 1 Socio. Theory, 201 (1983). Granovetter understood that if Person A was close friends with Persons B and C, then Persons B and C were also likely friends with one another. Accordingly, the stronger the bonds between individuals, the more likely their first degree nodes are also connected. In network analysis, this is known as balance theory. *See* Fritz Heider, *Attitudes and Cognitive Organization*, 21 J. of Psych. 107 (1946) (asserting in part the idea of balance). *See also* Wasserman & Faust *supra* note 13 at 220-32.

replications[34] still demonstrated a "small world," Granovetter worked to develop an alternative causal account which would sustain the empirical phenomena. He noticed that the weaker the ties between individuals the more likely those connections would not coincide. Hence, these weak ties maintained the small-world characteristics observed by Milgram. Accordingly, Granovetter supplemented Milgram's by categorizing the connections between individuals by the strength of those bonds, while also placing more realistic restraints on Milgram's random networks.

Following on these themes of prior scholars, the launch of the current study of network analysis can be traced to the Watts and Strogatz small-world model.[35] Motivated by the organizational behavior of fireflies in Southeast Asia these scholars demonstrated how a relatively small amount of random wiring can allow a network to simultaneously hold both small world properties and high clustering.[36] Apparently, fireflies in this region have the rather unusual habit of flashing in unison.[37] However, every neurological analysis of the fireflies indicated that they should not have the mental faculty necessary to coordinate this effort. Although the fireflies may take cues from their neighbors, this alone was not enough to generate the witnessed behavior. Namely, in the early evening witnesses commonly observe one firefly light and then another. Suddenly, groups of fireflies flash. Finally, concentrations of hundreds of fireflies on the same tree synchronize their flashes in unison.

In the initial moments at dusk when the fireflies are randomly flashing, these uncoordinated flashes could be considered possible offerings of timing. Think of applause in an auditorium. Since only one sequence ultimately emerges, it is important to understand how the landscape moves from divergence to convergence, from randomness to some sense of relative order. Undoubtedly, the "location" of an offeror is important. Network analysts use terms such as closeness, betweenness and eigenvector centrality to formalize such ideas of structural position.[38]

Watts and Strogatz thought network analysis could provide some insight into the behavior of the fireflies. They used computer programs to simulate the fireflies' flashing based upon different rules about how the insects could react to cues from their neighbors. However, none of the simulations reproduced the flashing in unison. Even with near immediate reaction time to the fireflies in close proximity, the overall pattern was still too protracted. Thus, Watts and Strogatz added one more component to their model: they gave a small proportion of fireflies the ability to see and thus be able to react to a random firefly. This simulation worked in an egalitarian network because each of the dyads[39] is relatively equal in its number of connections but with a select few connections across great distances. This approach reflected a successful replication of the observed

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[34] *See* Travers & Milgram, *supra* note 29; Korte & Milgram *supra* note 29.

[35] Duncan J. Watts & Stephen Strogatz, *Collective Dynamics of 'Small World' Networks*, 393 Nature 440 (1998).

[36] *Id.*

[37] *See e.g.* STEVEN H. STROGATZ, SYNC: THE EMERGING SCIENCE OF SPONTANEOUS ORDER 11-40 (2003).

[38] *See* Wasserman & Faust *supra* note 13 at 169-220 (1994). For an extensive discussion of the various measures of centrality *see* Appendix III.

[39] While Mathematicians might provide a more formal definition of dyad involving vectors, tensors and vector space, it can loosely be considered as two individuals or units considered as a pair.

- 9 -

phenomena and, as constructed, is the biological equivalent to Granovetter's Strength of Weak Ties.[40]

Extrapolating from the fireflies and returning to the social world, there are many phenomena that display similar properties. In reduced form, a cascade is essentially emergent behavior upon which there is enough initial convergence by certain actors to see it take hold. Cascades are often driven by a small number of structurally important or prestigious actors. Network analysis is designed to identify such critical actors.

In network analysis, the unit of analysis is the network. The components of the network are the nodes, also known as actors or agents, and the arcs or edges, which signify the connections between the agents. In the federal judicial social network, the nodes are the individual judges and as operationalized *infra*, the edges reflect a measure of shared clerks between the jurists. In an undirected network such as the judicial social network, the connections or arcs have a magnitude but not necessarily a direction.[41]

II. DEVELOPING A PROXY FOR THE SOCIAL LANDSCAPE: THE PUBLIC LAW AND CLERKS MARKET LITERATURES

Among the immense public law literature analyzing the operation of the American Federal Judiciary are two important strands that together with the greater body of available work, advance our understanding of the operation of this important political institution. The first line of scholarship considers the relative prestige and influence of various judges and justices.[42] Specifically, as a variety of commentators note, the views of some courts and some jurists' seem to be uniquely privileged while others are not nearly as well regarded.[43] In order to understand the impact this empirical fact imposes upon the legal landscape, the literature has been consumed with innovative methods to help adjudicate these questions of relative esteem.[44] However, regardless of the approach employed, virtually all scholarship finds significant variance across judges on the question of prestige.

Also under the large umbrella of the judicial politics literature, is a largely different group of individuals who devote attention to the study of federal law clerks.[45] This "clerks" scholarship includes analysis of the process governing their selection as well as their impact upon judicial outputs. At first glance, this strain of scholarship might appear wholly unrelated to the question of relative prestige and influence. However, a careful review counsels otherwise. There is important information regarding judicial

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[40] *See* Granovetter *supra* note 28.

[41] Our judicial social network based upon clerk traffic, displayed infra, is thorny as the traffic is clearly directed but we believe the social importance associated with the linkage travel in both directions.

[42] *See e.g.* Montogomery A. Kosma, Measuring the Influence of Supreme Court Justices, 27 J. Legal Stud. 333 (1998); Klein & Morrisore supra note 5; Landes, Lessig & Solimine supra note 5; RICHARD POSNER, CARDOZO: A STUDY IN JUDICIAL REPUTATION 74-91 (1990).

[43] *See supra* note 42. For a study using an entire court as the unit of analysis *see* Michael E. Solimine, *Judicial Stratification and the Reputations of the United States Courts of Appeals*, 32 Fla. St. L. Rev. 1331 (2005).

[44] Id, at 1350. Professor Solimine provides a very detailed description of the various approaches used consider the question. Discussing the existing studies he notes "Reputation is a difficult subject to objectively study. Couple that with the snapshot quality of most of the studies; they usually cover a relatively short period of time or only samples of the judges who constitute a circuit." *Id*.

[45] *See* Section II (B) *infra*.

reputation embedded within the market for judicial law clerks. Namely, despite any existing allocative inefficiencies in the clerk market, clerks more or less seek to work for the most prestigious judges and judges seek the "best" clerks. While not conclusive, we believe the consistent movement of law clerks provides significant insight into the role of peer effect in judicial decision making. Later, we will explicitly develop this link—but first, we provide introduction to both literatures.

A. FROM QUALITATIVE SUPREME COURT STUDIES TO DECISION MAKING THROUGHOUT THE HIERARCHAL FEDERAL JUDICIARY

Throughout its long history, the judicial politics sub-field has embraced a variety of substantive questions and methodological approaches. Early work in the subfield emphasized the decision making of the United States Supreme Court and privileged the use of qualitative methods. However, these approaches were largely jettisoned as the rise of behavioralism ushered in the use of quantitative statistical models across a variety of intellectual domains. Following their prior embrace by allied disciplines such as economics, within political science, large N empirical approaches were initially adopted in neighboring sub-fields such as legislative politics[46] and political participation.[47]

Public law behavioralism is epitomized by *The Attitudinal Model* where Professors Segal and Spaeth derive judicial preferences through attention to the objective voting behavior of members of the United States Supreme Court.[48] Analyzing aggregate voting data, attitudinalists argue as Justices vote, they seek to maximize their individual partisan policy preferences. Thus, in broad stroke their model asserts "Rehnquist votes the way he does because he is conservative while Marshall votes the way he does because he is extremely liberal."[49] While a significant amount of the current scholarship still embraces behavioral studies of the high court, recent years witnessed the increasing use of alternative methods as well as the study of other judicial actors. For example, the past

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[46] In legislative politics, for example, many studies embracing the behavioralist paradigm use outputs, in this case roll call votes of members of congress to characterize and predict legislative behavior. Suffice to say, the literature is vast. *See e.g.* Christopher Achen, Measuring Representation, 66 Amer. J. of Pol. Sci. (1978); John Jackson & John Kingdon, *Ideology, ADA Scores, and Legislative Votes*, 80 Amer. J. of Pol. Sci. 805 (1992); Keith Krehbiel, *Where's the Party?*, 23 Brit. J. of Pol. Sci. 235 (1993); RICHARD L. HALL, PARTICIPATION IN CONGRESS (1996); Keith T. Poole & R. S. Daniels, *Ideology, Party, and Voting in the U.S. Congress, 1959-1980*, 79 Amer. Pol. Sci. Rev. 373 (1985).

[47] *See e.g.* ANGUS CAMPBELL, ET.AL., THE AMERICAN VOTER (1960); SIDNEY VERBA & NORMAN H. NIE, PARTICIPATION IN AMERICA: POLITICAL DEMOCRACY AND SOCIAL EQUALITY (1972); RAY E. WOLFINGER & STEVEN J. ROSENSTONE, WHO VOTES? (1980); Paul Abramson & John Aldrich, *The Decline of Electoral Participation in America*, 76 Amer. Pol. Sci. Rev. 502 (1982).

[48] *See* JEFFREY A. SEGAL & HAROLD J. SPAETH, THE SUPREME COURT AND THE ATTITUDINAL MODEL (1993). For a discussion of early behavioral work in the judicial politics subfield *see generally* NANCY MAVEETY, THE PIONEERS OF JUDICIAL BEHAVIOR (2003). Behavioralism generally and attitudinalism more specifically has been critized by other scholars. For a sample of critiques of the attitudinal model, see e.g., LAWRENCE BAUM, THE PUZZLE OF JUDICIAL BEHAVIOR (1997); Howard Gillman & Cornell W. Clayton, *Beyond Judicial Attitudes: Institutional Approaches to Supreme Court Decision-Making, in* SUPREME COURT DECISION MAKING: NEW INSTITUTIONALIST APPROACHES (Howard Gillman & Cornell Clayton eds.) (2001); FORREST MALTZMAN, ET.AL., CRAFTING LAW ON THE SUPREME COURT: THE COLLEGIAL GAME (2000); Richard A. Brisben, *Slaying the Dragon: Segal, Spaeth and the Function of the Law in Supreme Court Decision Making*, 40 Amer. J. Pol. Sci. 1004, 1007 (1996).

[49] *See* Segal & Spaeth, *supra* note 13 at 65.

