

2-11-2021

## United States Supreme Court IP Cases, 1810–2019: Measuring & Mapping the Citation Networks

Joseph Scott Miller

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## United States Supreme Court IP Cases, 1810–2019: Measuring & Mapping the Citation Networks

### Cover Page Footnote

Professor, University of Georgia School of Law. My thanks for helpful feedback on earlier drafts to workshop participants at Northwestern University Law School's Text Analysis and Law Conference (April 2019), University of San Diego Law School's IP Speaker Series (April 2019), and ETH Zürich's Conference on Data Science and Law (June 2019); and from Greg Day, Sam Ernst, Lori Ringhand, Ted Sichelman, Jessica Silbey, and Deepa Varadarajan.

UNITED STATES SUPREME COURT  
 IP CASES, 1810–2019:  
 MEASURING & MAPPING  
 THE CITATION NETWORKS

*Joseph Scott Miller<sup>+</sup>*

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“Reasoning from precedent is perhaps the most characteristic mode of reasoning in the common law.”<sup>1</sup> Indeed, “[r]are is the opinion that does not justify its outcome in terms of prior precedents.”<sup>2</sup> An apex court’s precedents thus comprise, as Judge Posner has described it, a valuable “stock of knowledge that yields services over many years to potential disputants in the form of information about legal obligations.”<sup>3</sup> How, then, should one take inventory of this knowledge stock? Perhaps a list of decisions can suffice, with a line or two about each case that sums up its holding; this could work, at least if the number of cases is not too large. But even this simple approach leaves untapped the very precedents to which each case expressly links itself, and thus the relevance judgments that such citations to precedent embody. Better, then, to model an apex court’s decisional output “as a network, where each ruling is a node, and

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1. MELVIN A. EISENBERG, *THE NATURE OF THE COMMON LAW* 50 (1988).  
 2. Stefanie A. Lindquist & Frank B. Cross, *Empirically Testing Dworkin’s Chain Novel Theory: Studying the Path of Precedent*, 80 N.Y.U.L. REV. 1156, 1166 (2005).  
 3. RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* 759 (9th ed. 2014).

each citation to another ruling is a unidirectional link,<sup>74</sup> using the tools and techniques of graph theory to measure and to map the citation networks.<sup>5</sup>

The network analysis of case citations in apex-court judgments is, after more than a decade of studies, established.<sup>6</sup> With the second decade begun, the literature describes citation networks, and accompanying case-specific centrality measures, from numerous national and international courts: the foundational studies of the Supreme Court of the United States,<sup>7</sup> the Supreme Court of India,<sup>8</sup> the European Court of Human Rights,<sup>9</sup> the World Trade Organization's Appellate Body,<sup>10</sup> and the Court of Justice of the European Union.<sup>11</sup> The

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4. Krzysztof J. Pelc, *The Politics of Precedent in International Law: A Social Network Application*, 108 AM. POL. SCI. REV. 547, 552 (2014).

5. See generally STEPHEN P. BORGATTI, MARTIN G. EVERETT & JEFFREY C. JOHNSON, *ANALYZING SOCIAL NETWORKS* (2d ed. 2018) (describing and illustrating the application of these tools and techniques); MARK NEWMAN, *NETWORKS* (2d ed. 2018) (same).

6. Janet Box-Steffensmeier, et al., *Judicial Networks*, in *THE OXFORD HANDBOOK OF POLITICAL NETWORKS* 491, 492–97 (Jennifer Nicoll Victor et al. eds., 2018).

7. Seth J. Chandler, *The Network Structure of Supreme Court Jurisprudence*, 10 MATHEMATICA J. 501 (2007); James H. Fowler & Sangick Jeon, *The Authority of Supreme Court Precedent*, 30 SOC. NETWORKS 16 (2008); James H. Fowler et al., *Network Analysis and the Law: Measuring the Legal Importance of Precedents at the U.S. Supreme Court*, 15 POL. ANALYSIS 324 (2007).

8. Kawin Ethayarajh, Andrew Green & Albert H. Yoon, *A Rose by Any Other Name: Understanding Judicial Decisions that Do Not Cite Precedent*, 15 J. EMPIRICAL LEGAL STUD. 563, 564 (2018); Andrew Green & Albert H. Yoon, *Triaging the Law: Developing the Common Law on the Supreme Court of India*, 14 J. EMPIRICAL LEGAL STUD. 683, 689–90 (2017).

9. Yonatan Lupu & Erik Voeten, *Precedent in International Courts: A Network Analysis of Case Citations by the European Court of Human Rights*, 42 BRIT. J. POL. SCI. 413, 413–15 (2011). Though it is not, strictly speaking, a network-analysis study, Alschner & Charlotin have recently published an important examination of the self-citation practices of the International Court of Justice in The Hague. Wolfgang Alschner & Damien Charlotin, *The Growing Complexity of the International Court of Justice's Self-Citation Network*, 29 EUR. J. INT'L L. 83, 83 (2018).

10. Damien Charlotin, *The Place of Investment Awards and WTO Decisions in International Law: A Citation Analysis*, 20 J. INT'L ECON. L. 279, 279 (2017); Joost Pauwelyn, *Minority Rules: Precedent and Participation Before the WTO Appellate Body*, in *ESTABLISHING JUDICIAL AUTHORITY IN INTERNATIONAL ECONOMIC LAW* 141 (Joanna Jemielniak et al. eds., 2016); Pelc, *supra* note 4, at 552.

11. Mattias Derlén & Johan Lindholm, *Is It Good Law? Network Analysis and the CJEU's Internal Market Jurisprudence*, 20 J. INT'L ECON. L. 257, 257 (2017) [hereinafter Derlén & Lindholm, *Good Law*]; Mattias Derlén & Johan Lindholm, *Peek-A-Boo, It's a Case Law System! Comparing the European Court of Justice and the United States Supreme Court from a Network Perspective*, 18 GERMAN L.J. 647, 650–51 (2017) [hereinafter Derlén & Lindholm, *Peek-A-Boo*]; Mattias Derlén & Johan Lindholm, *Characteristics of Precedent: The Case of the European Court of Justice in Three Dimensions*, 16 GERMAN L.J. 1073, 1073 (2015) [hereinafter Derlén & Lindholm, *Characteristics*]; Mattias Derlén & Johan Lindholm, *Goodbye van Gend en Loos, Hello Bosman? Using Network Analysis to Measure the Importance of Individual CJEU Judgments*, 20 EUR. L.J. 667, 667 (2014) [hereinafter Derlén & Lindholm, *Goodbye*]; Mattias Derlén, Johan Lindholm, Martin Rosvall & Atieh Mirshahvalad, *Coherence Out of Chaos: Mapping European Union Law by Running Randomly Through the Maze of CJEU Case Law*, 16 EUROPARÄTTSLIG TIDSKRIFT 517, 517 (2013) [hereinafter Derlén & Lindholm, *Coherence*]; Urska Šadl & Henrik Palmer Olsen, *Can Quantitative Methods Complement Doctrinal Legal Studies? Using Citation*

networks in these studies range broadly over the examined court's entire output in all doctrinal domains, for a substantial timespan. And the studies producing these measures repeatedly demonstrate the value of three particular metrics for identifying the most important—in network terms, the most *central*—cases. These metrics are Authority & Hub scores;<sup>12</sup> PageRank score, familiar from Google's efforts to provide higher-quality search results;<sup>13</sup> and Betweenness score.<sup>14</sup> In addition, more recent studies map the citation networks visually, showing the case clusters that the citation links establish.<sup>15</sup> The case clusters in the network maps provide a bottom-up, citation-driven view of doctrinal topics.

These citation-network studies promise, for jurisprudence, what digital humanities scholars describe as a working synthesis of close and distant reading. Providing an otherwise unavailable perspective on a large body of self-citing decisional law at a scale that no amount of close reading of individual cases can produce, network analysis uniquely blends granular detail with synoptic sweep. Network analysis thus provides a vital cooperative complement to more traditional case analysis.<sup>16</sup> As Professor Jockers puts it in the context of digital literary studies, “[t]he underlying assumption is that by exploring the literary record writ large, we will better understand the context in which individual texts exist and thereby better understand those individual texts.”<sup>17</sup> Read *common-law*

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*Network and Corpus Linguistic Analysis to Understand International Courts*, 30 LEIDEN J. INT'L L. 327, 327 (2017).

12. Fowler & Jeon, *supra* note 7, at 20; Green & Yoon, *supra* note 8, at 689; Joseph Scott Miller, *Which Supreme Court Cases Influenced Recent Supreme Court IP Decisions? A Citation Study*, 21(2) UCLA J.L. & TECH. 1, 12–15 (2017).

13. Derlén & Lindholm, *Good Law*, *supra* note 11, at 267; Derlén & Lindholm, *Peek-A-Boo*, *supra* note 11, at 658 n.69; Derlén & Lindholm, *Characteristics*, *supra* note 11, at 1078–79; Derlén & Lindholm, *Goodbye*, *supra* note 11, at 676–77; Greg Leibon et al., *Bending the Law: Geometric Tools for Quantifying Influence in the Multinetwork of Legal Opinions*, 26 ARTIFICIAL INTELLIGENCE & L. 145, 147 (2018).

14. Derlén & Lindholm, *Goodbye*, *supra* note 11, at 680–81.

15. Charlotin, *supra* note 10, at 290; Leibon et al., *supra* note 13, at 159; Miller, *supra* note 12, at 34–35; Pauwelyn, *supra* note 10, at 155–59; Šadl & Olsen, *supra* note 11, at 343–45. The pioneering Fowler studies also used illustrative network maps, which focused on a selection of the Supreme Court's abortion rights cases. Fowler et al., *supra* note 7, at 326 (fig.1), 329 (fig.2); Fowler & Jeon, *supra* note 7, at 18 (fig.1), 21 (fig.5). The post-Fowler papers, by contrast, map networks that straddle either multiple doctrinal areas, longer timespans, or both.

16. Cf. Wolfgang Alschner, *The Computational Analysis of International Law* 4–5 (Aug. 2, 2019), <https://ssrn.com/abstract=3428762>:

A distant reading of international law literally offers a new perspective. It allows us to see patterns and trends that only become visible through aggregation. Yet, this bird's-eye-view also misses many nuances; it sees the forest but not the tree. A close reading of international law, in turn, can offer much needed detail to validate and contextualize computational findings. Distant and close readings are thus compliments and not substitutes and together they can contribute to a fuller and deeper understanding of international law.

*Id.*

17. MATTHEW L. JOCKERS, *MACROANALYSIS: DIGITAL METHODS AND LITERARY HISTORY* 27 (2013).

for “literary,” and the premise is equally true for citation-network analyses of an apex court’s cases.

More steps remain, though, to make good on the promise of these methods for a digital jurisprudence. The research reported here takes two of those steps. First, to use a large-scale network as a context that generates new insights about specific cases, it helps to bring the network scale down a peg, or two, with a top-down focus on a particular doctrinal area. Rather than extracting a network from all Supreme Court merits cases on all topics, for example,<sup>18</sup> one can construct a network of all Supreme Court cases containing topic-driven keywords or phrases. The cases that generate the citation network, and the network that contextualizes the cases, offer insights more readily to a lawyer generally familiar with the overall topic.

In the research reported here, the doctrinal area is intellectual property law (“IP law”), which itself embraces multiple areas—patent, copyright, trademark, trade secret, and publicity rights. The area is especially apt for network analysis, given that federal law has played a central role in patent and copyright since 1790; Congress has framed the IP statutes as broadly pitched, sparsely worded principles that require elaboration to decide individual disputes; and, given the absence of any strong federal agency issuing substantive IP law rules (along the lines of the EPA or SEC in their respective areas), the Supreme Court’s cases applying IP principles and construing IP statutes establish a robust federal IP common law.<sup>19</sup> At the same time, the analytic methods are general.

Second, to define topical clusters of cases more richly, and to track the changing contours of those topical clusters over time, it helps to augment simple citation networks with *co-citation* networks.<sup>20</sup> Two earlier texts are said to be

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18. See Fowler & Jeon, *supra* note 7, at 17 (taking this approach). For a fascinating paper that moves in the broadening, comparative direction, using citation network analysis to study multiple judicial institutions side by side, see generally Niccolò Ridi, *The Shape and Structure of the ‘Usable Past’: An Empirical Analysis of the Use of Precedent in International Adjudication*, 10 J. INT’L DISP. SETTLEMENT 200 (2019).

19. See generally Shyamkrishna Balganes, *Introduction: Exploring an Unlikely Connection*, in INTELLECTUAL PROPERTY AND THE COMMON LAW 1 (Shyamkrishna Balganes ed., 2013); Peter Menell, *The Mixed Heritage of Federal Intellectual Property Law and Ramifications for Statutory Interpretation*, in INTELLECTUAL PROPERTY AND THE COMMON LAW (Shyamkrishna Balganes ed., 2013).

20. This is an analytically distinct difference, separate from tighter topical focus, in this study. Put differently, one could subject an apex court’s *entire* output to co-citation analysis. At present, the literature shows only one co-citation network analysis of case law, and that study is a preliminary to this one. See Joseph Scott Miller, *Law’s Semantic Self-Portrait: Discerning Doctrine with Co-citation Networks and Keywords*, 81 U. PITT. L. REV. 1, 6–7 (2019 forthcoming). There is a co-citation study of the communications-law literature, but it omits cases. Yorgo Pasadeos et al., *Influences on the Media Law Literature: A Divergence of Mass Communication Scholars and Legal Scholars?*, 11 COMM. L. & POL’Y 179, 190–91 (2016) (describing sources). There is a co-citation study of United States Tax Court cases, but its studies cite to Tax Code sections, not to cases. Michael J. Bommarito et al., *An Empirical Survey of the Population of U.S. Tax Court Written Decisions*, 30 VA. TAX REV. 523, 527 (2011). The lack of co-citation studies is surprising, given that the method recognized, in theory, for case law more than 25 years ago. Patti

co-cited if a subsequent third text cites back to both of them;<sup>21</sup> and in the network model of a set of texts' co-citations, the nodes represent texts and the edges, weighted, state the frequency of the co-citation pairs they connect.<sup>22</sup> The methods and tools of co-citation analysis, developed in bibliometrics to track and map change within scientific and other scholarly literatures over time,<sup>23</sup> serve just as readily to track and map doctrinal change in an interconnected network of judicial decisions.<sup>24</sup> If “frequently cited papers represent the key concepts, methods, or experiments in a field, then co-citation patterns can be used to map out in great detail the relationships between these key ideas.”<sup>25</sup> Critically, co-citation patterns are dynamic, changing as a literature grows:

The pattern of linkages among key papers establishes a structure or map for the specialty which may . . . be observed to change through time. Through the study of these changing structures, co-citation provides a tool for monitoring the development of scientific fields, and for assessing the degree of interrelationship among specialties.<sup>26</sup>

Precedent-rich decisional law roots itself in prior decisions and thus should change slowly, relative to the novelty-seeking scientific and academic literatures that bibliometric studies typically feature. But even slow change, over a long enough time, can become material change. Relatively rapid shifts can also occur.