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two decades saw the rise of a variety neo-institutional decision making theories[50] as well as the extensive study of the decision making of courts such as the State Supreme Courts[51] and the lower federal courts.[52]

This new work is important as both the industrial organization of the judicial branch and its norms and variant institutional rules undoubtedly exert influence upon its final outcomes. With the wide variety of actors and institutions, the precise trajectory of American law is difficult, if not impossible, to predict as a host of interactive parameters, including legal doctrine and partisanship, work to shape the path of American jurisprudence. Yet, the increasing nuance and diversity[53] of the judicial politics literature certainly brings scholars closer to understanding the complicated landscape in which judicial decision making is undertaken.

In addition to all of the aforementioned decisional factors, judicial "peer effects" are one additional element that received recent study.[54] Of course, it is hardly new or novel to assert that, in general terms, maintaining high status among one's peers as well as sustaining relationships with one's close colleagues might, together with other factors,

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[50] *See e.g.* Rogers Smith, *Political Jurisprudence, the 'New Institutionalism,' and the Future of Public Law*, 82 Amer. Pol. Sci. Rev. 89 (1988) (previewing some of the future development in the public law field); LEE EPSTEIN & JACK KNIGHT, THE CHOICES JUSTICES MAKE (1998); FORREST MALTZMAN, ET. AL., CRAFTING LAW ON THE SUPREME COURT: THE COLLEGIAL GAME (2000); CORNELL CLAYTON & HOWARD GILLMAN (EDS) SUPREME COURT DECISION-MAKING: NEW INSTITUTIONALIST APPROACHES (1998). It is important to note how institutional theories take a variety of flavors including strategic institutionalism and historical institutionalism. Furthermore, the methods employed by these respective camps range from formal theory to qualitative historical methods. For an attempt to use qualitative historical methods to support a strategic account *see* Daniel Katz, *Institutional Rules, Strategic Behavior and the Legacy of Chief Justice William Rehnquist: Setting the Record Straight on Dickerson v. United States*, 22 J. of L. & Pol. 303 (2006).

[51] *See e.g.* F. Andrew Hanssen, *Learning about Judicial Independence: Institutional Change in the State Courts*, 33 J. of Legal Stud. 431(2004); Paul Brace, Melinda Gann Hall & Laura Langer, *Placing State Supreme Courts in State Politics*, 1 State Politics & Policy Q. 81 (2001); Donald Songer & Kelly Crews-Meyer, *Does Judge Gender Matter? Decision Making in State Supreme Courts*, 81 Soc. Sci. Q. 750 (2000); Paul Brace, Laura Langer & Melinda Gann Hall, *Measuring the Preferences of State Supreme Court Judges*, 62 J. of Pol. 387 (2000); Melinda Gann Hall*, Electoral Politics and Strategic Voting in State Supreme Courts*, 54 J. of Pol. 427 (1992); Gregory A. Calderia, *The Transmission of Legal Precedent: A Study of State Supreme Courts*, 79 Amer. Pol. Sci. Rev. 178 (1985); Lawrence Friedman, et. al., *State Supreme Courts: A Century of Style and Citation*, 33 Stan. L Rev. 773 (1981).

[52] While there certainly exists important early work on lower courts, recent witnessed substantial amount of scholarship studying lower courts. *See e.g.*VIRGINIA HETTINGER, STEFANIE LINDQUIST & WENDY MARTINEK, JUDGING ON A COLLEGIAL COURT: INFLUENCES ON APPELLATE COURT DECISION MAKING (2006); Frank Cross, *Appellate Court Adherence to Precedent*, 2 J. of Emper. Leg. Stud. 369 (2005); DAVID E. KLEIN, MAKING LAW IN THE UNITED STATES COURT OF APPEALS (2002); Susan Haire, Stefanie Lindquist & Donald Songer, *Appellate Court Supervision in the Federal Judiciary: A Hierarchical Perspective*, 37 L. & Soc. Rev. 143 (2002); DONALD R. SONGER, REGINALD S. SHEEHAN & SUSAN B. HAIRE, CONTINUITY AND CHANGE ON THE UNITED STATES COURTS OF APPEALS (2000); Charles Cameron, Jeffrey Segal & Donald Songer, *Strategic Auditing in a Political Hierarchy*, 94 Amer. Pol. Sci. Rev. 101 (2000); Frank Cross & Emerson Tiller, *Judicial Partisanship and Obedience to Legal Doctrine: Whistleblowing on the Federal Courts of Appeal*, 107 Yale L. J. 2155 (1998); Donald R. Songer, Jeffrey A. Segal & Charles M. Cameron, *The Hierarchy of Justice: Testing a Principal-Agent Model of Supreme Court—Circuit Court Interactions*, 38 Amer. J. Pol. Sci. 673 (1994).

[53] The "logic of diversity" I invoke herein is drawn from the work of Scott Page. *See* SCOTT PAGE, THE DIFFERENCE (2007) (explaining the conditions under which diversity can create better public and private institutions).

[54] For an example *see* Cameron & Cummings *supra* note 3.

- 12 -

impact an individual's decision calculus. Legal formalists, however, long denied such influence instead arguing judicial decision making was the by product of the "technocratic application of neutral legal principles." With respect to crafting law, a number of important scholars assert a strong role for social factors. Consider Judge Posner's book *Overcoming Law* where he identifies a host of variables that together define the judicial utility function.[55] Among these core parameters, Judge Posner argues that a judges' reputation among his or her fellow judges affects the types of judicial outputs he or she would be willing to support.[56]

Reputational or peer related effects are difficult to operationalize. However, this has not prevented scholars from developing methodological approaches to measure the relative prestige and influence of federal judicial actors.[57] While early work on prestige relied upon ratings by academics and other court observers,[58] recent efforts use more objective measures to gain leverage on these questions. For example, Landes, Lessig and Solimine operationalize prestige using the total citations to opinions produced by a given judge.[59] These scholars support the use of citations as a proxy for prestige and influence arguing judges who garner high citation counts do so because their brethren either hold them in high regard or otherwise feel some social obligation to cite the opinion of their close colleague.[60]

Klein and Morrisroe resist this assertion arguing that the raw citations, relied upon by Landes, Lessig & Solimine, do not adequately capture the question at issue.[61] Namely, "it is not at all clear what citations measure."[62] For example, raw citations might capture an entire host of factors unrelated to prestige and influence including panel assignment, case effects, as well as other stochastic elements. To combat these concerns, Klein and Morrisoe offered a modified citation analysis—limited to instances where individual judges are cited by name. They assert "…more prestigious judges should more often be cited by name and, therefore, citations by name should be a valid indicator of a judge's prestige."[63] The Klein and Morrisroe approach provides a list of ultra prestigious jurists whose views might be more likely to be followed than less socially prominent colleagues.[64]

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[55] *See* RICHARD A. POSNER, OVERCOMING LAW (1995). The chapter on the judicial utility function is based upon important earlier work. *See* Richard A. Posner, *What Do Judges Maximize (The Same Thing Everybody Else Does)*, 3 Sup. Ct. Econ. Rev. 1 (1993).

[56] *Id.*

[57] Although largely focused upon the entire circuit, for a helpful discussion of these approaches *see generally* Solimine *supra* note 43.

[58] *See e.g.* ALBERT BLAUSTEIN & ROY MIERSKY, THE FIRST ONE HUNDRED JUSTICES: STATISTICAL STUDIES OF THE SUPREME COURT OF THE UNITED STATES (1978); Blaustein, Albert Blaustein & Roy Mersky, Rating Supreme Court Justices, 58 A.B.A. Journal 1183 (1972); Rodney Mott, *Judicial Influence*, 30 Amer. Pol. Sci. Rev. 295 (1936) (using rating by academics to analyze the reputations of state supreme courts). For a more general discussion of the reliance upon qualitative ratings *see* Gregory Caldeira, *In the Mirror of the Justices: Sources of Greatness on the Supreme Court*, 10 Pol. Behav. 247 (1988).

[59] *See* Landes, Lessig & Solimine *supra* note 5.

[60] *Id.*

[61] Klein & Morrisroe, *supra* note 5.

[62] *Id.* at 374.

[63] *Id.* at 376.

[64] *Id.* at 381 table 2.

- 13 -

These lists are important as socially elite opinion regarding what constitutes a sound legal rule is not static. At the same time, given that the judicial social world displays significant adherence to particular interpretative approaches, a robust theory of change, must describe which actors, if any, are disproportionately likely to garner acceptance from their colleagues. Specifically, at first pass, it would appear no individual jurist could through his or her mere pronouncement induce acceptance of a given legal rule by his or her colleagues. Yet, this may depend upon the social position of the actor making the pronouncement. If certain jurists in the judicial hierarchy possess a greater level of prestige and influence than their surrounding peers, then only a small number of diffuse but socially important players would actually be necessary to induce widespread convergence from their less prominent colleagues. The popular literature calls this threshold a "tipping point."[65] In more formal terms, it is the relative measures of social structure developed within the networks literature which may yield information about the conditions under which we might observe doctrinal phase transition.

The growing work using the citation methodology provides significant insight into questions of judicial esteem.[66] Building on the themes of this scholarship, we believe a mapping of the judicial social landscape, built upon the traffic of law clerks, should supplements this literature by visualizing the relative position of both individuals and communities of judicial actors. In the aggregate, our analysis of the social structure of the federal judiciary yields insight into the path of "peer effects" by providing a glimpse into the overall network structure of the federal judiciary. While our measures are partial and do not completely adjudicate all questions, this article, taken together with the prior citation based scholarship should provide for significant understanding.

B. THE MARKET FOR FEDERAL JUDICIAL LAW CLERKS

Federal judicial clerkships are desirable employment opportunities to which may law students aspire. For the successful applicant, an elite clerkship provides personal prestige as well as a series of tangible dividends.[67] In addition to the immediate financial

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[65] *See generally* MALCOM GLADWELL, THE TIPPING POINT (2002).

[66] There is a growing domestic and international literature analyzing judicial citations. *See e.g.* Stephen Choi & Mitu Gulati, *Bias in Judicial Citations: A Window into the Behavior of Judges?* Paper Presented at the 2007 Annual Meeting of the American Law and Economics Association, available at http://law.bepress.com/alea/17th/art61; Stephen Choi & Mitu Gulati, Choosing the Next Supreme Court Justice: An Empirical Ranking of Judicial Performance, 78 S. Cal. L. Rev. 23 (2004); Mita Bhattacharya & Russell Smyth, *The Determinants of Judicial Prestige and Influence: Some Empirical Evidence from the High Court of Australia*, 30 J. of Legal Stud. 223 (2001); Peter McCormick, *The Supreme Court Cites the Supreme Court: Follow-up Citation on the Supreme Court of Canada, 1989-1993*, 33 Osgoode Hall L. J. 453 (1996). *See also supra* note 42 and accompanying text. Critiques of citations counts assert the randomness associated with case assignment as well as other factors, injects stochasticity into the analysis of citations. Thus, a model merely built upon citation counts arguably paints an incomplete picture of judicial esteem. We believe that our effort, taken together with the citation count scholarship, should yield strong insight into the path of information flow and the development of so called "citation clubs." For a sample of the critiques of citation analyzes *see* Steven Goldberg, *Federal Judges and the Heisman Trophy*, 32 Fla. St. L. Rev. 1237 (2005); Arthur Austin, *The Reliability of Citation Counts. in Judgments on Promotion, Tenure, and. Status*, 35 Ariz. L. Rev. 829-39 (1993); James Gordon, *Cordozo's Baseball Card*, 44 Stan. L. Rev. 899 (1992). For a counter-argument *see* Richard Posner, *An Economic Analysis of the Use of Citations in the Law*, 2 Amer. L. & Econ. Rev. 381 (2000).

[67] A series of recent reports note that the bonuses offered by law firms seeking to employ a Supreme Court Law Clerk now reach as high as $250,000. Taken together with their base salary such individuals can earn

- 14 -

rewards, such positions are serially correlated with advancement in a variety of hierarchies—including advancement within the legal profession, the legal academy and in some instances future elevation to the bench. The financial and professional rewards are not the only attractive elements. Commentators assert that law clerks exert an ever increasing influence over both the agenda[68] and the substantive content of judicial outcomes.[69] For a law student or freshly minted lawyer, the opportunity to participate in the shaping of the law, taken together with the social prestige and labor market dividends, incentivize a qualified individual to seek such employment.

       Following an initial sorting process, including in most cases a personal interview, a judge may extend an offer to a selected applicant.[70] Such an offer could be extended immediately following the interview or could come at a future moment. The content of the offer is exceedingly similar across judges at a given level of the judicial hierarchy.[71] The salary is determined exogenously and "fixed."[72] As Professor Priest notes, "even where there are differences across clerkships, their expected value is low because of the

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in excess of $400,000. *See e.g.* David Lat, *The Supreme Court's Bonus Babies*, The New York Times, June 18, 2007 (asserting these bonuses are good for the legal system as they incentivize talented young lawyers to provide service to the Court).

[68] *See e.g.* ARTEMUS WARD AND DAVID L. WEIDEN, SORCERER'S APPRENTICES: 100 YEARS OF LAW CLERKS AT THE UNITED STATES SUPREME COURT CHAPTER 4 &5 (2006); TODD PEPPERS, COURTIERS OF THE MARBLE PALACE: THE RISE AND INFLUENCE OF THE SUPREME COURT LAW CLERK (2006); Barbara Palmer, *The "Bermuda Triangle?" The Cert Pool and Its Influence over the Supreme Court's Agenda,* 18 Const. Commen. 105 (2001); Jan Palmer and Saul Brenner, *The Law Clerks' Recommendations and the Conference Vote On-the-Merits on the U.S. Supreme Court*, 18 Just. Sys. J. 185 (1995);

[69] *See* Ward & Weiden *supra* note 25; Peppers *supra* note 25; Jim Chen, *The Mystery and the Mastery of Judicial Power*, 59 Mo. L. Rev. 281, 302 (1994) (arguing that clerk involvement in opinion drafting "…can supply all the agenda control that is needed to swing outcomes and rationales in individual cases."); J. Daniel Mahoney, *Law Clerks: For Better Or For Worse?*, 54 Brooklyn L. Rev. 321, 339 (1998).

[70] While there are important variations in hiring practices, such as the timing of offer, there is also substantial consistency in approaches. With some limited variation, for those judges who hire permanent clerks, the basic selection process follows a consistent pattern. Law students or young lawyers submit an application of materials including their resume, transcripts, writing sample and letters of reference. *See generally* Ruggero J. Aldisert et al., *Rat Race: Insider Advice on Landing Judicial Clerkships*, 110 Penn. St. L. Rev. 835 (2006). As there is significant uncertainty regarding the prospects for placement, it is quite common for aspirants to submit tens or even hundreds of such applications. *Id*. at 837 (noting the average applicant send materials to sixty-five judges but "it is not atypical for a qualified applicant to apply to over 150 judges.") *Id*. In a manner similar to other hiring practices, judges, often with the assistance current clerks) filter the large sea of applicants and contact a selected few for an individual interview. Applicants as well as judges typically schedule a battery of such interviews. The interview is often a face-to-face interaction with the judge as well as members of the judge's staff. Assuming basic intellectual merit, many judges use the interview to determine whether the individual's temperament properly interfaces with the chambers. *See generally Id*.

[71] *See e.g.* George L. Priest, *Reexamining the Market for Judicial Clerks and Other Assortative Matching Markets*, 22 Yale J. on Reg. 123, 154-55 (2005) ("Although individual judges will have different temperaments and will work their clerks more or less intensively, job conditions themselves over a large range.")

[72] *See* Christopher Avery, Christine Jolls, Richard A. Posner & Alvin E. Roth, *The Market for Federal Judicial Law* Clerks, 68 U. Chi. L. Rev. 793, 799 n. 14 (2001); *See* Priest *supra* note 29 at 154 ("Salaries are fixed, set by Congress.")

short tenure of the job."[73] There is very little range for negotiation over the terms of the position. Essentially, the offer is dichotomous.[74]

While this description of the clerk selection process might appear innocuous, a substantial amount of recent scholarship argues otherwise. The past two decades witnessed a burgeoning literature devoted to analyzing both the role of[75] as well as labor market for federal judicial law clerks. It is this latter commentary regarding clerk hiring that is most germane to this article. Although not completely attributable to any single source, Judge Wald's 1990 essay is the probable origin of recent commentary discussing the selection mechanism for federal law clerks.[76] Then the Chief Judge of the D.C. Circuit Court of Appeals, she describes the hiring process as undignified and cites others who characterize it as "frenzied"[77] "ludicrous"[78] and "madcap decisionmaking." [79] While her essay is a call for reform, she makes some keen observations about the conditions underlying the nature of the law clerk market.

She observes that an "excellent versus a mediocre team of clerks makes a huge difference in the judge's daily life and in her work product."[80] Thus, judges in part seek strong clerks as it lightens their workload or allows them to more effectively advance their vision of the law. As Judge Wald notes, "a judge sometime decides whether to file a separate opinion or to dissent in a case based—a least in part— upon the support she can anticipate from her clerks."[81] In addition to internal administrative motivations, external reputational considerations also encourage artful hiring practices. In a commonly quoted sentence, Judge Wald asserts, "[A] judge's reputation among his own colleagues may in part reflect his ability to garner the most highly credentialed clerks under his banner so that he can maintain a reputation as a 'feeder' of clerks to the Supreme Court."[82]

It is the strong demand for ultra competent clerks that in large part fueled the "frenzied mating ritual."[83] The process, as described by Wald, includes "short fuse" offers and "early –bird judges skim[ming] off those applicants with the brightest credentials."[84] Despite various efforts to cajole their colleagues to adhere to a consistent hiring date, reform efforts consistently unraveled. While unraveling alone is a strong source of concern for Judge Wald, it is the behavior produced by the market for clerks and its reflection upon the judicial branch that is her greatest concern.[85]

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[73] *Id*.

[74] In other words, it is a zero or one—a take it or leave it offer.

[75] For a small slice of this literature *see supra* note 68-69 and accompanying text.

[76] *See* Patricia M.Wald, *Selecting Law Clerks*, 89 Mich. L. Rev. 152 (1990).

[77] *See id. citing* David Margolick, *At the Bar: Annual Race for Clerks Becomes a Mad Dash*, N.Y. Times, March 17, 1989, at B4 col. 1.

[78] *Id*.

[79] *See* Wald *supra* note 76 *citing* internal correspondence.

[80] *Id*. at 153.

[81] *Id*. Judge Wald additionally notes "[O]r she may ask for, or beg off, responsibility for a particular opinion assignment because of the availability or nonavailability of a particular clerk to work on the case." *Id*.

[82] *Id*. at 154.

[83] *Id*. at 152 *citing* David Margolick, *At the Bar: Annual Race for Clerks Becomes a Mad Dash*, N.Y. Times, March 17, 1989, at B4, col. 1.

[84] *Id* at 156.

[85] Id. at 152. "The law of the reigns and badmouthing, spying and even poaching among judges is rife." Id.

This early commentary by Judge Wald did not end discussion and instead only begat further debate about the condition of the clerk market. For example, the following year witnessed a rejoinder to Judge Wald's reform agenda offered by Ninth Circuit Judge Alex Kozinski.[86] Through his 1991 article, the self proclaimed "bad apple" acknowledged in reaction to "complaints about 'badmouthing, spying and even poaching among judges'…we should all try to do better."[87] Despite this concession, Judge Kozinski otherwise argued "…there is nothing at all wrong with the current law clerk selection process; everything is hunky dory."[88] Instead of reform, he argued "…federal judges should get off their pedestals and compete…."[89] For Judge Kozinski, reform proposals simply stymie upstarts by advantaging judges with geography, seniority and existing high levels of prestige.[90]

This first round of commentary, including efforts by the aforementioned jurists as well as others,[91] brought a variety of unique reform proposals and provided a wealth of qualitative insight into the state of the law clerk hiring process. The second strand of "clerk market" scholarship advanced an economic solution. Most notably, economists Christopher Avery, Christine Jolls, Alvin Roth along with Judge Richard Posner produced what has been called the Harvard-Chicago analysis of the law clerk market.[92] Using detailed survey data, the Harvard-Chicago study provided extensive, empirical insight into the experience of judges and clerks in the hiring process.[93] Their data, taken together with subsequent economic analysis, argued the clerk selection process failed to maximize "the sum of satisfaction" of judge and clerk match. Namely, the clerk market, like other markets with timing problems, is plagued with unraveling. Individual judges have substantial incentive to deviate from agreed hiring dates as the existing regulatory mechanisms did not impose enforceable timing regulations.[94] Judges who might otherwise be inclined to abide with a given hiring date are forced to defect from that date

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[86] Alex Kozinski, *Confessions of a Bad Apple*, 100 Yale L.J. 1707 (1991).

[87] *Id*. at 1715.

[88] *Id*. at 1707.

[89] *Id*. at 1714.

[90] *Id*. at 1719. "Judges with many years on the bench naturally have an advantage over *upstarts* like me who have to work hard at achieving a national reputation. The problem with many reform proposals is that they tend to *reinforce these patterns* by decreasing the means by which less-favored clerkships can compete for desirable applicants." (emphasis added)

[91] With a debate in full force, the years that immediately followed witnessed a number of judges and commentators entering the fray. For example, Judge Oberberdorfer and his former clerk filed a response to Judge Kozinski arguing his objections are misplaced and that a medical style matching system would improve the state of affairs. Louis F. Oberdoerfer & Michael N. Levy, *On Clerkship Selection: A Reply to the Bad Apple*, 101 Yale L. J. 1097 (1992). Trenton Norris offered a clerk's perspective on the discontents of the current market while Judge Becker, Justice Breyer and Judge Calabresi set forth their "Modest March 1 solution" to the clerk hiring process. Edward R. Becker, Stephen G. Breyer & Guido Calabresi, *The Federal Judicial Law Clerk Hiring Problem and the Modest March 1 Solution*, 104 Yale L.J. 207 (1994). In the period between crafting and final publication of this article Judge Breyer became Justice Breyer.