The primary citation network in this study reflects all the citations to prior Supreme Court cases that one finds in all the Supreme Court's IP cases from 1790 to the June 2019 conclusion of the Court's October 2018 Term. Though

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Ogden, *Mastering the Lawless Science of Our Law': A Story of Legal Citation Indexes*, 85 LAW LIBR. J. 1, 47 (1993); Fred R. Shapiro, *The Most-Cited Articles from the Yale Law Journal*, 100 YALE L.J. 1449, 1457 (1991). See also NEWMAN, *supra* note 5, at 41 (noting, in 2018, lack of co-citation studies of legal-precedent networks).

21. NEWMAN, *supra* note 5, at 39.

22. ROBERTO TODESCHINI & ALBERTO BACCINI, HANDBOOK OF BIBLIOMETRIC INDICATORS: QUANTITATIVE TOOLS FOR STUDYING AND EVALUATING RESEARCH 39–42 (2016).

23. See NICOLA DE BELLIS, BIBLIOMETRICS AND CITATION ANALYSIS: FROM THE SCIENCE CITATION INDEX TO CYBERMETRICS 156–66 (2019) (recounting the history of these methods); Dahui Dong & Meng-Lin Chen, *Publication Trends and Co-Citation Mapping of Translation Studies Between 2000 and 2015*, 105 SCIENTOMETRICS 1111 (2015) (providing a recent example of these methods); Henry Small, *Co-citation in the Scientific Literature: A New Measure of the Relationship Between Two Documents*, 24 J. AM. SOC'Y INFO. SCI. 265 (1973) (establishing the basic conceptual roadmap for these methods); Jennifer Nicoll Victor et al., *Introduction: The Emergence of the Study of Networks in Politics*, in THE OXFORD HANDBOOK OF POLITICAL NETWORKS 3, 12–20 & figs.1.2–1.3 (Jennifer Nicoll Victor et al. eds., 2018) (providing a recent example of these methods).

24. See generally Miller, *supra* note 20 (demonstrating the utility of these methods for smaller samples of cases).

25. Small, *supra* note 23, at 265–66.

26. Small, *supra* note 23, at 265–66.

the Court's first IP decision is from 1810,<sup>27</sup> the first Supreme Court IP case to cite out to an earlier Supreme Court case is *Evans v. Hettich*.<sup>28</sup> There are 910 outward-citing Supreme Court IP cases in all, to date. Perhaps the most surprising finding in this study is that, in the co-citation network derived here, a number of patent-related antitrust cases dating from the 1920s to 1940s form the heart of the densest IP-law topic cluster, a cluster that is also one of the two most weighty clusters in the entire co-citation map.

### I. NETWORKS OF IP CASES

One builds a case-law citation network with cases, from which one extracts citations to earlier cases. To gather cases for this study using topic-driven keywords and phrases, I framed the "IP case" category broadly. Searching all of the Supreme Court's merits cases through June 2019, I included cases deciding claims brought under the Patent Act, Copyright Act, and Lanham Act (the federal statute providing trademark and false advertising claims). Using search queries such as "trade secret" and "(licens! or infring! or valid! or invalid!) /s (patent or copyright or trademark)," I also swept in cases that, according to the Court's opinion(s), turn on the scope of an IP right or the preemptive effect of a federal IP statute. The network thus includes decisions such as *FTC v. Actavis, Inc.*,<sup>29</sup> an antitrust enforcement case about whether a species of patent-litigation-settlement agreement can trigger Sherman Act liability; *Zacchini v. Scripps-Howard Broadcasting Co.*,<sup>30</sup> a case involving a "human cannonball" performer's publicity-rights claim against a broadcast television station; and *Aronson v. Quick Point Pencil Co.*,<sup>31</sup> a trade-secret licensing case that turned on whether the Patent Act renders a particular kind of royalty term unenforceable. Finally, as the network grew, I reviewed cases that were cited two or more times in the network but that my text-string searches had not otherwise identified. Some of these cases were IP cases. In all of this, when in doubt I erred in favor of including the case. If the case cited few or no other cases in the network, or was cited by few or no other cases in the network, it would have little to no effect on the final network. In short, if including the case were an error, the network itself would show it to be a harmless one.

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27. The Court's very first IP case, a patent case captioned *Tyler v. Tuel*, 10 U.S. (6 Cranch) 324 (1810), contains no citation to an earlier Supreme Court case. There are 193 cases, beginning with *Tyler* and ending with *Standard Brands, Inc. v. Nat'l Grain Yeast Corp.*, 308 U.S. 34 (1939), that fit the subject-matter focus of this study but that do *not* cite out to any prior Supreme Court case. These cases appear in the citation networks, if at all, *only* as a result of having been cited to by one or more subsequent cases. A list of all 193 cases is available at [https://digitalcommons.law.uga.edu/fac\\_artchop/1334/](https://digitalcommons.law.uga.edu/fac_artchop/1334/)

28. *Evans v. Hettich*, 20 U.S. (7 Wheat.) 453 (1822).

29. 570 U.S. 136 (2013).

30. 433 U.S. 562 (1977).

31. 440 U.S. 257 (1979).



To create the basic edge list of citing source cases and their respective citations to target cases, for generating the network data,<sup>32</sup> I read all the opinions (majority, concurring, and dissenting) in each citing case and recorded each Supreme Court case cited one or more times therein. I also re-corded each citing case's decisional year and featured type of IP right. The resulting edge list does not identify how many times a source case cited a target case, nor whether the source cited the target positively, neutrally, or negatively, nor whether the citing or cited opinion was a majority, a concurrence, or a dissent. In other words, the network approach used here, as in prior studies,<sup>33</sup> does not track citation directionality (+ or -) or intensity; it treats a citing case, in its entirety, as a bag of citations to earlier cited cases,<sup>34</sup> tracking stated influence of all kinds.<sup>35</sup> This loss of some of the information from the full case reports is the price for getting a network-wide perspective. I think it is a fair price, but I concede another legal theorist may judge the trade's worthiness otherwise.<sup>36</sup>

#### A. The Data

The current citation network spans citing cases from 1822 to June 2019 (*i.e.*, the close of the Court's October 2018 Term). Across the main IP types—patent, copyright, and trademark—there are 912 citing cases to date. Figure 1 shows a four-year rolling average of the annual count of the cases through the Court's history. (For this tally, I put the network's five trade-secret cases in the patent group, and the one publicity-rights case with the trademark group.) Cases involving patent rights dominate the network. The rolling average for annual patent-case count hit its highest point, 19.0, in 1891, and its second highest point, 8.0, in 1945. The rolling average for copyright cases exceeded 2.0 for only brief period, 1908–1911; the rolling average for trademark cases has, thus far, never exceeded 2.0.

The Supreme Court IP cases' citations generate different networks, depending on the decisional years of the citing cases they include. The starting year for all the networks discussed here is the same: 1822. The ending year varies, defining network snapshots at five points in time: through 1890, 1922, 1954, 1986, and 2019 (*i.e.*, the end of the October 2018 Term). I use 1890 because it is the last

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32. NEWMAN, *supra* note 5, at 236–37.

33. See, e.g., Derlén & Lindholm, *Goodbye*, *supra* note 11, at 672; Pelc, *supra* note 4, at 553.

34. In that sense, the method is akin to the “bag of words” approach common to topic modeling in semantic analysis. David M. Blei, *Probabilistic Topic Models*, 55(4) COMM. ACM 77, 82 (2012); Leibon et al., *supra* note 13, at 150.

35. See Richard A. Posner, *An Economic Analysis of the Use of Citations in the Law*, 2 AM. L. & ECON. REV. 381, 386 (2000) (observing that many reasons for citation behavior reflect, in essence, “forms of influence”).

36. See Alschner, *supra* note 16, at 8 (“Many lawyers may find it appalling to reduce textual information so crudely. Yet, it bears reminding that computational methods seek to offer a complementary perspective (‘distant reading’) rather [than] replicate what lawyers already do (‘close reading’). The benchmark for evaluating text-as-data methods is their usefulness, not their semantic accuracy.”).

full year before Congress enacted the Evarts Act,<sup>37</sup> which created new intermediate appellate courts in the federal system (the United States Courts of Appeals) and made the Supreme Court's jurisdiction over most federal claims (including IP claims) largely discretionary.<sup>38</sup> Dividing the remaining 128 years into four periods, I added 32-year spans to generate the next four snapshot years. Using common network-analysis software (Gephi<sup>39</sup> and Sci2<sup>40</sup>), I scored, clustered,<sup>41</sup> and mapped the citation and co-citation networks for each of the five periods. To derive the co-citation networks, I used all the citation network nodes having an in-degree of two or more; to be co-cited often with another case, a case must itself be cited often.<sup>42</sup> Table 1 provides summary statistics for each of the networks.

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37. Judiciary Act of 1891, ch. 517, 26 Stat. 826 1891.

38. See Joshua Glick, Comment, *On the Road: The Supreme Court and the History Circuit Riding*, 24 CARDOZO L. REV. 1753, 1825–28 (2003) (describing the Evarts Act and its effects on the Court's work).

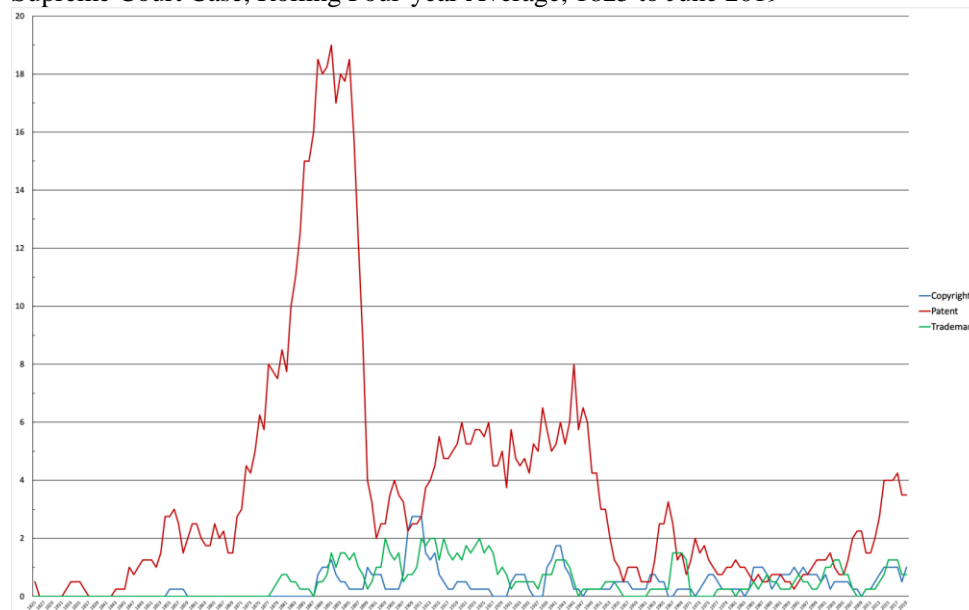
39. NEWMAN, *supra* note 5, at 220; GEPHI, <https://gephi.org/> (last visited Feb. 21, 2020).

40. SCI2 TOOL, <https://sci2.cns.iu.edu/user/index.php> (last visited Feb. 21, 2020).

41. Gephi's community-detection function, called *Modularity*, implements the Louvain algorithm. See NEWMAN, *supra* note 5, at 511–12 (discussing the Louvain algorithm). In all the clustering runs, I left *Randomization* on and set the *Resolution* parameter to 1.0.

42. Small, *supra* note 23, at 265. Setting a threshold to focus one's co-citation analysis on the more frequently cited items is a standard step in the method. See, e.g., Bommarito et al., *supra* note 20, at 542 (setting a co-citation strength threshold of five); Dong & Chen, *supra* note 23, at 1117 (setting a threshold of 33); Small, *supra* note 23, at 266 (setting a threshold of seven); Steffensmeier et al., *supra* note 23, at 14 (setting a threshold of eight).

Figure 1: Annual Count of Supreme Court IP Cases Citing at Least One Prior Supreme Court Case, Rolling Four-year Average, 1825 to June 2019



Notes: The “IP case” category is broad, including both cases adjudicating IP claims and cases adjudicating non-IP claims that turn materially on an IP right (*e.g.*, an antitrust claim based on the manner of enforcing a patent right). The *Patent* category includes four trade-secret cases, and the *Trademark* category includes one publicity-rights case.

Table 1: Summary Statistics for the Citation and Co-Citation Networks Derived from All Supreme Court IP Cases' Citations to Any Supreme Court Case

	<i>Time Periods</i>				
	<i>1822 to 1890</i>	<i>1822 to 1922</i>	<i>1822 to 1954</i>	<i>1822 to 1986</i>	<i>1822 to 2019</i>
<i>Citation Networks</i>					
Number of nodes	547	1359	2189	2553	3438
Number of edges	1239	3172	5540	6483	8188
Nodes with outdegree > 0	292	558	750	812	912
Range of indegree scores	0–20	0–27	0–35	0–36	0–38
Range of outdegree scores	0–32	0–44	0–84	0–84	0–84
Number of node clusters	36	43	39	35	38
<i>Co-Citation Networks</i>					
Number of nodes	172	438	767	885	1124
Number of edges	1532	5305	14989	19012	24761
Range of node weighted-degree scores	1–111	1–183	1–402	1–475	1–569
Range of edge weight scores	1–9	1–13	1–14	1–16	1–17
Number of node clusters	8	14	11	10	12

Notes: In the citation networks, a node's *indegree* score is the number of in-bound citations to the node, and its *outdegree* score is the number of out-bound citations from the node. In the co-citation networks, a node's *weighted degree* score is the sum of the *weight* scores of the edges that connect the node to other nodes, and an edge's *weight score* is the number of times that the two nodes the edge connects are co-cited in the underlying citation network.

### B. The Citation Networks

Network analysis allows one not only to graph the citing and cited relationships in a group of cases, it also enables one to differentiate cases by their relative importance to—their *centrality* in—the network, using all those citation relationships. “A citation analysis is an ideal way to tap ‘case importance’ . . . define[d] as the legal relevance of a case for the network of law at the Supreme Court.”<sup>43</sup> Indeed, because we can treat a citation “as a latent judgment by a judge regarding the relevance of the [cited] case for helping to resolve a legal dispute,” it is “reasonable to determine how relevant a particular

43. Fowler et al., *supra* note 7, at 325.

opinion is by considering how,” in granular detail, “it is embedded in the broader network of opinions comprising the law.”<sup>44</sup>

There are, to be sure, “many possible definitions of importance and there are correspondingly many centrality measures for networks.”<sup>45</sup> Three metrics have emerged as especially apt for analyzing case-law citation networks. The most common centrality measure, *Authority Score*, is one of a pair of interrelated scores, known as Hubs & Authorities.<sup>46</sup> Each score reflects not only what a node cites, and what it is cited by, but also the citations those other nodes send out and receive in. As Fowler & Jeon describe it,

[a] *hub* is a case that cites many other decisions, helping to define which legally relevant decisions are pertinent to a given precedent, while an *authority* is a case that is widely cited by other decisions. . . . A case that is a *good hub* cites many *good authorities*, and a case that is a *good authority* is cited by many *good hubs*.<sup>47</sup>

As others have, I focus this study on Authority Score. The second popular network-centrality measure, familiar from its pioneering use by Google, is *PageRank Score*.<sup>48</sup> We can interpret the score as the result of “a ‘Random Walker’ [who] explore[s] the structure of a network by randomly following citations and occasionally teleporting to a random link in the network,” with a node’s score expressing “the relative probability that the Random Walker will find itself” at that case-node.<sup>49</sup> The third measure, equally applicable to both

44. Fowler et al., *supra* note 7, at 326.

45. Newman, *supra* note 5, at 159.

46. Box-Steffensmeier et al., *supra* note 6, at 494–96; Green & Yoon, *supra* note 8, at 689–90 & fig.1.

47. Fowler & Jeon, *supra* note 7, at 20.

48. Chandler, *supra* note 7, at 522–23; Derlén & Lindholm, *Goodbye*, *supra* note 11, at 676–77; Leibon et al., *supra* note 13, at 147.

49. Derlén & Lindholm, *Characteristics*, *supra* note 11, at 1079. The PageRank algorithm relies on a tunable parameter, known as the “damping factor,” or  $d$ , where  $(1-d)$  “gives the fraction of random walks that continue to propagate along the links.” P. Chen et al., *Finding Scientific Gems with Google’s PageRank Algorithm*, 1 J. INFORMETRICS 8, 9 (2007). As Google initially used PageRank, for example,  $d$  was set to 0.15—from “the anecdotal observation that an individual surfing the web will typically follow . . . 6 hyperlinks.” *Id.* Following Chen et al.’s study of scientific article published in the journal *Physical Review*, *id.* at 9–10, Derlén & Lindholm’s studies of the CJEU citation network set  $d$  at 0.5. Derlén & Lindholm, *Good Law*, *supra* note 11, at 267; Derlén & Lindholm, *Characteristics*, *supra* note 11, at 1079; Derlén & Lindholm, *Goodbye*, *supra* note 11, at 677. In other words, the reader who searches the law by following citation paths is viewed as typically taking two citation steps back before jumping, rather than taking six. Derlén & Lindholm, *Goodbye*, *supra* note 11, at 677. In my PageRank scoring here, I also set  $d$  at 0.5. In a quite recent paper, Olsen & Esmark report using a PageRank damping factor of 0.66 as an “acceptable balance” between the poles of the dilemma any fair observer must acknowledge—“a high damping factor will likely generate too much pagerank in older judgments,” but “a damping factor set too low will fail to catch the depth in the jurisprudence.” Henrik Palmer Olsen & Magnus Esmark, *Needles in a Haystack: Using Network Analysis to Identify Cases That Are Cited for General Principles of Law by the European Court of Human Rights* 10 (iCourts, Working Paper No. 164, 2019), available at [http://papers.ssrn.com/abstract\\_id=3413518](http://papers.ssrn.com/abstract_id=3413518).

directed and undirected networks, is known as *Betweenness Score*.<sup>50</sup> It states “the extent to which a node lies on paths between other nodes.”<sup>51</sup> A case of “high betweenness serve[s] as a communications hub that facilitates the transmission of ideas,”<sup>52</sup> or “acts as a bridge between otherwise distantly connected or unconnected areas of law.”<sup>53</sup>

Each of these scores reflects a different facet of case importance as a lawyer might conceptualize that notion. Speaking colloquially, Authority Score captures the most lawyerly conception of importance, highlighting the influential cases that subsequent well-grounded cases most often cite. PageRank Score highlights the cases to which a cite-to-cite search technique takes one again and again—the cases to which all roads seem to lead. And Betweenness Score highlights the cases through which numerous cite-to-cite searches flow along their way, even if they do not stop there. Taken together, these three-importance metrics give greater depth to any network snapshot.

The network data provide different insights from different perspectives—if one views a snapshot at a given time, looking across the centrality metrics; or if one views a given centrality metric’s outputs across different timespans. I present the citation network data in those two ways. In addition, for each network snapshot in time, I provide maps of the top 100 nodes for each centrality metric using Gephi’s implementation of the ForceAtlas2 algorithm<sup>54</sup> to generate a force-directed layout.<sup>55</sup>

### 1. Snapshots in Time

The first snapshot timespan is from 1822 to 1890, *i.e.*, 69 years of the Court’s IP jurisprudence. In 1890, the network’s 292 outciting cases yield a network with 547 nodes and 1239 edges. Table 2 reports the top ten cases, in rank order,

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50. Chandler, *supra* note 7, at 520; Derlén & Lindholm, *Goodbye*, *supra* note 11, at 680–81.

Graphs may be directed or undirected. In a directed graph, the edges are like arrows—they have direction. . . . In undirected graphs, the edges are unordered pairs. Undirected graphs are used for relations where direction does not make sense or logically must always be reciprocated, as in “was seen with” or “is kin to.”

Borgatti et al., *supra* note 5, at 14. Citation networks are directed, temporally; co-citation networks are undirected, with edges connecting co-cited pairs. NEWMAN, *supra* note 5, at 110, 39. Both the PageRank and the Authority & Hub metrics make sense in the context of directed networks, such as the World Wide Web (for which both were originally designed). NEWMAN, *supra* note 5, at 165–70. The Betweenness metric, as an index of flow, makes sense in both types of networks. NEWMAN, *supra* note 5, at 173–76; Borgatti et al., *supra* note 5, at 201.

51. NEWMAN, *supra* note 5, at 173.

52. Chandler, *supra* note 7, at 520.

53. Derlén & Lindholm, *Goodbye*, *supra* note 11, at 681.

54. Mathieu Jacomy et al., *ForceAtlas2, a Continuous Graph Layout Algorithm for Handy Network Visualization Designed for the Gephi Software*, 9(6) PLOS ONE 2 (2014).

55. See Miller, *supra* note 12, at 32–33 (describing force-directed mapping for a case citation network).

according to the three centrality metrics.<sup>56</sup> One, and only one, case is among the top ten by every metric: *Seymour v. Osborne* (1871), a patent infringement case.<sup>57</sup> It is interesting that, even now, the Court continues to quote *Seymour's* statements of patent-law principles—including three times in just the last nine years.<sup>58</sup>

Table 2. Top Ten Cases in the 1822–1890 Citation Network, Using Three Centrality Metrics

<i>Centrality Metrics for Ranking</i>			
<i>Rank</i>	<i>Authority Score</i>	<i>PageRank Score</i>	<i>Betweenness Score</i>
1	Gill v. Wells (1874)	Pennock v. Dialogue (1829)	<b>SEYMOUR V. OSBORNE (1871)</b>
2	Miller v. Bridgeport Brass (1882)	McClurg v. Kingsland (1843)	Providence Rubber v. Goodyear (1870)
3	Atl. Works v. Brady (1883)	Grant v. Raymond (1832)	Mahn v. Harwood (1884)
4	Hotchkiss v. Greenwood (1851)	Miller v. Bridgeport Brass (1882)	Gill v. Wells (1874)
5	Heald v. Rice (1882)	Wilson v. Rousseau (1846)	Heald v. Rice (1882)
6	James v. Campbell (1882)	Hotchkiss v. Greenwood (1851)	Gage v. Herring (1883)
7	Prouty v. Ruggles (1842)	SEYMOUR V. OSBORNE (1871)	Root v. Lake Shore Ry. (1882)
8	Brown v. Piper (1875)	O'Reilly v. Morse (1854)	Dunbar v. Myers (1876)
9	SEYMOUR V. OSBORNE (1871)	Prouty v. Ruggles (1842)	O'Reilly v. Morse (1854)
10	Slawson v. Grand St. (1883)	Gayler v. Wilder (1851)	Penn. R.R. v. Locomotive (1884)

Notes: One case, *Seymour v. Osborne* (1871), is among the top ten cases by all three-centrality metrics. That is indicated in the table with boldface type. *Gill v. Wells* (1874) and *Heald v. Rice* (1882) are among the top ten by Authority and Betweenness Scores, but they rank only 21<sup>st</sup> and 78<sup>th</sup>, respectively, in PageRank score. *O'Reilly v. Morse* (1854) is among the top ten by PageRank Score and Betweenness Score, but it ranks only 36<sup>th</sup> in Authority Score. *Miller v. Bridgeport Brass* (1882), *Hotchkiss v. Greenwood* (1851), and *Prouty v. Ruggles*

56. To avoid overwhelming the tables with footnotes, complete citation information for all the cases appearing in this table, and all other tables in this paper, appears in Appendix A. The cases there are listed in alphabetical order.

57. *Seymour v. Osborne*, 78 U.S. 516, 533 (1871).

58. *LLC v. Greene's Energy Grp., LLC*, 138 S. Ct. 1365, 1373 (2018); *Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318, 331–32 (2015); *Bilski v. Kappos*, 561 U.S. 593, 652 (2010); *Oil States Energy Servs.*

(1842) are among the top ten by both Authority and PageRank Scores, but all have an outdegree of zero and thus a Betweenness Score of zero.<sup>59</sup>

The maps of the top 100 cases<sup>60</sup> for each centrality metric put these top ten lists in richer context. The mapping software permits one to identify different clusters of nodes, based on their greater interconnection relative to the other nodes, and assign each cluster a different color.<sup>61</sup> The links between nodes, in turn, share the color of the node from which they originate. Both node and text size vary with centrality score, thus higher scores mean larger nodes and text. Figures 2 through 4 map the nodes with the top Authority, PageRank, and Betweenness scores for 1822 to 1890, respectively. It is notable that, in all three maps, one finds top-scoring nodes spread among multiple clusters.

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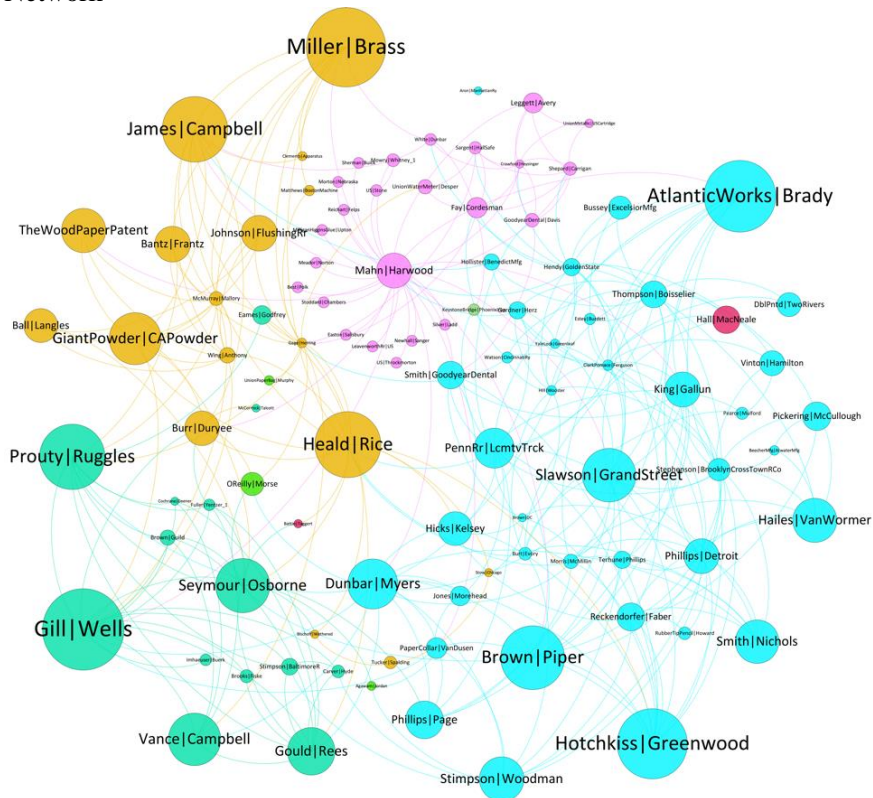
59. *Heald v. Rice*, 104 U.S. 737 (1881); *Miller v. Brass co.*, 104 U.S. 350 (1881); *Seymour v. Osborne*, 78 U.S. 516 (1870); *Gill v. Wells*, 89 U.S. (22 Wall.) 1 (1874); *O'Reilly v. Morse*, 56 U.S. (15 How.) 62 (1854); *Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248 (1851); *Prouty v. Ruggles*, 41 U.S. 336 (1842).

60. The top 100 was my goal for each map, but I could not always hit it: With some metrics at sometimes, there were not 100 nodes, precisely, that fell at or above a given score. The caption for each figure states the map's number of nodes.

61. For all the network maps in this paper, I used the same color scheme to identify clusters in the whole network. In declining order of node-count per cluster, the first eight colors in the scheme are blue, orange, pink, green, grey, red, and seafoam and goldenrod.