[92] Christopher Avery, Christine Jolls, Richard A. Posner & Alvin E. Roth, *The Market for Federal Judicial Law Clerks*, 68 U. Chi. L. Rev. 793 (2001).

[93] *Id*. at 796. "A fundamental goal of our project has been to gain an improved understanding of how the market for federal judicial law clerks actually operates. There are many rumors and opinions about this market, and few hard facts." *Id*.

[94] *Id*.

- 17 -

to avoid the "sucker payoff."[95] These conditions only cause other individuals to engage in similar practices until, across the vast majority of participants, there is widespread non-compliance.

Although disagreeing with a number of conclusions of the Harvard-Chicago study, Professor Priest observes "job conditions are fungible across a large range…even where there are differences across clerkships, their expected value is low because of the short tenure of the job."[96] Since less prestigious judges cannot offer a compensating wage differential "[T]he timing of offer, thus, becomes a term of trade in the clerkship market transaction."[97] Thus, "first movers" such as Judge Kozinski are able to increase their relative standing through strategic behavior early in their career.

Of course, if timing of offer was the sole sorting mechanism in the clerk market, the traffic of law clerks might be a poor proxy from which to operationalize the aggregate social structure. Some portions of the literature, if reviewed in isolation, imply that the strategic behavior of judges simply overwhelms law clerks and precludes them from obtaining their optimal match. For example, the Harvard-Chicago data indicates a majority of respondents who received an offer did so either during or within two days of their interview.[98] At the same time, judges often expected quick or even immediate responses to such offers.[99]

Given these conditions, clerks face significant pressure to avoid an "exploding" offer from a less preferred judge. It turns out that a number of clerks, often with guidance from their professors and law school career services offices, use compensating techniques to resist a sub-optimal match. For example, Judge Wald notes "savvy clerk applicants…called chambers in advance to announce that that particular judge was the first choice."[100] In addition, strategic scheduling is another important compensating technique. Strategic schedulers organize their interviews in relationship to their choices over judges. Specifically, if clerks can schedule interviews in strict association to their preference ordering, than an exploding offer would not be problematic but rather a welcome event.[101]

C. A MARRIAGE OF CONVENIENCE?

The purpose of this article is not to engage the debate over the proper regulatory mechanism, if any, that should govern the clerk market. The recent hiring moratorium,

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[95] The Harvard-Chicago study offers a partial solution to the problem of enforceability. They argue "…the Supreme Court could play an important and productive role in helping to organize and improve the market for federal law clerks….we have suggested a partial solution, which would require judges who wish their clerks to be eligible for United States Supreme Court clerkships to enroll in a centralized matching system…" *Id*. at 885. The genius of their proposal is how it sanctions the very individuals who are most inclined to engage in early exploding offers.

[96] George L. Priest, *Reexamining the Market for Judicial Clerks and Other Assortative Matching Markets*, 22 Yale J. on Reg. 124, 154 (2005).

[97] *Id*.

[98] *See* Harvard-Chicago *supra* note 57 at 814 tbl. 1.

[99] *Id*. at 814 tbl. 2.

[100] *See* Wald *supra* note 76 at 159.

[101] *See* Aldisert et al. *supra* note 70 at 848 (quoting an unnamed Fifth Circuit judge "If an applicant really wants a position with a particular judge, he can signal that by offering to do an interview on the first day.") *Id*.

- 18 -

for example, may limit some the discontents experienced under the prior regime.[102] We will leave the evaluation of such questions to other scholars.[103] For the purposes of this article, our interest in law clerks is simply to study and visualize their traffic to gain insight into questions of inter-judge connectivity. The hiring of clerks is an intimate act,[104] one where deliberation or forethought should attach. While it is a choice under uncertainty, a significant number of signals are available. Some signals, such as grade point average, law review membership or personal background, are intrinsic to the individual clerk. Other cues come from third parties. As the foregoing analysis is limited to law clerks which flow between various judicial actors, judges who previously employed the given clerk provide either an explicit or implicit signal to the subsequent hiring jurist. In general, judges and communities of jurists who consistently share clerks probably do so because the receiver either respects the judgment of his or her colleagues or otherwise shares a social connection with the senders.

Thus, embedded in the immensely interesting literature analyzing the market for federal law clerks is language and commentary that should be of particular interest to the larger public law scholarship. Notwithstanding their critiques of the efficiency of a number of allocative elements of the clerk market, many authors observe it is prestige which in substantial part motivates both the judges and their would-be apprentices.[105] Consider Judge Wald as quoted earlier[106] and Professor Priest who notes "other things equal, prominent judges are able to secure the most qualified clerks."[107] Of course, the Harvard-Chicago findings counsel some degree of a caution from reliance upon clerk traffic as an unambiguous instrument for the relative social position of federal judges. However, even their proposal for reform, centered upon restricting feeding to the United States Supreme Court, acknowledges that social prestige and influence is attached to the ability to attract and feed "star" clerks.[108]

In all, despite the caveats the literature on the clerk market might impose, there remains significant information embedded in the market for judicial clerks that should help inform the greater public law literature. While a simple descriptive account or tabulation of so called "feeder" judges would certainly demonstrate which individuals consistently sent their law clerks to the levels above, such analysis fails to characterize communities and capture concepts such as social position and attraction. While some of the clerk moves may be wholly unrelated to our question of inquiry, we believe in the aggregate, the majority of such moves are related to social advancement. On average, clerks move from judges with a lower social position to those with a higher social standing. Given the clear labor market payoffs available in the private market, many of clerks who remain in the network in order to flow between judges often do so in order to

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[102] For an analysis of the effects of the hiring moratorium *see* Christopher Avery, Christine Jolls, Richard A. Posner & Alvin E. Roth, *The New Market for Federal Law Clerks*, 74 U. Chi. L. Rev. 447 (2007).
[103] *See generally Id.*
[104] *See* Wald *supra* note 76 at 153 (arguing "[T]he judge-clerk relationship is the most intense and mutually dependant one I know of outside of marriage, parenthood, or a love affair.") *Id.*
[105] The term "sorcerers' apprentice" is borrowed from a recent book on Supreme Court Law Clerks. *See* ARTEMUS WARD & DAVID L. WEIDEN, SORCERERS' APPRENTICES : 100 YEARS OF LAW CLERKS AT THE UNITED STATES SUPREME COURT (2006).
[106] *See* Wald *supra* note 76 at 153.
[107] *Id.* at 162.
[108] *See* Avery *supra* note 92.

increase their personal position.[109]   In the face of significant opportunity costs for remaining a public employee, clerks are voting with their feet and their traffic, particularly in the aggregate, says something important.

III. FOLLOWING THE EIGENVECTOR: THE VISUALIZATION OF A DECADE OF FEDERAL LAW CLERK TRAFFIC

Inspired by our desire to better understand the impact of "peer effects," we used the tools of social network analysis to visualize the social architecture of the federal judiciary.   To build the connections between actors, we painstakingly collected a decade's worth of federal law clerk information and used this data to visualize the flow of clerks between judges. Bolstered by subsequent analytics, our visualizations yield some interesting findings. First, while the notion of a "feeder judge" is commonly invoked, this study visualizes the concept. Visualization displays a host of secondary movers who "feed" the feeders thereby increasing their centrality within the network. The overall structure of the network, shown in Figures 1-4 *infra*, is also intriguing. Despite the presence of clear cliques or communities, the center of the network is dense and clustered enough to keep interconnected most of the members of the federal judiciary.[110]

A. DATA COLLECTION: SOURCES AND APPROACH

With the assistance of our research team[111], we collected available information for every federal law clerk employed by an Article III judge during the "natural" Rehnquist Court (1995-2004).   This process proved challenging as no particular data source contained a complete listing of such information. However, our data set combines a diverse set of sources and reflects nearly all law clerks at all levels for the relevant years.[112]

Given its extensive treatment, we began our effort by consulting *The Judicial Yellow Book* published by Leadership Directories, Inc. This tri-annual serial publication contains extensive biographic information on virtually every state and federal judge in the United States. Included within this broad range of information are the names, and in most cases, educational history of various members of the judges' chambers. Using the fall edition in each year, our team transcribed all available identifying information

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[109] At least some number of clerks who remain and move from the Federal Circuit Court to the Federal District Court may do so in order to offer potential employers a better portfolio of experience. We thank Owen Jones for bringing this point to our attention. In fact, it is also possible that clerks who move downward in the hierarchy may do so in order to work in geographic locations that they consider more attractive. Recognizing this caveat, we still believe that as a clerk searches for an additional clerkship, imposing whatever limiting parameters he or she chooses, that to the extent the individual selects among judges prestige is an important part of the decisional calculus.

[110] Figures 1-4 displayed *infra* do not contain every member of the federal judiciary. Although more than five hundred members are present, the visualizations omit judges who over the decade long period failed to send a single clerk to another federal judge.

[111] We would be remiss if we did not take the opportunity to thank Eric Provins, Steven Schwartz, Courtney O'Brien, Pamela Kiel, Stephen Janos, Eitan Ingall, Daniel Schwartz, Art Reyes, Jon Tshiamala, Alex Hughes, Noah Korn, Neil Tambe, Nicole Tyrna, Erin Copland, Matthew Smith, Darin Goldstein, Alex Satanovsky, Benjamin Ruano and Alex Karpowitz for their assistance with data coding.

[112] By our best estimate, our data collection effort yielded approximately 97% of all law clerk events during the decade long period.

- 20 -

including the clerk's full name, educational background and year of service. Across the decade long period, this process yielded a significant amount of the desired data.

Despite the extensive amount of information contained in *The Judicial Yellow Book*, our primary data collection effort left a non-trivial number of "missing" clerk values. In order to bolster the comprehensiveness of our dataset, we searched and filled missing values using *The Judicial Staff Directory* produced by CQ Press. This second level was largely successful and moved the dataset near completion. Yet, as we reviewed the totality of the dataset, it was clear that the set still contained some systematic bias with a large number of the missing values drawn from a discrete number of judges. In order to obtain these public but otherwise unavailable "clerk values," our team searched for missing clerk values using MartinDale-Hubbell as well as the websites of various prominent law firms. To the extent the sum of these combined efforts also proved unavailing, we contacted both the judge's former law clerks as well as the career services offices at a number of law schools located near the particular judge's chambers.

In sum, while the dataset does not contain every discrete clerk value, the Katz, Stafford & Provins dataset (hereinafter KSP) reflects all currently available law clerk information for a decade long period. Appendix I displays some sample lines of code drawn from the KSP dataset. As displayed *infra*, a given line of code contains not only the clerk's full name but also the clerk's educational background, year of service and the judge's name.[113] Furthermore, in order to link our set to existing data sources and to aid in future research, each "clerk event" reflected as an individual line of code contains judge identification and seat numbers drawn from the Gary Zuk, Deborah J. Barrow & Gerard S. Gryski Attributes of Federal Court Judges datasets.[114]

A complete version of the KSP dataset contains in excess of 25,000 law clerk events drawn from not only every Article III judge but also Article I Bankruptcy Court Judges. As the available data sources maintain the greatest degree of accuracy for the law clerks of non-senior status Article III judges,[115] we restricted our analysis herein to these jurists. Even with the clerks of Bankruptcy and Senior Status Judges removed, the dataset does not suffer from a want of information. Namely, the remaining dataset, as restricted, still contains nearly 20,000 total law clerk events for the decade long period. These events are distributed across the federal judicial hierarchy with the majority of clerk events attributed to Federal District Courts.

Many of the clerks who appear in our dataset occupy exactly one line of code. These individuals typically are employed by a judge immediately following law school and exit the clerk network at the completion of their discrete term. So called

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[113] For an example of the information contained in this dataset *see* Appendix I infra.

[114] The Zuk dataset is housed at the University of Kentucky Political Science Department under the umbrella of a Center named for Judicial Behavioralist S. Sidney Ulmer. The page contains both the District and Circuit court datasets. *See* http://www.as.uky.edu/polisci/ulmerproject/databases.htm

[115] For a detailed discussion of senior judges including a claim that Senior Judges are unconstitutional *see* David R. Stras & Ryan W. Scott, *Are Senior Judges Unconstitutional?*, 92 Corn. L. Rev. 453 (2007). "Senior judges are the product of a patchwork of several statutes governing judicial retirement, the most significant of which is 28 U.S.C § 371. Federal judges become eligible for retirement benefits upon satisfying the "Rule of Eighty"—when the sum of their age and years of service on the federal bench reaches eighty. At that point, the judge has two retirement options: outright retirement, which for the sake of clarity we will call 'resignation,' and the form of semiretirement known as 'senior status.'" *Id*. at 460.

- 21 -

"permanent" law clerks reflect another subset of individuals in the KSP dataset. These clerks reflect multiple lines of code because they are employed by one individual judge over a number of years. Our analysis is not directly focused upon either of these subgroups. Instead, it is directed at clerks who flow between judges.

To find clerk "movers," we sorted the dataset by *clerkname* and then by *year*. This displayed clusters of individual clerk names. Using limiting properties such middle initial, law school and undergraduate institution,[116] we differentiated cases involving similar names. To qualify as a clerk move, an individual employed in a given period must be hired by a different judge in a subsequent period. As such, it requires two lines of code to qualify as a clerk move. While we placed no precise limitation upon the timing of the subsequent interval, the vast majority of the clerk moves involved transfers in the year immediately following the first clerkship.

From our nearly 20,000 clerk events, we detected nearly nine hundred movements. As our analysis is exceedingly conservative in it willingness to validate a "mover," the number of connections present in the true population likely exceeds the connections in our visualization of the social landscape. To execute the visualizations and craft the corresponding network statistics, we converted the lines of code representing "movers" into connections between judges. For example, if law clerk Doe_John moved between Judge A and Judge B, than we tallied a connection between those two jurists. Of the close to nine hundred total connections more than five hundred represented discrete movers. In other words, the repeated connections, concentrated on a very limited number of judicial actors. We entered this final dataset of clerk connections into Guess and Pajek[117] which produced the visualizations and statistics contained in *infra* Figures 1-4.

B. THE VISUALIZATION OF LAW CLERK TRAFFIC 1995-2004

After sorting the data, our analysis produced 558 nodes and close to 900 edges. Drawing a network of this size in a consistent and unbiased manner would be rather implausible without the aid of a computer based automated drawing programs. The automated drawing procedures also accelerate the process and provide better clarity, transparency and replicability. The two automated drawing models used in this paper, Kamada-Kawai and Fruchterman-Reingold, are spring-embedded, force-directed placement algorithms. Although the technical characterization is discussed further in Appendix II, an analogy may help characterize the drawing process.

Imagine that the judge nodes are steel rings that have opposing magnetic charges and thus work to repel one another. Now visualize springs connecting the steel rings as the edges in the network. The longer a spring must stretch to connect the steel rings, the more energy is required to stretch that spring. The closer the position of rings without connections is to one another, the greater required energy to hold those positions.[118] The aforementioned algorithms seek to minimize the energy required to balance these attracting and repelling forces. After applying either Kamada-Kawai or Fruchterman-

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[116] We relied upon these values this cell to the extent available. For example, most of the law school information was available while much of the undergraduate institutional information was unavailable.

[117] Guess and Pajek are computer programs used by network scholars to visualize network and run various network statistics.

[118] Peter Eades, *A Heuristic for Graph Drawing*, 42 Congressus Numerantium 149 (1984).

Reingold, the result is a graph that generally distributes vertices evenly, minimizes edge crossings, uses the planar area, reflects inherent symmetry, and minimizes differences in edge lengths.[119]

The mathematical difference between Kamada-Kawai and Fruchterman-Reingold lie in their calculation of the optimal distance for edge length, interpretation of Hooke's Law[120] and the time iterations until the automated drawings cease.[121] In terms of visualization, Fruchterman-Reingold tends to increase the difficulty of remaining in the center, pushing less connected nodes to an orbit with a larger circumference. Nevertheless, in overall structure and clustering, no substantive difference exists. Some network scholars believe the choice of algorithms should be determined by the size and density of the graph, and recommend 500 nodes as a rather noisy line of demarcation.[122] Since the federal judicial network is just over 500 nodes, we included visualizations of both types of automated drawing. While the Kamada-Kawai energizing algorithm provides a nice visual of the overall structure of the network, the Fruchterman-Reingold automated drawing provides greater clarity of the interconnectedness of the network's center.

With this introduction, consider the foregoing series of networks visualizations. Figure 1 and 3 uses the Kamada-Kawai algorithms while Figures 2 and 4 employ Fruchterman-Reingold. Figures 1 & 3 provide a wide view of the energized network while Figures 2 and 4 provide a close-up view including of the network's core. A careful review of the Supreme Court justices displays a familiar ideological distribution. As this effort is primarily directed at classifying social structure and differentiating among lower court judges, what is a greater interest are the communities of both circuit and district court judges who cluster around and feed these Justices. These visualizations do not follow the typical x and y axis and as such can be rotated. For ease, we rotated the foregoing figures so as to hold the traditional left to right ideological distribution.[123]

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[119] Thomas M. J. Fruchterman & Edward M. Reingold, *Graph Drawing by Force-Directed Placement*, 21 Software Practice and Experience 1129 (1991).

[120] Mark Newman, *Power laws, Pareto distributions and Zipf's law*, 46 Contemporary Physics 323 (2005).

[121] *See* Fruchterman & Reingold *supra* note 119.

[122] *See* WOUTER DE NOOY, ANDREJ MRVAR & VLADIMIR BATAGELJ, EXPLORATORY NETWORK ANALYSIS WITH PAJEK, 17 (2005).

[123] If the graphics were rotated 180°, the relative positions of the nodes would remain unchanged. Rather, the Supreme Court Justices would simply be distributed North to South rather than East and West.