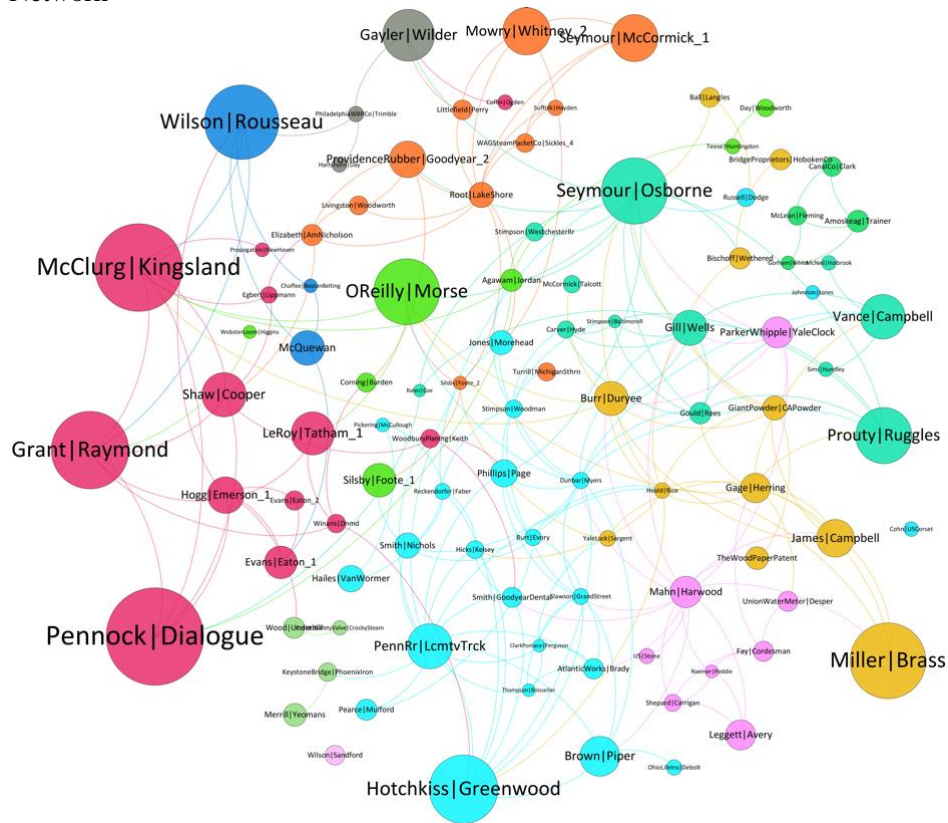


Figure 2: Top 100 Cases, by Authority Score, in the 1822–1890 Citation Network



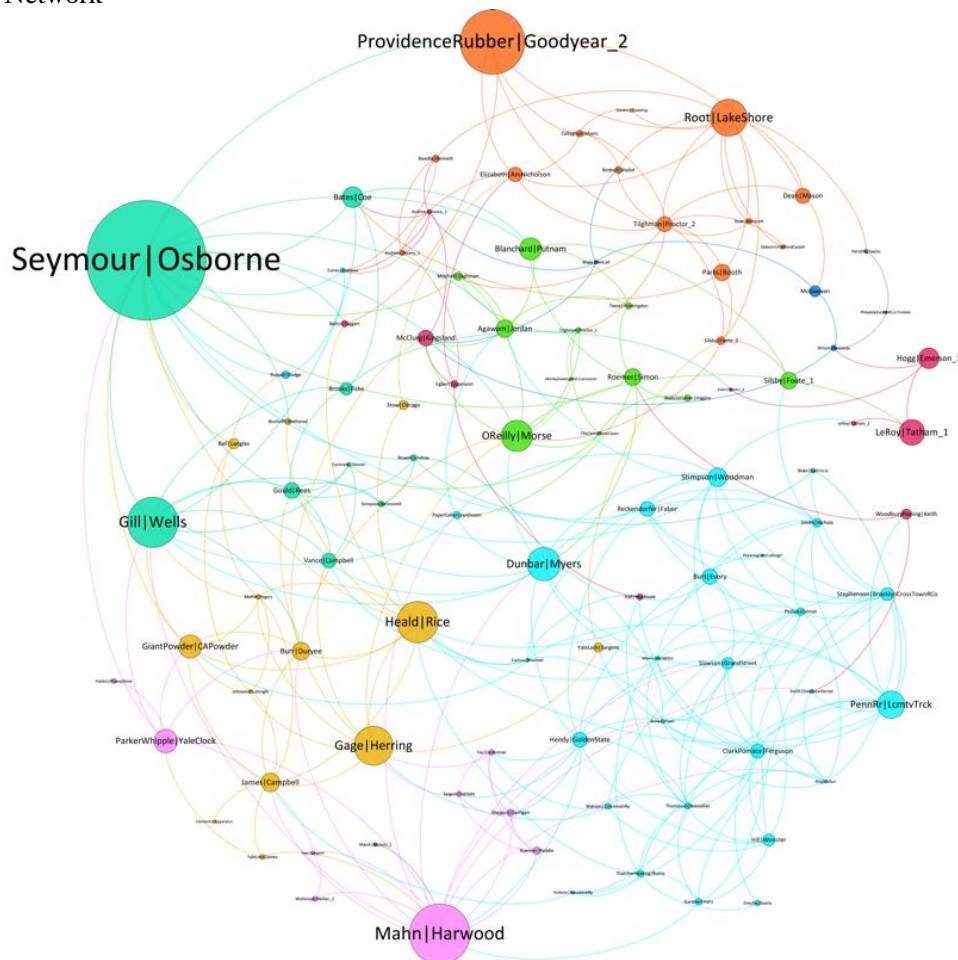
Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Authority Score.

Figure 3: Top 100 Cases, by PageRank Score, in the 1822–1890 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by PageRank Score.

Figure 4: Top 100 Cases, by Betweenness Score, in the 1822–1890 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score.

The second snapshot timespan is from 1822 to 1922, a century of the Court's IP case law. In 1922, the network's 558 outciting cases (a 91% increase from 1890) yield a network with 1359 nodes and 3172 edges. Table 3 reports the top 10 cases, in rank order, according to the three centrality metrics. As was true in the 1890 snapshot, *Seymour v. Osborne* (1871) is the only case among the top ten by every metric. And although the snapshot is in 1922, all but three of the cases are from the 1800s. There is change as well, however. Compared to the top ten in 1890, the PageRank Score group has changed the least: the top eight are the same (though the second and third have changed places), *Gayler v. Wilder* (1851) has moved up a place, and *Amoskeag Manufacturing v. Trainer*

(1879)—a trademark case—has taken the place of *Prouty v. Ruggles* (1842)—a patent case. The 1922 Authority Score group shows more change, with more place changes and two new cases, *Mahn v. Harwood* (1884) and *Giant Powder v. California Powder* (1878). The 1922 Betweenness Score group shows the most change: although the 1890 and 1922 groups have four cases in common, including *Seymour v. Osborne* (1871) on top, six are new to the 1922 group. The net effect of the changes is that the top ten lists are more divergent in 1922: in 1890, seven cases appeared on two or more lists, but in 1922 only three do. Given that each metric focuses on a different facet of centrality, the divergence is effectively an indication that the stock of IP law develops multiple complex layers of authority over time.<sup>62</sup>

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62. *Id.* *Mahn v. Harwood*, 112 U.S. 354 (1884); *Mfg. Co. v. Trainer*, 101 U.S. 51 (1879); *Powder Co. v. Powder Works*, 98 U.S. 126 (1878); *Gayler v. Wolder*, 51 U.S. (10 How.) 509 (1851).

Table 3. Top Ten Cases in the 1822–1922 Citation Network, Using Three Centrality Metrics

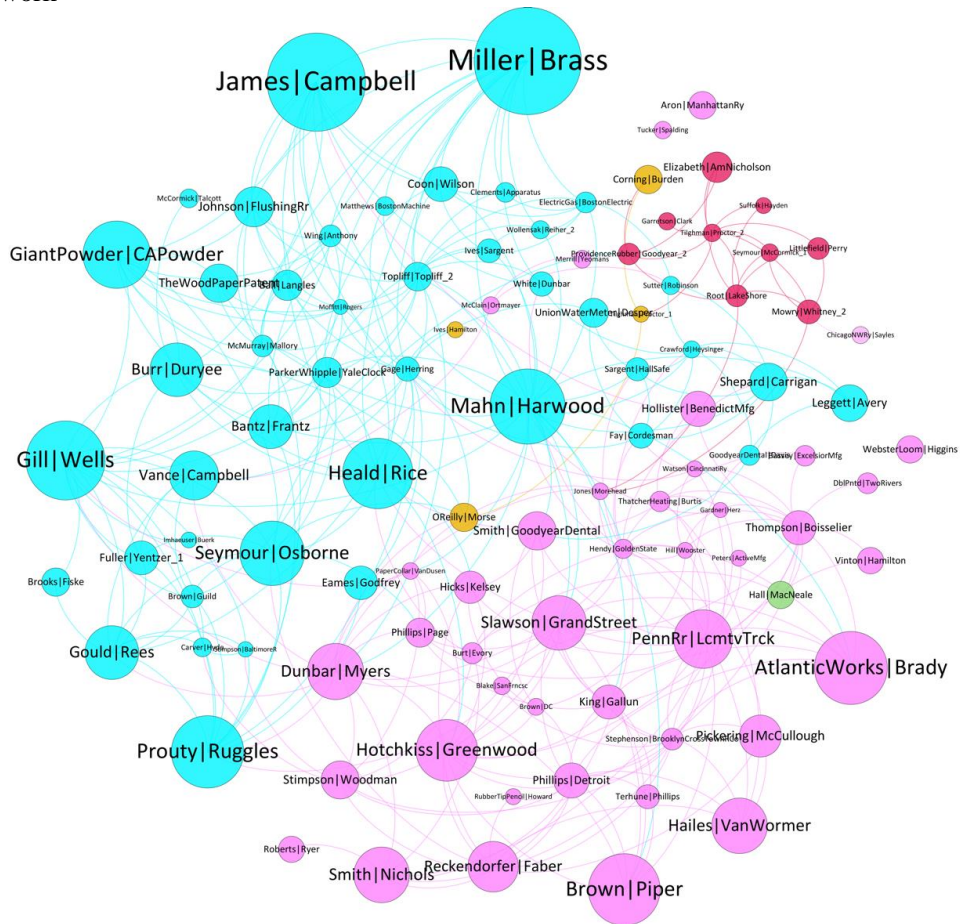
Rank	Centrality Metrics for Ranking		
	Authority Score	PageRank Score	Betweenness Score
1	Miller v. Bridgeport Brass (1882)	Pennock v. Dialogue (1829)	SEYMOUR V. OSBORNE (1871)
2	James v. Campbell (1882)	Grant v. Raymond (1832)	Cont'l Paper Bag v. E. Paper Bag Co. (1908)
3	Gill v. Wells (1874)	McClurg v. Kingsland (1843)	Miller v. Eagle Mfg. (1894)
4	Mahn v. Harwood (1884)	Miller v. Bridgeport Brass (1882)	Mahn v. Harwood (1884)
5	Atl. Works v. Brady (1883)	Wilson v. Rousseau (1846)	Topliff v. Topliff (1892)
6	Prouty v. Ruggles (1842)	Hotchkiss v. Greenwood (1851)	Knapp v. Morss (1893)
7	Brown v. Piper (1875)	SEYMOUR V. OSBORNE (1871)	Root v. Lake Shore Ry. (1882)
8	Heald v. Rice (1882)	O'Reilly v. Morse (1854)	United States <i>ex rel.</i> Steinmetz (1904)
9	Giant Pwdr. v. Cal. Pwdr. (1878)	Gayler v. Wilder (1851)	Providence Rubber v. Goodyear (1870)
10	SEYMOUR V. OSBORNE (1871)	Amoskeag v. Trainer (1879)	Henry v. A.B. Dick Co. (1912)

Notes: One case, *Seymour v. Osborne* (1871), is among the top ten cases by all three centrality metrics. That is indicated in the table with boldface type. *Mahn v. Harwood* (1884) is among the top ten by Authority and Betweenness Scores, but it ranks only 20th in PageRank score. *Miller v. Bridgeport Brass* (1882) is among the top ten by both Authority and PageRank Scores, but it has an outdegree of zero and thus has a Betweenness Score of zero.<sup>63</sup>

Figures 5 through 7 map the nodes with the top Authority, PageRank, and Betweenness scores for 1822 to 1922, respectively. As is the case with the maps for 1822 to 1890, in all three maps for 1922, one finds top-scoring nodes spread among multiple clusters, though the Authority map has two dominant groups.

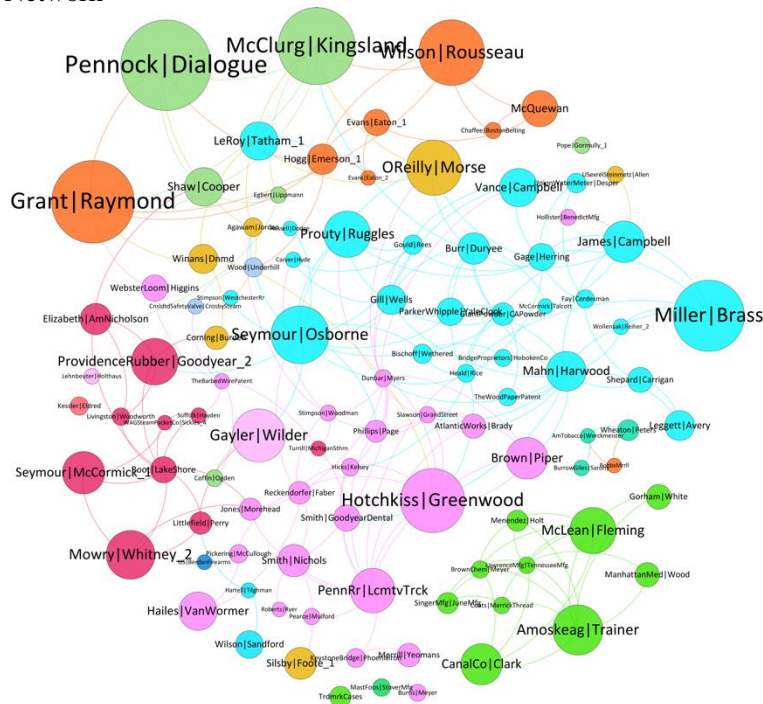
63. *Seymour*, 78 U.S. at 516; *Mahn*, 112 U.S. at 354; *Miller*, 104 U.S. at 350.

Figure 5: Top 100 Cases, by Authority Score, in the 1822–1922 Citation Network



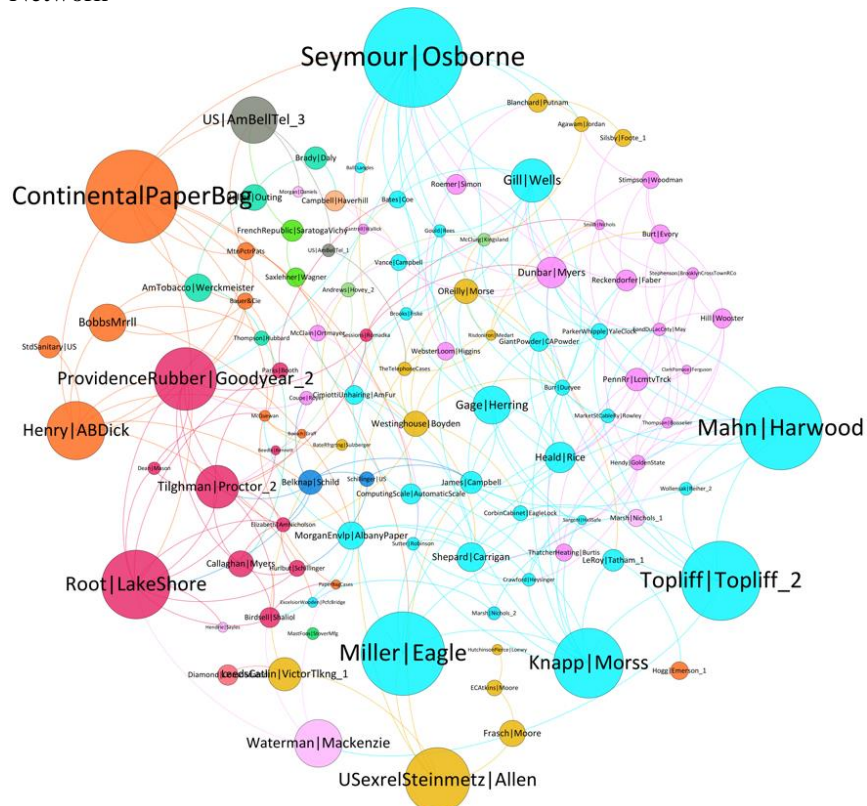
Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Authority Score.

Figure 6: Top 102 Cases, by PageRank Score, in the 1822–1922 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by PageRank Score.

Figure 7: Top 101 Cases, by Betweenness Score, in the 1822–1922 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score.

The third snapshot timespan is from 1822 to 1954. In 1954, the network's 750 outciting cases (a 34% increase from 1922) yield a network with 2189 nodes and 5540 edges. Table 4 reports the top ten cases, in rank order, according to the three centrality metrics. No case appears in all three top ten lists. *Seymour v. Osborne* (1871) remains on only the top ten list for PageRank Score. (It dropped to 14<sup>th</sup> on Betweenness and 26<sup>th</sup> on Authority.) The PageRank top ten has, again, changed the least; only one case, in 10<sup>th</sup> place, differs from the 1922 list, and only one pair (*Miller* and *McClurg*) have swapped places. The PageRank top ten also remains firmly in the 1800s; by contrast, only three Betweenness top ten and one Authority top ten are from the 1800s. No cases appear on both the 1922 and 1954 Authority Score top ten lists. That is a remarkably swift, pronounced change; no other 32-year period shows such change in the top ten Authority Score cases.

The Authority Score top ten list has also shifted in subject matter. In 1922, all of the Authority-Score top ten cases adjudicated patent infringement claims.



In 1954, by contrast, three of the top ten adjudicated Sherman Act antitrust enforcement claims brought by the United States: *Standard Sanitary Manufacturing v. United States* (1912), *Ethyl Gasoline Corp. v. United States* (1940), and *United States v. General Electric Co.* (1926). Six others, though patent enforcement claims, involved licensing practices that courts analyzed as putative patent misuse: *Motion Picture Patents Co. v. Universal Film Manufacturing Co.* (1917), *Carbice Corp. v. American Patents Development Corp.* (1931), *Straus v. Victor Talking Machine Co.* (1917), *Bauer & Cie v. O'Donnell* (1913), *Boston Store of Chicago v. American Graphophone Co.* (1918), and *Bement v. National Harrow Co.* (1902).<sup>64</sup> Misuse doctrine, in which these cases played a key role,<sup>65</sup> is an affirmative defense to infringement sounding in antitrust law's condemnation of anticompetitive conduct. Thus *nine* of the 1954 Authority-Score top ten focus on intertwined patent and antitrust.

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64. *Standard Sanitary Mfg. Co. v. United States*, 226 U.S. 20 (1912); *Ethyl Gasoline Corp. v. United States*, 309 U.S. 436 (1940); *United States v. Gen. Elec. Co.*, 272 U.S. 476 (1926); *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502 (1917); *Carbice Corp. of Am. v. Am. Patents Dev. Corp.*, 283 U.S. 1 (1913); *Bos. Store of Chi. v. Am. Graphophone Co.*, 246 U.S. 8 (1918); *Bement v. Nat'l Harrow Co.*, 186 U.S. 70 (1902).

65. Thomas F. Cotter, *Misuse*, 44 HOUS. L. REV. 901, 902–11 (2007); Herbert Hovenkamp, *Antitrust and the Patent System: A Reexamination*, 76 OHIO ST. L.J. 467, 468–72 (2015) [hereinafter Hovenkamp, *Antitrust*]; Steven P. Reynolds, *Antitrust and Patent Licensing: Cycles of Enforcement and Current Policy*, 37 JURIMETRICS 129, 132–38 (1997).

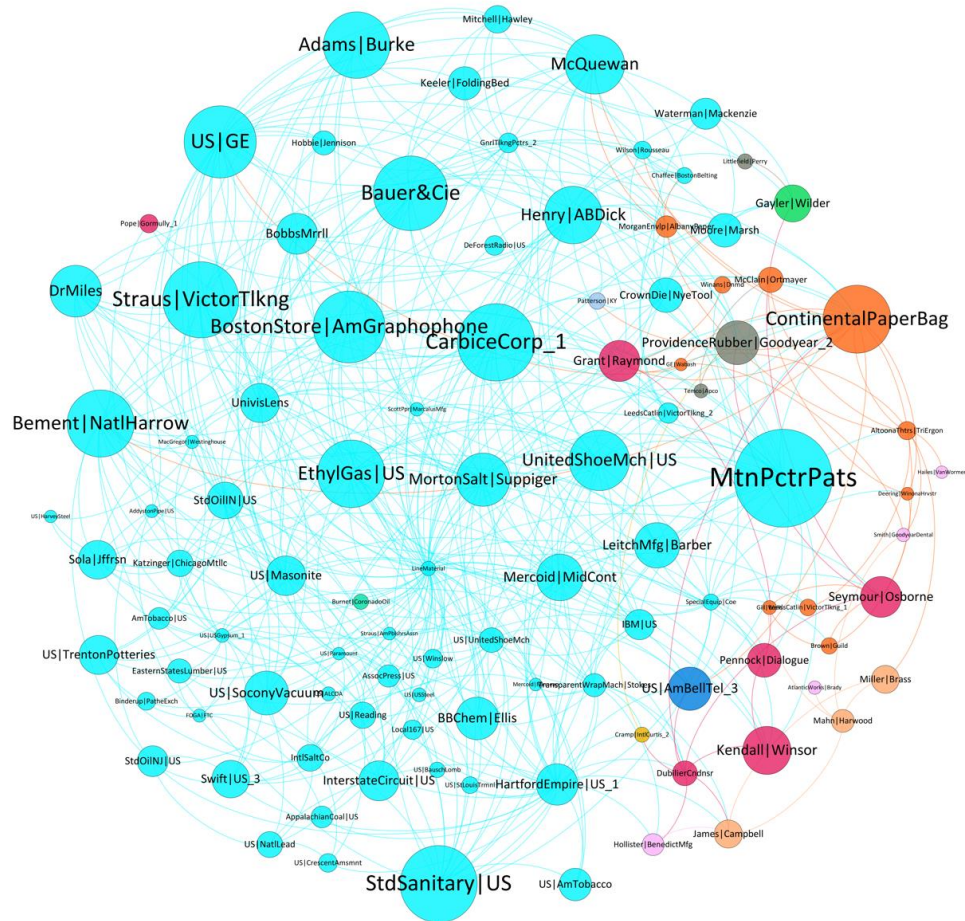
Table 4. Top 10 Cases in the 1822–1954 Citation Network, Using Three Centrality Metrics

Rank	Centrality Metrics for Ranking		
	Authority Score	PageRank Score	Betweenness Score
1	Motion Picture Patents v. Universal Film Mfg. Co. (1917)	Pennock v. Dialogue (1829)	Cont'l Paper Bag v. E. Paper Bag Co. (1908)
2	Carbice Corp. v. Am. Pats. (1931)	Grant v. Raymond (1832)	Altoona Publix Theaters. (1935)
3	Standard Sanitary v. United States (1912)	Miller v. Bridgeport Brass (1882)	Mercoide v. Mid-Continent Inv. Corp. (1944)
4	Straus v. Victor Talking (1917)	McClurg v. Kingsland (1843)	United States v. Am. Bell Tel. (1897) (#3)
5	Bauer & Cie v. O'Donnell (1913)	Wilson v. Rousseau (1846)	Henry v. A.B. Dick Co. (1912)
6	United States v. Gen. Elec. (1926)	Hotchkiss v. Greenwood (1851)	Miller v. Eagle Mfg. (1894)
7	Bos. Store of Chi. v. Am. Graph. (1918)	Seymour v. Osborne (1871)	Topliff v. Topliff (1892)
8	Cont'l Paper Bag v. E. Paper Bag Co. (1908)	O'Reilly v. Morse (1854)	Carbice Corp. v. Am. Pats. (1931)
9	Ethyl Gasoline v. United States (1940)	Gayler v. Wilder (1851)	Bobbs-Merrill v. Straus (1908)
10	Bement v. Nat'l Harrow (1902)	Mowry v. Whitney (1872) (#2)	Marconi Wireless v. United States (1943)

Notes: Two cases, *Continental Paper Bag Co. v. Eastern Paper Bag Co.* (1908) and *Carbice Corp. v. American Patents Development Corp.* (1931), appear on more than one top ten list—namely, those for Authority Score and Betweenness Score.

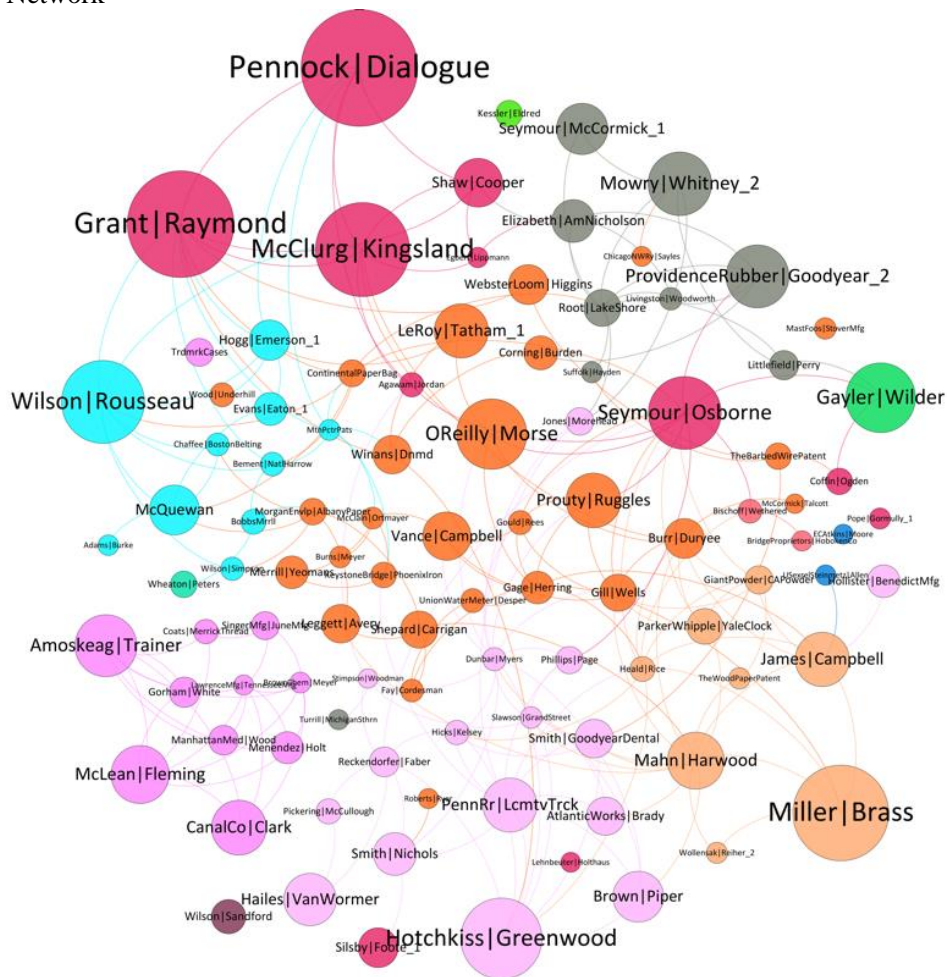
Figures 8 through 10 map the nodes with the top Authority, PageRank, and Betweenness scores for 1822 to 1954, respectively. The Authority-Score map is now sharply skewed to one cluster.