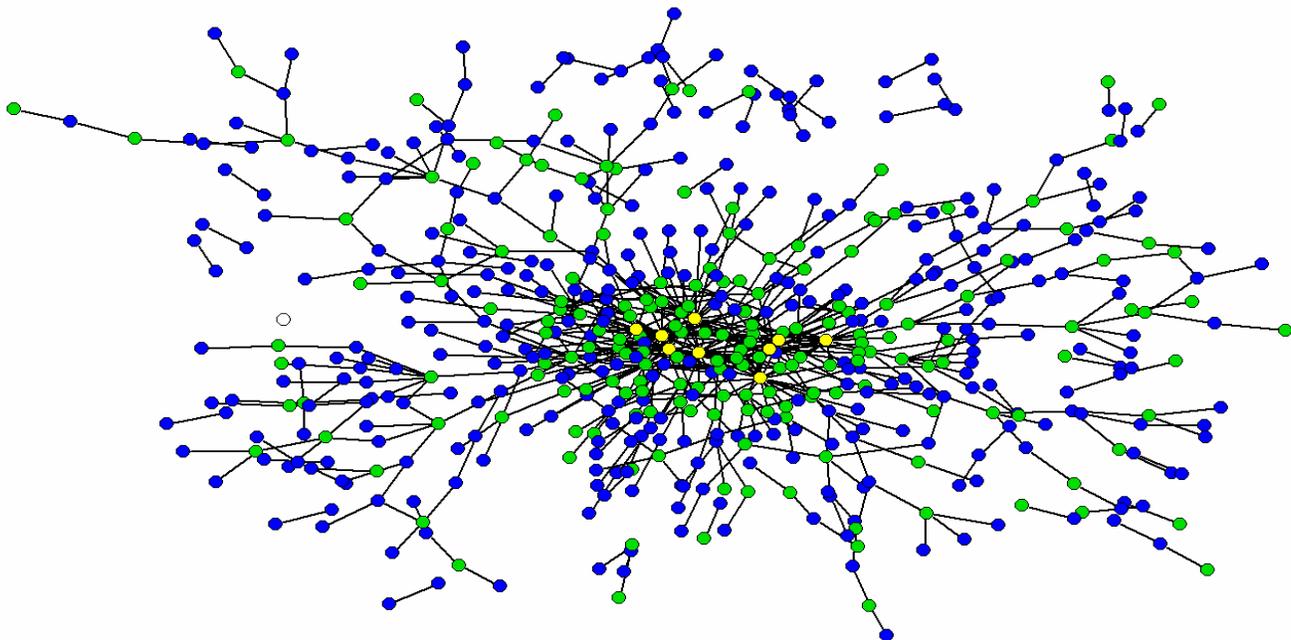FIGURE 1: A WIDE VIEW OF THE KAMADA KAWAI ENERGIZED NETWORK

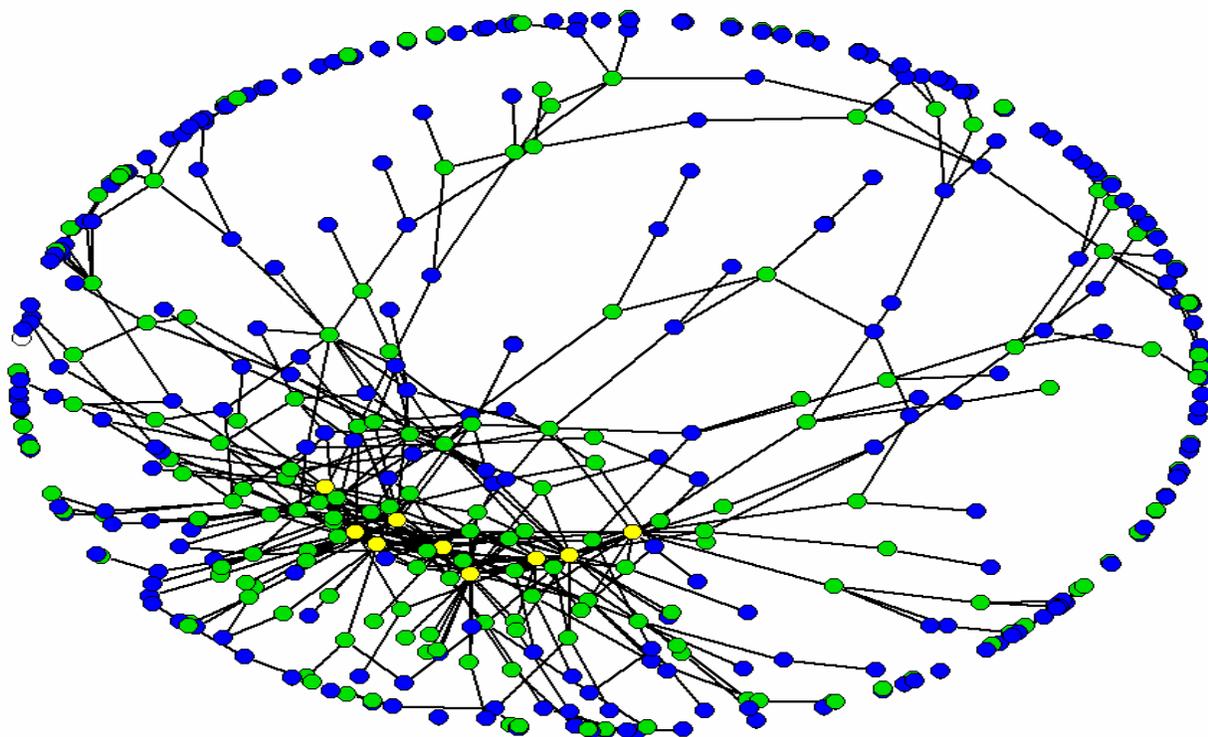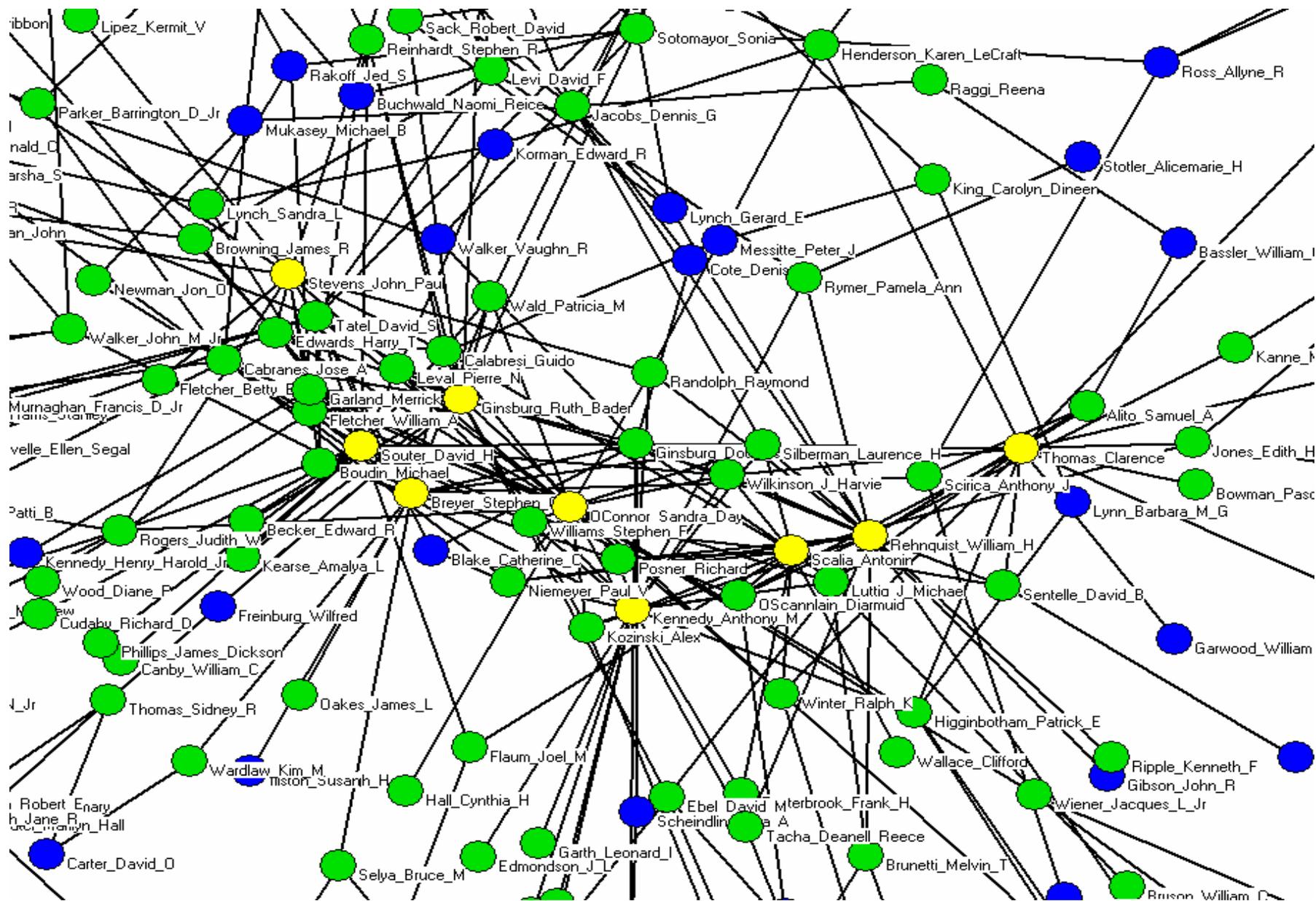FIGURE 2: A WIDE VIEW OF THE FRUCHTERMAN REINGOLD NETWORK

FIGURE 3: A CLOSE VIEW OF THE KAMADA KAWAI ENERGIZED NETWORK

FIGURE 4: A CLOSE VIEW OF THE FRUCHTERMAN-REINGOLD ENERGIZED NETWORK

- 26 -

C. THE STRUCTURE OF THE JUDICIAL SOCIAL NETWORK

In network analysis, after the energizing algorithm is applied, the difference between center and periphery can have different meanings depending upon the operationalization of the edges and nodes, and the overall structure of the network. In the judicial network, we have a densely connected center with clusters around the Supreme Court justices. The circuit and occasional district judges in these clusters frequently send clerks to the same member of the Supreme Court or to an ideological bundle of judges or justices. However, occasionally, a lower court judge sends a clerk across these clusters. These core feeders are sometimes supplied with clerks from surrounding circuit or district judges. The energizing algorithms push judges to the periphery based in part on the number of degrees of separation from both the feeders as well as the Supreme Court justices.

Although the formal institutional authority of each federal judge is nearly identical for holding the circuit/district distinction, surely the informal prestige and influence of every judge is not equal. Given this analysis, do we believe the judges clustered around the Supreme Court are influentially equivalent to the judges on the margins of the network? Are all Circuit Court Judges as equally influential as say Merrick Garland, Diarmuid O'Scannlain, Alex Kozinski, Michael Luttig, Michael Boudin or Richard Posner? After operationalizing connections based on micro decisions by both the clerks and the receiving judges, we believe that centrality in this judicial network, in the aggregate, is a rough proxy for judicial esteem.

Considering the Fruchterman-Reingold automated drawing tends to spread nodes around the periphery in relatively small networks, when speaking about the overall structure of the judicial network, we will refer to the Kamada-Kawai energized network. In each network visual, we have included a partition for the formal distinctions between district, circuit and Supreme Court judges. We might expect the district court judges to fill the space near the outer rim of the network and seldom spread into the center. Yet, District Court judges are diffused throughout the network, including a few judges who find themselves in close proximity to or in the core of the network. The concentration of district judges does appear to decrease from the periphery to the center. The Circuit judges are also dispersed throughout the network and are densely concentrated in the center. Despite egalitarian institutional authority, certain agents have emerged as informal forces. This broad distribution of judges, both circuit and district, argues that while institutional authority is a valid and important component for the study of the judicial decision making an legal change, we also need to consider informal authority and social structure.

D. THE POWER LAW PROPERTIES OF THE JUDICIAL DEGREE DISTRIBUTION

These visualizations provide insight into the nature of informal authority in the federal judiciary hierarchy. Figures 3 and 4 display micro-level communities of jurists linked to each other through their law clerks. While the general composition of these subgroups might be of little surprise to many court scholars[124], some interesting actors do

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[124] It is likely of little surprise to observe prolific Judges such as the Honorable Richard Posner, Harry T. Edwards, Samuel Alito, Merrick Garland, J. Harvie Wilkinson, Michael Luttig, Guido Calabresi located in the core of the network.

find themselves located within the core of the network.[125] Furthermore, as noted above, a select number of centrally located jurists act to bridge communities thereby maintaining a fairly high degree of connectivity across these sub-groups.

In broad stroke, one manner to classify the overall structure of a network is to tally the number of connections or "degrees" between the actors and determine the distribution of such connections. With respect to such a distribution, there exist many potential states of the world. For example, the relative distribution could be fairly uniform—with a wide number of actors possessing a moderate level of degrees. The degrees could be distributed normally or alternatively could be centered upon a small number of socially prominent actors. The degree distribution in this judicial network clearly has heavy tails.

The "top-heavy" or "fat tails" distributions normally refer to three specific probability density functions: the exponential, the power law, and log-linear.[126]

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[125] Of greatest note are the District Court Judges located close to the core of the network. Included among them is Judge Michael Mukasey of the Southern District of New York. In late 2007, Judge Mukasey was confirmed as the Eighty-First Attorney General of the United States.

[126] A Power Law, Exponential, and Log-Normal Distributions are generated by the following equations respectively, $p(x) = \left[(\alpha - 1)x_{\min}^{\alpha-1}\right]x^{-\alpha}$, $p(x) = \left[\lambda e^{\lambda x_{\min}}\right]e^{-\lambda x}$, and

$\sqrt{\dfrac{2}{\pi\sigma^2}}\left[erfc\left(\dfrac{\ln x_{\min} - \mu}{\sqrt{2}\sigma}\right)\right]^{-1}\left[\dfrac{1}{x}\exp\dfrac{-(\ln x - \mu)^2}{2\sigma^2}\right]$. In each equation, the probability of reaching a given

value varies inversely linearly with the power of that value. Often any distribution that meets this criterion is said to be a power law. *See* Aaron Clauset, Cosma Rohilla Shalizi, & M. E. J. Newman, *Power-Laws Distributions in Empirical Data*, available at http://arxiv.org/PS_cache/arxiv/pdf/0706/0706.1062v1.pdf (last visited January 4th, 2008). To then demonstrate the function was a power law, scientists used to create a histogram of the frequencies then log the x and y-axis then look for the negative linear relationship, and if the slope of that line was between -2 and -3, the distribution was called a power law, and the slope termed Alpha. *See* David C. Roberts & Donald L. Turcotte, *Fractality and Self-Organized Criticality of Wars*, 6 Fractals 351 (1998); Felisa A. Smith, *Body Mass of Late Quaternary Mammals*, 84 Ecology 3403 (2003); Takashi Ito, et. al., *Toward a Protein-Protein Interaction Map of the Budding Yeast: A Comprehensive System to Examine Two-Hybrid Interactions in All Possible Combinations between the Yeast Proteins*, 97 Proceedings of the National Academy of Sciences 1143 (2000); Newman *supra* note 120. The Alpha for our line is -2.3, placing out distribution fairly centered in the acceptable Alpha interval for a power law. Then to calculate the statistical likelihood of that distribution being a power law, the least squares estimators were then applied to the log/log plots any the coinciding p-values then illustrated the likelihood of the distributions. Unfortunately, the least squares parameter estimates are systematically biased because of the large fluctuations in the tails of each of this probability functions. In other words, noise or variation in the few observations in the tail disproportionately affects error estimates.

As the included functions indicate, different processes are responsible for these distributions. Recently, a new technique, derived from maximum likelihood estimators and Kolmogorov-Smirnov statistic, has emerged to differentiate between these probability distribution functions. *See generally* WILLIAM H. PRESS, NUMERICAL RECIPES IN C: THE ART OF SCIENTIFIC COMPUTING (1992); INDRA CHAKRAVARTI, ET. AL., HANDBOOK OF METHODS OF APPLIED STATISTICS, VOLUME I (1967). The statistic requires much larger sample sizes and orders of magnitude greater in degree variation than our sample contains to adjudicate which function is responsible for our observed frequency distribution. However, differentiating between the exponential, power law, and log-normal distributions is not necessary for our later claims about phase transitions and self-organized criticality as all three heavy-tailed functions would suffice. Nevertheless, we are prepared to claim that based on the inversely logarithmic relationship and -2.3 alpha, we are prepared to claim our distribution is most consistent with a power law distribution, but could be one of the other non-linear fat-tailed or top-heavy distributions produced by exponential or log-normal probability functions.

- 28 -

Differentiating between the different probability functions is relatively difficult because of the small number of orders of magnitude within our sample population. The parameter estimates for the distribution also increase in difficulty because degree distribution is a discrete variable.

Specifically, many such distributions of "degrees" track the power law distribution or display power law properties. Power Law distributed phenomena appear in studies throughout many disciplines including physics, biology, astronomy, finance and computer science. In renowned physicist Mark Newman's words, "When the probability of measuring a particular value of some quantity varies inversely as a power of that value, the quantity is said to follow a power law."[127] Thus, the normal manner in which people test for power law distributions is to construct a frequency distribution plot and look for the L shape, then log the x and y-axes to see a straight line.

One difficulty associated with accurately asserting that given phenomena are power law generated is the noise in the tail of the distribution. Specifically, given the nature of inverse exponentials in the tail of the distribution, the number of observations in the tail is likely to be very small.

In Figure 5, the frequency distribution plot of the number of judges by the degree of each judge (the degree is simply the measure of how many edges are incident with each node), the familiar L-shaped curve emerges. Within the frequency plot, we included the both separate and aggregate plots for the district and the circuit courts separately and aggregated. The Supreme Court justices are excluded from the analysis because their structural position relative to degree distribution is a construct of their institutional position. Each year, each justice accepts a defined number of clerks, virtually all of whom have served as a clerk for one of their lower court colleagues.[128] In the log/log graph, the inverse line is apparent but obviously noisy. The noise in this graph prevents us from definitively concluding that judicial degree is distributed as a power law. Yet, considering the relatively small number of observations comparable to the AOL example, at a minimum, we can conclude the judge degree distribution is consistent with a power law.

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[127] *See* Newman *supra* note 120.

[128] In the period 1995-2004, we find that nearly 99% of the Supreme Court law clerks were drawn from lower courts. Professor W. William Hodes, Law Clerk to Justice Ginsburg during the 1996 term, represents a rare exception to this global trend. A former student of Justice Ginsburg from her service as a law professor at Rutgers, Mr. Hodes served as her law clerk without first serving for a lower court judge. Other exceptions include individuals such as Rachael L. Brand who clerked for the Honorable Charles Fried of the Massachusetts Supreme Court prior to her service to Justice Kennedy and Adam M. Samaha who clerked for the Honorable Alexander Keith of the Minnesota Supreme Court prior to clerking for Justice Stevens.

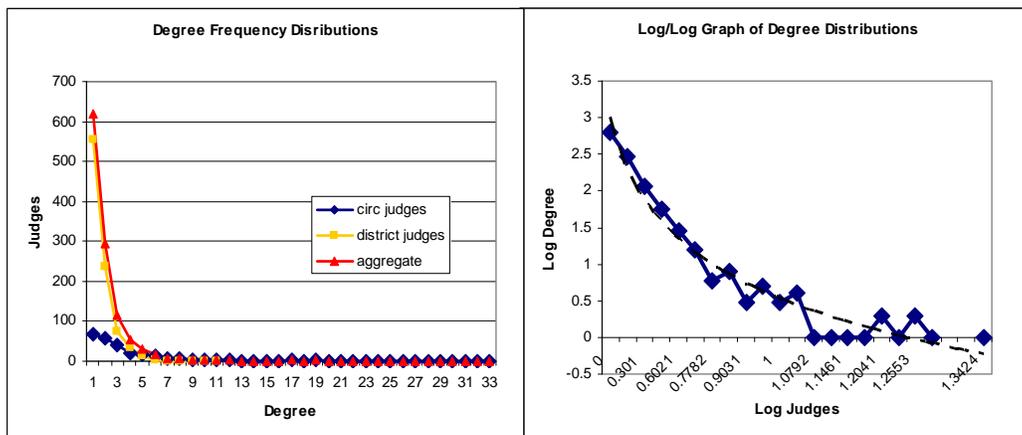FIGURE 5: THE POWER LAW PROPERTIES OF LAW CLERK TRAFFIC

Figure 5 reinforces our claim that the degree of federal judges is consistent with a power law distribution. We have excluded the Supreme Court Justices from the analysis for previously stated reasons. Although the district and circuit partitions may be of individual interest, the frequency distribution of the aggregated judicial levels provides the most useful information about the entirety of the interactions. For instance, in the "aggregate" column, there is an exponential decline of degree frequency over the first six degree classifications.

Table 1 below provides rather stark evidence regarding the concentration of degree distribution in the tail. Only 3.42% of the judges have six or greater incident lines. Those twenty-five judges account for 33.58% of the total connections. The fifteen judges or 1.28% of the population, that has a degree greater than ten are responsible for 19.27% of the connections. Again, while we cannot definitively conclude that the frequency distribution of clerk movements perfectly mirrors the power law, Table 1 displays the many of properties of the power law.

- 30 -

Table 1: Degree Distribution

	District Judges	Circuit Judges	Total
Percentage of Judges			
with Degree 0	60.31%	26.29%	53.00%
	(553)	(66)	(619)
with Degree 1	25.74%	22.71%	25.09%
	(236)	(57)	(293)
with Degree 2	8.19%	16.33%	9.93%
	(75)	(41)	(116)
with Degree 3	3.71%	8.37%	4.70%
	(34)	(21)	(55)
with Degree 4	1.31%	6.77%	2.48%
	(12)	(17)	(29)
with Degree 5	0.44%	4.78%	1.37%
	(4)	(12)	(16)
with Degree 6-10 inclusively	0.33%	8.76%	2.14%
	(3)	(22)	(25)
with Degree greater than 10	0%	3.98%	1.28%
	(0)	(15)	(15)
Total	917	251	1168

If our micro-level clerk movements both from the perspectives of the clerk and receiving judge were successful in at least partially operationalizing professional relationships and prestige, then having a degree distribution that follows a power law is substantively interesting for both our conclusions about the role "peer effects" of the federal judiciary and their relationship to theories of legal change. Namely, Professor Newman demonstrates that the two most likely causes of power law distributions are Yule's Law and Self-Organized Criticality—causes that need not be mutually exclusive.[129]

Yule's Law describes a process where the function generating the distribution builds upon itself.[130] In reduced form, a common example displaying this mechanism is the so-called "rich get richer" phenomena. When the percentage of return an individual investor receives is positively related the quantity of money that person is able to invest than those with large initial endowments are able to extend their relative advantage over those at a lower initial starting investment. Essentially, Yule's law is saying that history matters. How wealthy you are today is a function of how wealthy you were yesterday.

It seems likely that social or professional influence may in part manifest or grow in this manner. The more highly respected a colleague the greater the probability that two people with the same view of that colleague interact and share their opinions. These conversations would then reinforce their original assessments while possibly informing the opinions of present third parties, which would then increase that initial probability for secondary interactions. As such, following Yule's Law a relatively small number of

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[129] *See* Newman *supra* note 120.
[130] *Id.*

agents occupy vastly disproportionate influence in the system and play an important role in generating phase transitions. Table 1, again, provides evidence that the judicial network exhibits these properties.

"Self-Organized Criticality" describes how dynamic complex systems tend to arrange over time at the precipice for great change.[131] In 1987 at Brookhaven National Laboratory, Per Bak, Chao Tang, and Ken Weisenfeld decided to play a game with a hypothetical sand pile. Imagine randomly dropping sand onto a flat surface one grain at a time. Eventually a pile will form. The pile will start flat, and with time will grow steeper. Except, at irregular intervals avalanches occur and flatten the base of the sand pile, which will then grow again. By moving their game into computer simulations, Per Bak and colleagues kept track of the size of the avalanches in terms of the number of grains that move, and found that there was no typical or average size of an avalanche because the avalanche sizes followed a power law and not a normal distribution. Although the most frequent avalanches involved a single grain or two, the avalanche could also encompass a thousand or ten, and sometimes millions of grains that would restructure the entire sand pile. At first it seemed that virtually any avalanche would occur at any time.