Figure 8: Top 102 Cases, by Authority Score, in the 1822–1954 Citation Network



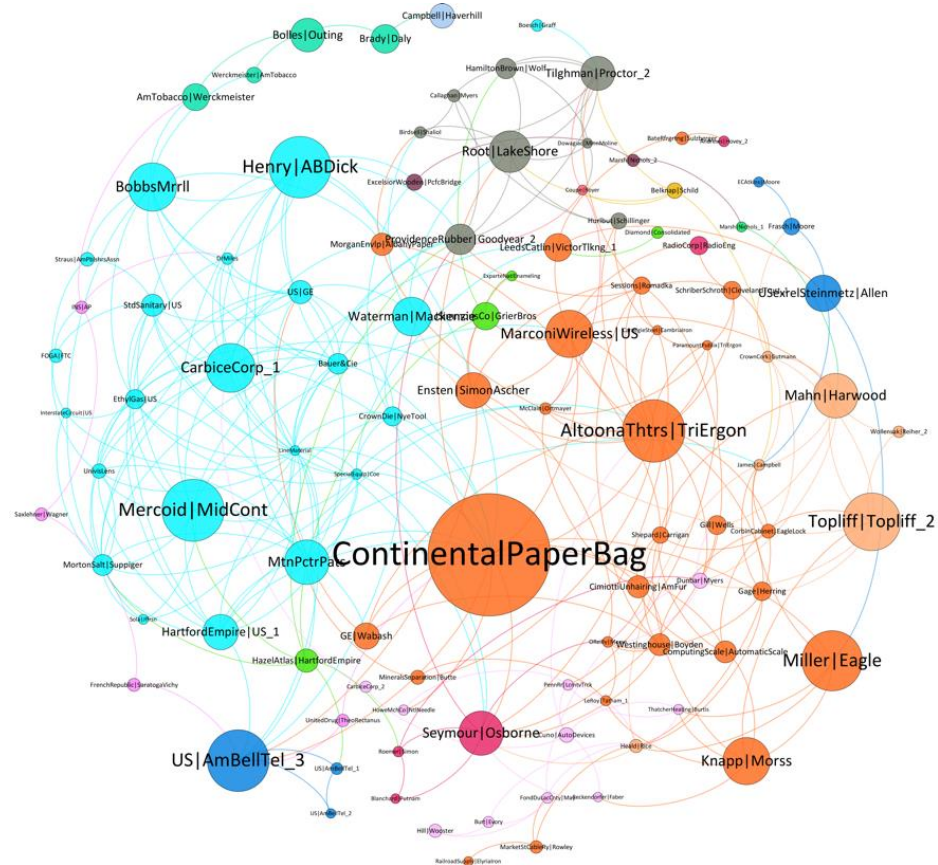
Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Authority Score.

Figure 9: Top 102 Cases, by PageRank Score, in the 1822–1954 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by PageRank Score.

Figure 10: Top 102 Cases, by Betweenness Score, in the 1822–1954 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score.

The fourth snapshot timespan is from 1822 to 1986. In 1986, the network’s 812 outciting cases (an 8% increase from 1954) yield a network with 2553 nodes and 6483 edges. Table 5 reports the top ten cases. Unlike the move to 1954, the move from 1954 to 1986 shows little change. The top-ranked case for each metric has not changed. All top ten cases for both PageRank and Betweenness are the same, with some changes in rank order. Among the top ten cases by Authority Score, three of the patent & antitrust cases from the 1954 list—*General Electric* (1926), *Boston Store of Chicago* (1918), and *Bement* (1902)—have been replaced by two 1940s patent misuse cases—*Morton Salt Co. v. G.S. Suppiger Co.* (1942) and *Mercoid Corp. v. Mid-Continent Investment Corp.*

(1944)—and a foundational “patent exhaustion” case, *Adams v. Burke* (1873).<sup>66</sup> The other seven Authority-Score cases from 1954 remain. Figures 11 through 13 map the nodes with the top centrality scores for 1986.

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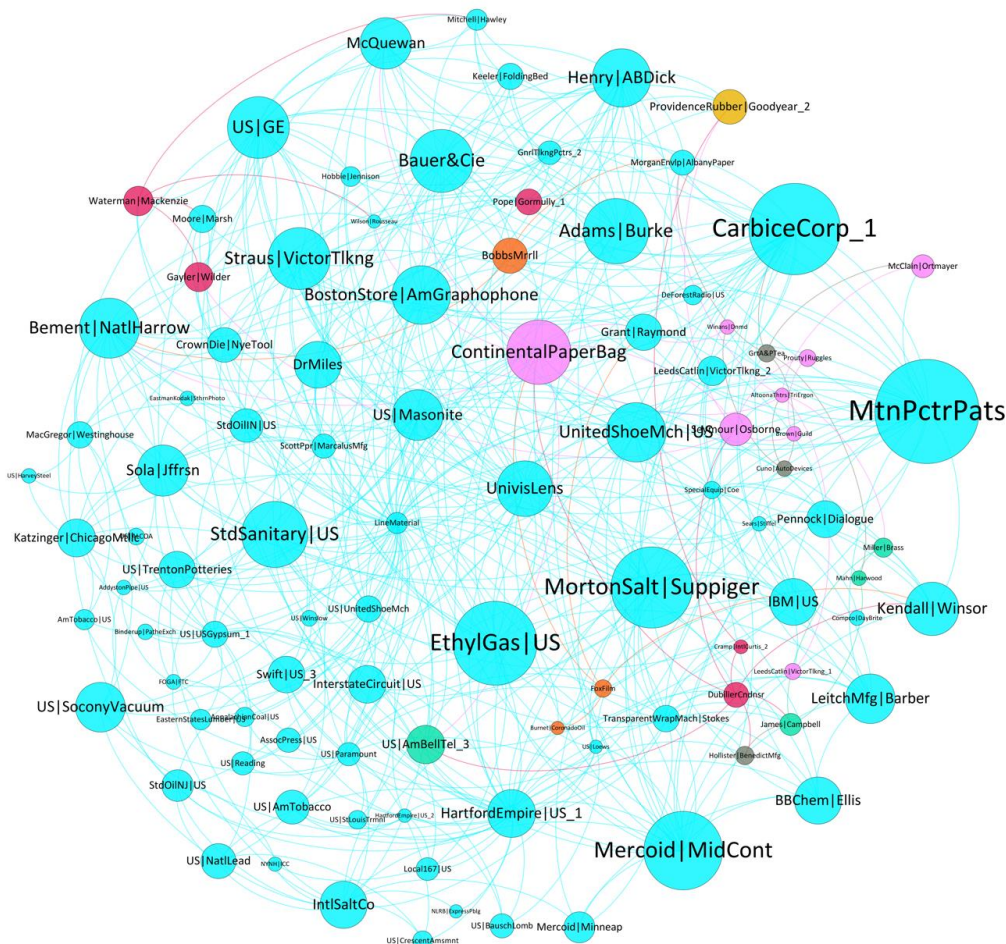
66. HERBERT HOVENKAMP, *THE OPENING OF AMERICAN LAW: NEOCLASSICAL LEGAL THOUGHT, 1870–1970* 195–96 (2015) (describing *Adams v. Burke*, 84 U.S. 453 (1873)) [hereinafter HOVENKAMP, *OPENING*]. Patent exhaustion, like patent misuse, constrains a patentee’s commercial exploitation of the patent right. See generally Samuel F. Ernst, *Total Patent Exhaustion!*, 42 *IDEA* 41, 43–50 (2018) (describing the doctrine). In that respect, the 18th century patent exhaustion cases take a kind of first step toward the misuse cases. See Hovenkamp, *Antitrust*, *supra* note 65, at 476–77 (explaining the progression); Reynolds, *supra* note 65, at 131 n.11 (same). Some would categorize *Motion Picture Patents* (1917) as a patent exhaustion case, see Ernst, *Total Patent Exhaustion!*, 42 *IDEA* 41, 51–54, and that seems eminently reasonable on the case’s own terms. It is also true, however, that antitrust scholars routinely group *Motion Picture Patents* with the patent misuse cases. See, e.g., CHRISTINA BOHANNAN & HERBERT HOVENKAMP, *CREATION WITHOUT RESTRAINT: PROMOTING LIBERTY AND RIVALRY IN INNOVATION* 261–62 (2012); WARD S. BOWMAN, JR., *PATENT AND ANTITRUST LAW: A LEGAL AND ECONOMIC APPRAISAL* 154–58 (1973); HOVENKAMP, *OPENING*, at 196–97, 201; RICHARD A. POSNER, *ANTITRUST LAW* 198 & n.11 (2d ed. 2001). The Supreme Court seems to have done so as well, observing in 1980 that “[t]he idea that a patentee should be denied relief against infringers if he has attempted illegally to extend the scope of his patent monopoly . . . goes back at least as far as *Motion Picture Patents Co. v. Universal Film Mfg. Co.*” *Dawson Chem. Co. v. Rohm & Haas Co.*, 448 U.S. 176, 180 (1980).

Table 5. Top Ten Cases in the 1822–1986 Citation Network, Using Three Centrality Metrics

Rank	<i>Centrality Metrics for Ranking</i>		
	<i>Authority Score</i>	<i>PageRank Score</i>	<i>Betweenness Score</i>
1	Motion Picture Patents v. Universal Film Mfg. Co. (1917)	Pennock v. Dialogue (1829)	Cont'l Paper Bag v. E. Paper Bag Co. (1908)
2	Carbice Corp. v. Am. Pats. (1931)	Grant v. Raymond (1832)	Mercoid v. Mid-Continent Inv. Corp. (1944)
3	Ethyl Gasoline v. United States (1940)	Miller v. Bridgeport Brass (1882)	Marconi Wireless v. United States (1943)
4	Morton Salt v. Suppiger (1942)	McClurg v. Kingsland (1843)	United States v. Am. Bell Tel. (1897) (#3)
5	Mercoid v. Mid-Continent Inv. Corp. (1944)	Hotchkiss v. Greenwood (1851)	Henry v. A.B. Dick Co. (1912)
6	Standard Sanitary v. United States (1912)	Wilson v. Rousseau (1846)	Altoona Publix Thtrs. (1935)
7	Adams v. Burke (1873)	Seymour v. Osborne (1871)	Carbice Corp. v. Am. Pats. (1931)
8	Cont'l Paper Bag v. E. Paper Bag Co. (1908)	O'Reilly v. Morse (1854)	Miller v. Eagle Mfg. (1894)
9	Bauer & Cie v. O'Donnell (1913)	Gayler v. Wilder (1851) Mowry v. Whitney (1872)	Topliff v. Topliff (1892)
10	Straus v. Victor Talking (1917)	(#2)	Bobbs-Merrill v. Straus (1908)

Notes: Three case, *Continental Paper Bag Co. v. Eastern Paper Bag Co.* (1908), *Carbice Corp. v. American Patents Development Corp.* (1931), and *Mercoid Corp. v. Mid-Continent Investment Corp.* (1944) appear on more than one top ten list—namely, those for Authority Score and Betweenness Score.

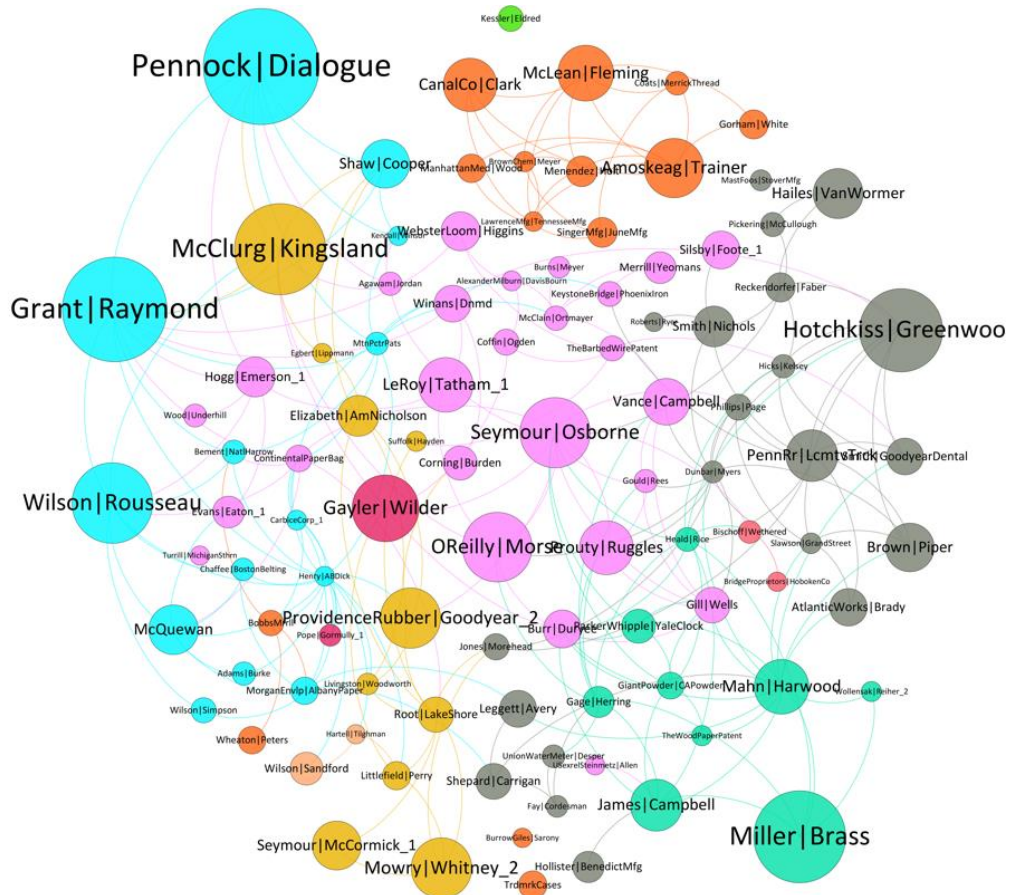
Figure 11: Top 101 Cases, by Authority Score, in the 1822–1986 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Authority Score.