Nevertheless, certain trends became evident. Obviously, the steeper the angle of the sand pile and the greater the amount of sand, the more likely a catastrophic avalanche would form. To better illustrate the game, Bak and colleagues then changed the angle of viewing the game so it was as though a person was standing directly over the sand pile, and shaded the pile according to steepness. As the angle increased the computer shaded the hill red to indicate a critical state. When the pile was at a greater equilibrium and less likely to be subject to greater avalanches, the computer shaded the pile green. The piles would begin green, then gradually shade red until an avalanche or several would settle the pile, only to provide a larger base for the next pile to form. As the number of grains increased, so too would the number of red spots. If a grain were to fall on the green plateaus, the likelihood of a cataclysmic avalanche was small, but if that same grain were to fall near the bright red peak, an avalanche could spread to other peaks flattening the entire pile. The sand pile would eventually jettison relatively stable equilibriums and organize itself at points of criticality, on the brink of great change. Although Bak and colleagues demonstrated that that each grain of sand regardless of where it falls may or may not cause an avalanche, and avalanche will not have a typical style thus making predictive properties impossible, perhaps seeing multiple red peaks in close proximity, may inform us the likelihood of a catastrophic avalanche is greater than when the pile appears to be a gentle shade of green.

Forest fires provide another potentially illuminating example.[132] Consider a single tree in an empty field. The likelihood this first tree will reproduce is dependent upon the surrounding conditions. A seedling will grow best with more access to sun and thus the more trees which surround the original tree the lower the probability for reproduction. In an open field, the original tree should be able to reproduce in multiple directions, and that tree's offspring so too should be able to reproduce in certain directions until the field is full.

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[131] *See* PER BAK, HOW NATURE WORKS: THE SCIENCE OF SELF-ORGANIZED CRITICALITY (1996).

[132] *See* Barbara Drossel & Franz Schwabl, *Self-Organized Critical Forest-Fire Model*, 69 Phys. Rev. Lett. 1629 (1992).

As the density of the field increases to its carrying capacity, the trees will begin competing for scarce resources, including light, soil, minerals and of course water. As a byproduct of this competition, both the field and the tree become drier. If the environment should reach a critical point, a lightning strike or a random variation in temperature will start a fire. It is tempting to assert that this fire spreads randomly. However, since the fire needs trees for fuel, it will spread as the trees have spread. Thus, the manner in which the trees of the forest self-organized directs the very conditions for the fire to spread across the field. The cycle from barren field to forest to conflagration back to barren field is a type of phase transition. As with most complex systems, prediction of either the path of the fire or the ideological change is impossible with such limited information, but as information increases, the model can generate more consistent and precise conclusions. What is the initial position of the fire? In what direction and with what magnitude is the wind blowing? What are the burn rates for different trees? Where is the water located? What are the physical boundaries?

As noted above, the causal mechanisms for power law distributions are not mutually exclusive. If complex systems self-arrange at positions on the precipice of great change, Yule's Law seems like a possible source for the degree distribution in the federal judicial network. We might assume that a phase transition is less likely to occur when that conversion requires the mobilization of a large proportion of actors. Accordingly, if power, formal and informal, is concentrated in a few nodes, each capable of influencing their communities, which can influence and in turn other communities, then that system is at a point of conversion. If the process that creates the concentration of power is such that the more influence an agent possesses the more influence that actor can acquire, then Yule's Law may very well be the process through which a system self-organizes at positions of criticality.

IV. From Micro to Macro and Back Again: Peer Effects, Emergence and Convergence in a Federal Judicial Hierarchy

Whether the actors in the federal judiciary self-organize at positions of criticality, follow Yule's law or display some element of both, our study helps at least partially inform the conditions for doctrinal phase transition. Just as knowledge of the position of trees throughout the field provides greater understanding of how the fire spreads, so to, various theories of legal change will be better informed by understanding the relative social position of various actors in judicial hierarchy. Whether invoking illusions to fireflies, sand piles or automobile traffic the overall goal of this endeavor is to illuminate the discussion of judicial "peer effects." Namely, while there are important properties drawn from each major judicial decision making theory, better understanding of the manner in which social factors structure the global outputs for the federal judicial hierarchy is arguably needed.

Judicial decision making is decision making in a hierarchy. Across all the actors and opinions, particularly those produced by lower courts, understanding why certain individuals and cases are privileged is a non-trivial enterprise. An important precursor to gaining leverage on these "peer effects" is characterizing the social structure in which actors operate. Following on Judge Posner's discussion of "reputation," as well as other literature discussing prestige and influence literature, it is difficult to deny a role for

- 33 -

social factors. Simply put, social factors "matter" and as such the federal judiciary is simultaneously marked by both emergent and convergent behaviors. Despite the widespread agreement, within the bounded range of legal discourse, there are still periods of legal change where the rise of new interpretative approaches is almost certainly supported by structurally important actors who champion a particular legal rule.

In all, despite the sorting issues associated with the law clerk market, we believe the traffic of law clerks provides significant insight into the relative clout actors in a judicial hierarchy. Namely, existing methods relying exclusively upon citation counts or subjective evaluations certainly furthered collective understanding about questions of social stature. However, these approaches did not bring complete closure to the debate. While we recognize that this article also does not completely adjudicate all open questions, it builds upon this earlier work by offering a graph theoretic approach to formalize discussion of concepts such as social position and social structure.

A significant number of individual-level theories of judicial decision making—including behavioral and strategic theories—purport to provide a complete view of judicial decision making. Other scholarship such as those offered by the historical institutionalists, emphasizes the Court's constitutive features and challenges strategic theories arguing the macro patterns of judicial decisions are inconsistent with observed macro-level judicial outputs. Our emphasis on judicial "peer effects" is an attempt to fill the void in these respective theories by arguing the existing social structure of the hierarchical federal judiciary in part explains how an existing set of individual mircomotives map to the aggregate macro-behavioral judicial outcomes.[133] Namely, while partisan policy preferences, strategic and other considerations are certainly important—so too are social factors. If judicial decision making is in part socially constituted than consider this an investigation of the relevant architecture. Scaffolding comes in a variety of flavors and different structures consequence outcomes in different manners. As such, we believe the public law literature should embrace a variety of complex systems based approaches including but not limited to network analysis.

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[133] *See* Shelling *supra* note 16.

- 34 -

APPENDIX I: A Sample from the Katz, Stafford, Provins Law Clerk Dataset

Year	Clerk Name	Undergraduate	Law School	Judge Name	Id	Seat No.
1995	Yoo_Christopher_S	Harvard	Northwestern	Randolph_A_Raymond	12109	DC.09.03
1995	Metzger_Gillian_E	Yale	Columbia	Wald_Patricia_M	18260	DC.11.01
2000	Van_Houwelling_Molly_S	Michigan	Harvard	Boudin_Michael	22750	01.01.08
2000	Seinfeld_Gil	Harvard	Harvard	Calabresi_Guido	23155	02.03.09
2000	Stras_David	Kansas	Kansas	Luttig_J_Michael	22225	04.13.01
2002	Prescott_J_J	Stanford	Harvard	Garland_Merrick_B	30168	DC.10.02
1998	Tushnet_Rebecca_L	Harvard	Yale	Becker_Edward_R	590	03.09.03
1996	Gulati_Mitu	Chicago	Harvard	Alito_Samuel_A	127	03.04.05
1998	Zearfoss_Sarah	Bryn_Mawr	Michigan	Ryan_James_L	13110	06.05.04
2000	Milani_Anup	Georgetown	Chicago	Williams_Stephen_F	20460	DC.01.09

APPENDIX II: From a Ring Lattice to an Energized Network

Energizing Algorith

34
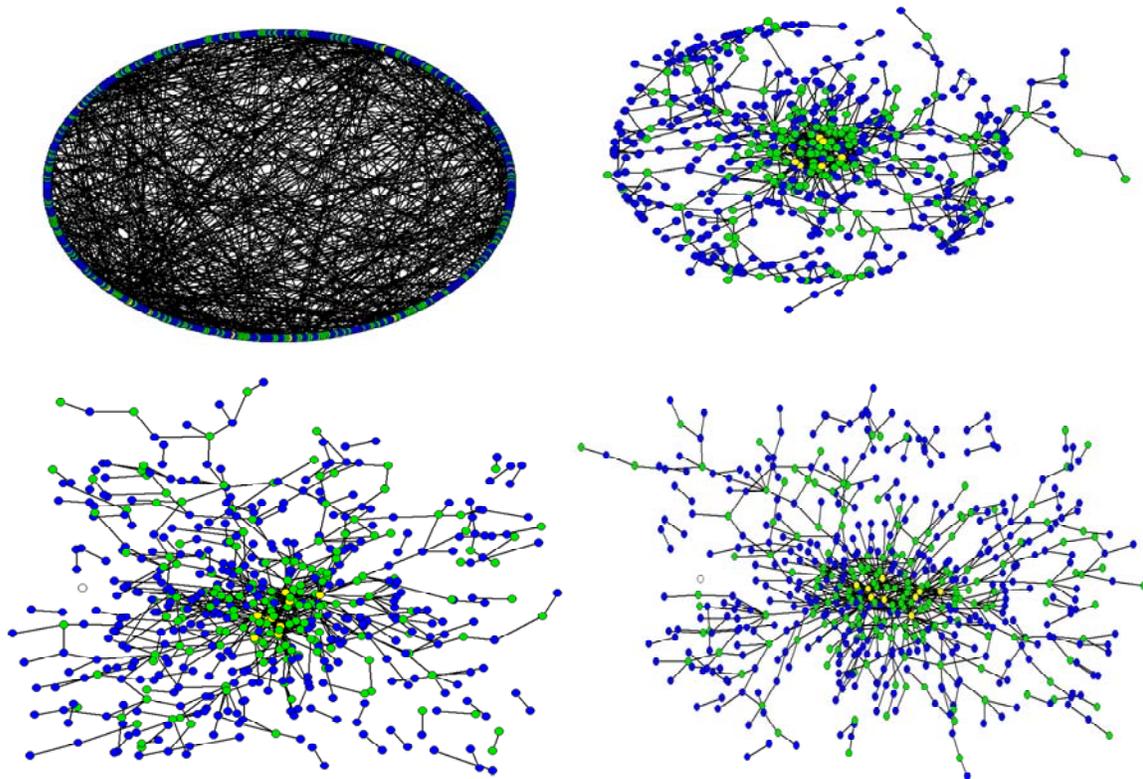
The above visual is a useful depiction of how the energizing algorithms processes the information contained in the network file to produce the visual depiction of the network contained in this study. Stage 1 is a picture of how Pajek initially registers the information. This is a circular network, in which the program begins at nine o'clock on the circle with the first node entered into the network data file. Each node in order listed in the data file then follows the original node moving clockwise around the circle. Once all of the nodes are aligned around the circle, the program allots the connections from the data file drawing lines between the nodes.   Obviously, Stage 1 is not a useful visualization.

Stage 2 represents the early stage of the Kamada-Kawai spreading algorithm: certain nodes based on their centrality are being fixed in the center, nodes that are connected attract one another and those that are not repel. The nodes with higher degrees immediately move to the center. Parts of the graph have maintained the initial circular structure, but the graph is flux and begins to spread. In Stage 3, the graph no longer circular, but the connections appear long and are thus strained according to Hooke's Law. In Stage 4, the graph has reached equilibrium, the connection length is balanced between the forces that attract and repel. Stage 4 is the Kamada-Kawai energized network used in visualizations.