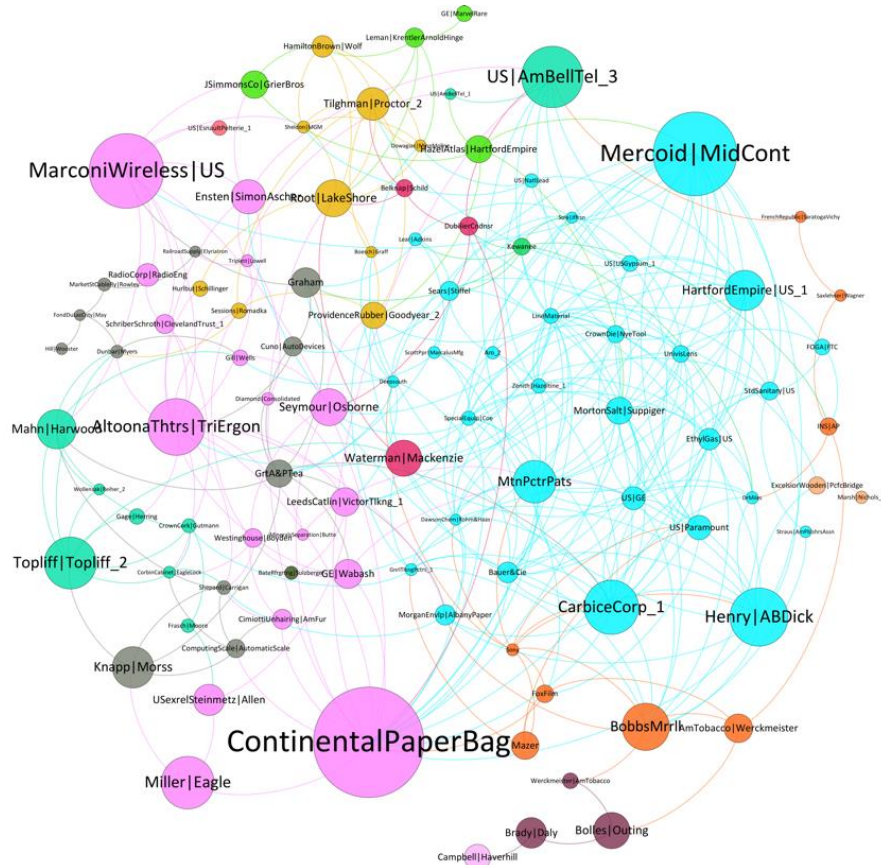


Figure 12: Top 100 Cases, by PageRank Score, in the 1822–1986 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by PageRank Score.

Figure 13: Top 101 Cases, by Betweenness Score, in the 1822–1986 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score.

The fifth, and final, snapshot timespan is from 1822 to June 2019. In 2019, the network's 912 outciting cases (a 12% increase from 1986) yield a network with 3438 nodes and 8188 edges. Table 6 reports the top ten cases. Like the move to 1986, the move from 1986 to 2019 shows little change. The top-ranked case for each metric remains the same, stable since 1954. All top ten cases in PageRank are, again, the same (with some rank-order shifts). Among the top ten cases by Authority Score, the top five cases are the same, and in the same order, as in 1954. Of the remaining five cases, three are the same (*Bauer & Cie*, *Adams*, and *Straus*), and two are new—*General Electric*, returning from the 1954 top ten; and *Henry v. A.B. Dick* (1912), one of the foundational cases in what would become the patent misuse doctrine. Among the top ten cases by Betweenness Score, the top three are the same (though *Marconi* and *Mercoid v. Mid-Continent Investment Corp.* swapped rank), two of the remaining seven are

the same (*American Bell*, and *A.B. Dick*), and five cases are new—including the famed “home recording” copyright fair use case, *Sony* (1984), the landmark patent nonobviousness case, *Graham* (1966), and a critical Patent Act preemption case, *Bonito Boats* (1989). Figures 14 through 16 map the nodes with the top centrality scores for 2019.<sup>67</sup>

Table 6. Top Ten Cases in the 1822–2019 Citation Network, Using Three Centrality Metrics

Rank	Centrality Metrics for Ranking		
	Authority Score	PageRank Score	Betweenness Score
1	Motion Picture Patents v. Universal Film Mfg. Co. (1917)	Pennock v. Dialogue (1829)	Cont’l Paper Bag v. E. Paper Bag Co. (1908)
2	Carbice Corp. v. Am. Pats. (1931)	Grant v. Raymond (1832)	Marconi Wireless v. United States (1943)
3	Ethyl Gasoline v. United States (1940)	McClurg v. Kingsland (1843)	Mercoid v. Mid-Continent Inv. Corp. (1944)
4	Morton Salt v. Suppiger (1942)	Miller v. Bridgeport Brass (1882)	Sony v. Universal (1984)
5	Mercoid v. Mid-Continent Inv. Corp. (1944)	Hotchkiss v. Greenwood (1851)	Bonito Boats v. Thunder (1989)
6	Bauer & Cie v. O’Donnell (1913)	Wilson v. Rousseau (1846)	Graham v. John Deere (1966)
7	Adams v. Burke (1873)	O’Reilly v. Morse (1854)	United States v. Am. Bell Tel. (1897) (#3)
8	Henry v. A.B. Dick Co. (1912)	Seymour v. Osborne (1871)	Henry v. A.B. Dick Co. (1912)
9	United States v. Gen. Elec. (1926)	Gayler v. Wilder (1851)	Zenith v. Hazeltine (1969)
10	Straus v. Victor Talking (1917)	Mowry v. Whitney (1872) (#2)	Inwood Labs v. Ives Labs (1982)

Notes: Three cases, *Continental Paper Bag Co. v. Eastern Paper Bag Co.* (1908), *Henry v. A.B. Dick Co.* (1912), and *Mercoid Corp. v. Mid-Continent Investment Corp.* (1944) appear on more than one top ten list—namely, those for Authority Score and Betweenness Score.<sup>68</sup>

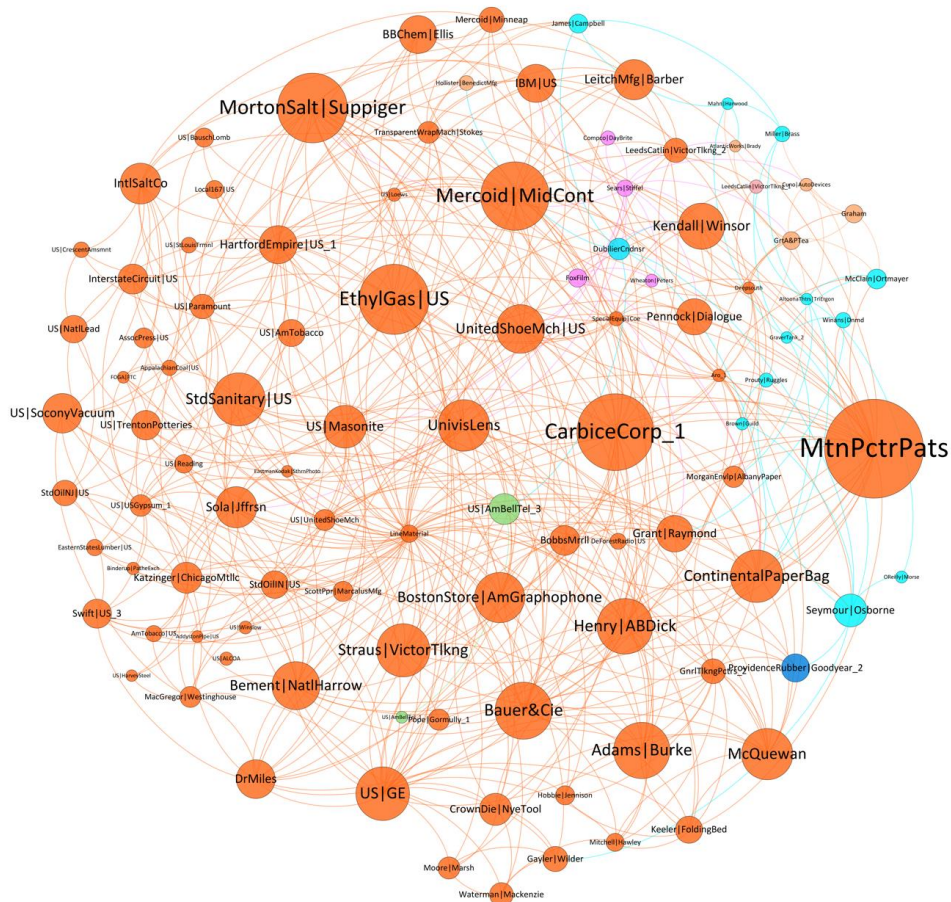
Given the relative stability of these top ten lists in 1986 and 2019, one might wonder whether the smaller annual number of Supreme Court IP decisions since the early 1950s (see Figure 1, above) have caused the rank-order of cases within

67. *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141 (1989); *Sony Corp. v. Universal City Studios, Inc.*, 464 U.S. 417 (1984); *Graham v. John Deere Co.*, 383 U.S. 1 (1966); *Mercoid Corp. v. Mid-Continent Inv. Corp.*, 320 U.S. 661 (1944); *Marconi Wireless Tele. Co. v. United States*, 320 U.S. 1 (1943); *United States v. Gen. Elec. Co.*, 272 U.S. 476 (1926); *Straus v. Victor Talking Mach. Co.*, 243 U.S. 490 (1917); *Bauer & Cie v. O’Donnell*, 229 U.S. 1 (1913); *Henry v. A.B. Dick Co.*, 224 U.S. 1 (1912); *United States v. Am. Bell Tele.*, 128 U.S. 315 (1888); *Adams v. Burke*, 84 U.S. 453 (1873).

68. *Mercoid Corp. v. Mid-Continent Inv. Corp.*, 320 U.S. 661 (1944); *Carbice Corp. v. Am. Patents Dev. Corp.*, 283 U.S. 27 (1931); *Henry v. A.B. Dick Co.*, 224 U.S. 1 (1912); *Cont’l Paper Bag Co. v. E. Paper Bag Co.*, 210 U.S. 405 (1908).

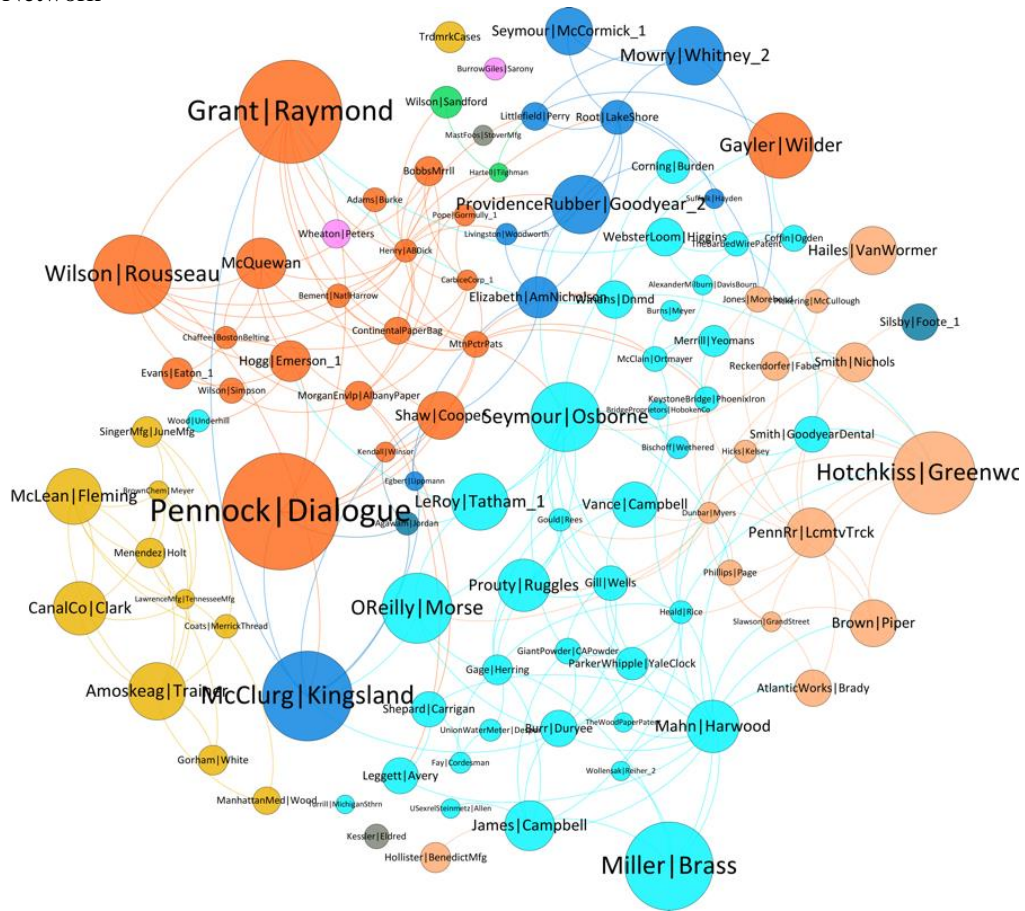
the centrality metrics to stagnate. One way to check whether this is so is to determine, for each of the top cases, the most recent year in which the case received an inward citation within this network. Among the Authority-Score top ten, the median year of most recent inward citation is 2009–10 (in a range from 2006 to 2017). Among the PageRank-Score top ten, the median year of most recent inward citation is 2013 (in a range from 1923 to 2019). And among the Betweenness-Score top ten, the median year of most recent inward citation is 2009–10 (in a range from 1966 to 2019). Among all 30 of the cases, only five of the most recent inward citation years are from before 2003, and 15 are from after 2010 (with nine from after 2016). It does not appear, then, that the Court’s citations to these top cases stagnated after 1954.

Figure 14: Top 103 Cases, by Authority Score, in the 1822–2019 Citation Network



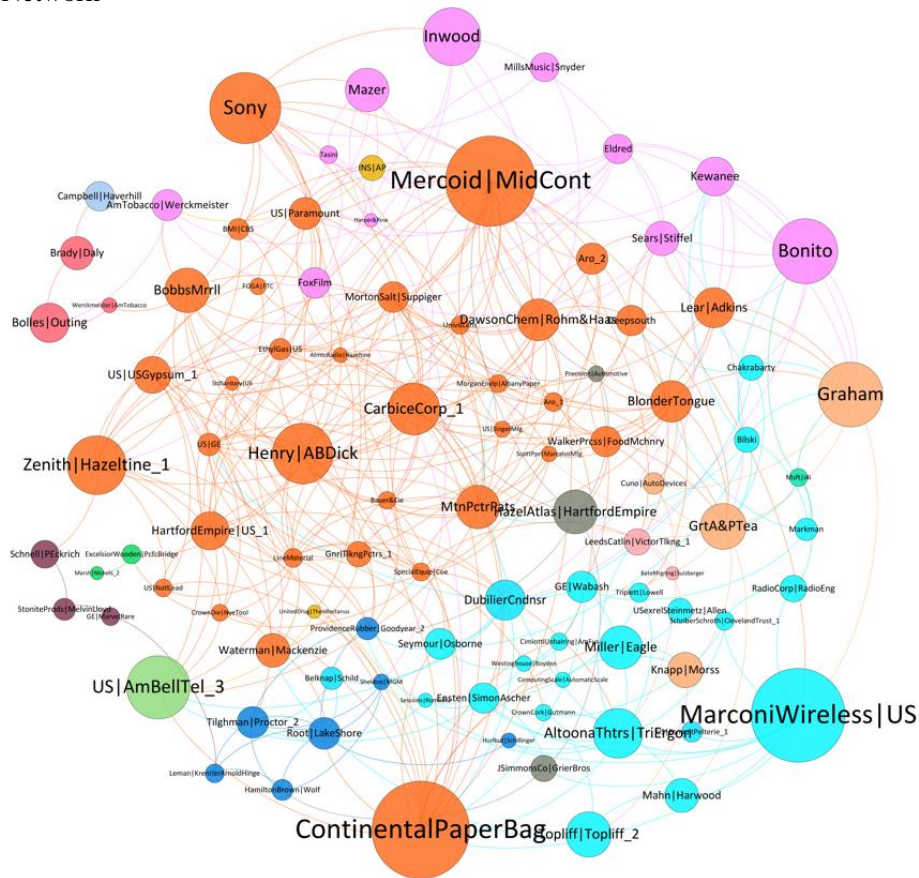
Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Authority Score.

Figure 15: Top 100 Cases, by PageRank Score, in the 1822–2019 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by PageRank Score.

Figure 16: Top 100 Cases, by Betweenness Score, in the 1822–2019 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score.

The foregoing series of five snapshots indicates that, in the full sweep of more than two centuries of Supreme Court IP jurisprudence, the 1922–1954 period was a pivotal one. Specifically, the knowledge stock of the Court’s IP cases shifted decisively, as a consequence of those three decades of decisions, to focus on the overlap between patent and antitrust law principles and doctrines, especially in the licensing context. That this decisive shift happened in a single 32-period is all the more remarkable, given that the pattern it established is still largely in place.

To zoom in more closely on that crucial period, one can measure and map the citation network of the IP cases decided from 1922 to 1954. The resulting slice of network time confirms the centrality of patent & antitrust cases to that era, and thus to our own. The 1922–1954 network’s 196 outciting cases yield a

network with 1309 nodes and 2409 edges. Table 7 reports the top ten cases in the network, by centrality score.

One, and only one, case is among the top ten by every metric—*Carbice Corp. v. American Patents Development Corp.* (1931)—and it is a patent misuse case. Moreover, every case in the top ten by Authority Score is either an antitrust enforcement case (*Ethyl Gasoline, General Electric, Standard Sanitary, United Shoe*) or a patent misuse case (*Motion Picture Patents, Carbice Corp., Boston Store of Chicago, Straus v. Victor, Morton Salt, and Bauer & Cie*). Such cases also pervade the top ten PageRank-Score list (*Carbice Corp., Motion Picture Patents, Morton Salt*) and the top ten Betweenness-Score list (*Mercoid v. Mid-Continent Investment Corp., Hartford-Empire, and Carbice Corp.*). Figures 17 through 19 map the nodes with the top centrality scores for the 1922–1954 period.<sup>69</sup>

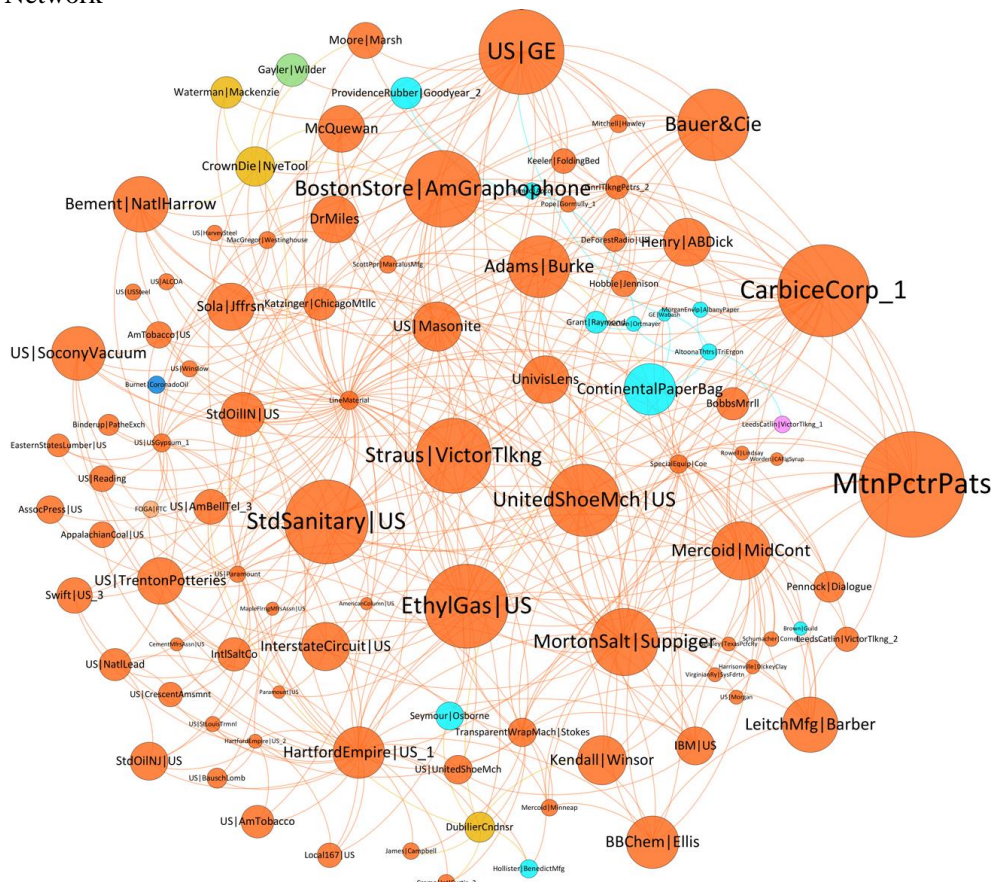
Table 7. Top Ten Cases in the 1922–1954 Citation Network, Using Three Centrality Metrics

<i>Centrality Metrics for Ranking</i>			
<i>Rank</i>	<i>Authority Score</i>	<i>PageRank Score</i>	<i>Betweenness Score</i>
1	Motion Picture Patents v. Universal Film Mfg. Co. (1917)	Hazel-Atlas v. Hartford (1944)	Mercoid v. Mid-Continent Inv. Corp. (1944)
2	Carbice Corp. v. Am. Pats. (1931)	Carbice Corp. v. Am. Pats. (1931)	Marconi Wireless v. United States (1943)
3	United States Gen. Elec. (1926)	Motion Picture Patents v. Universal Film Mfg. Co. (1917)	Altoon Publix Thtrs. (1935)
4	Ethyl Gasoline v. United States (1940)	Cuno v. Automatic Devs. (1941)	Hartford-Empire v. United States (1945)
5	Standard Sanitary v. United States (1912)	Hollister v. Benedict (1885)	Gen. Elec. v. Wabash Appl. (1938)
6	Bos. Store of Chi. v. Am. Graph. (1918)	Morton Salt v. Suppiger (1942)	Hazel-Atlas v. Hartford (1944)
7	Straus v. Victor Talking (1917)	McClain v. Ortmyer (1891)	Radio Corp. v. Radio Eng'g (1934)
8	United Shoe v. United States (1922)	Alexander Mil'n v. Davis (1926)	Schriber v. Cleveland (1938)
9	Bauer & Cie v. O'Donnell (1913)	Altoon Publix Thtrs. (1935)	Carbice Corp. v. Am. Pats. (1931)
10	Morton Salt v. Suppiger (1942)	Bourjois & Co. v. Katzel (1923)	United States v. Esnault-Pelterie (1936)

Notes: One case, *Carbice Corp. v. American Patents Development Corp.* (1931), is among the top ten cases by all three centrality metrics.

69. See Figures 17 & 19.

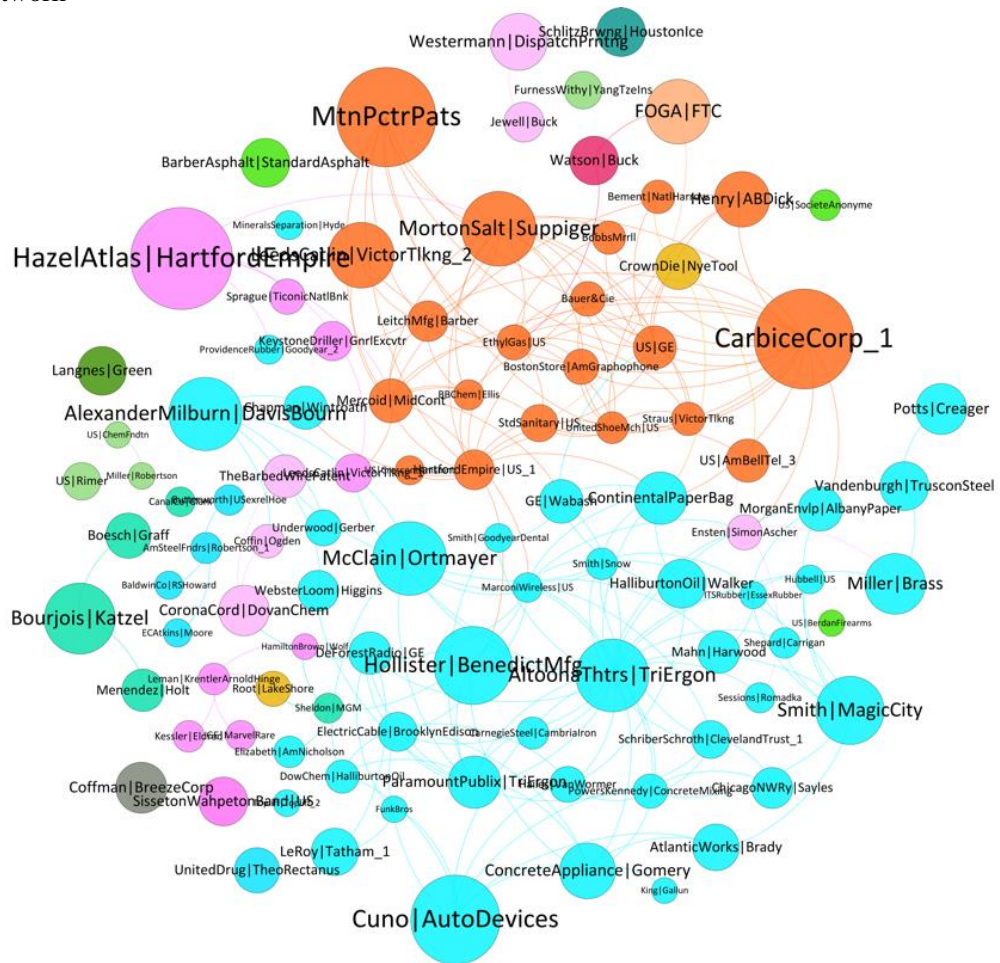
Figure 17: Top 100 Cases, by Authority Score, in the 1922–1954 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Authority Score.

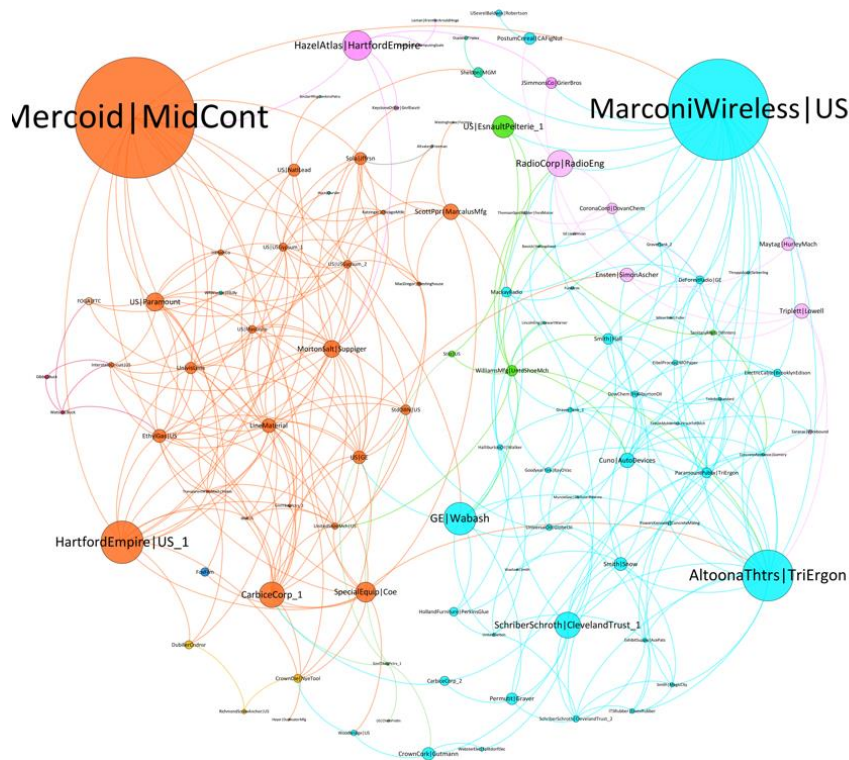


Figure 18: Top 103 Cases, by PageRank Score, in the 1922–1954 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by PageRank Score.

Figure 19: Top 101 Cases, by Betweenness Score, in the 1922–1954 Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score.

## 2. Centrality Metrics Through Time

Another vantage point from which to view the Supreme Court's IP citation network is by centrality metric, comparing different timespans. In light of the foregoing snapshots, there are three timespans as to which comparison seems most fruitful: 1822 to 1922, 1822 to 1954, and 1822 to 2019. Tables 8 and 9 show the top 20 for Authority Score and PageRank Score, respectively.

In the Authority Score table, all of the cases in the 1822–1922 network are from the 1800s, whereas only three of the cases in the 1822–1954 and 1822–2019 networks are. A dagger (†) marks antitrust cases and an asterisk (\*) marks patent-misuse cases. Sixteen of the top 20 (80%) in the 1822–1954 network fall in the two groups, as do 16 of the top 20 (80%) in the 1822–2019 network. Moreover, the top two, *Motion Picture Patents* and *Carbice Corp.*,<sup>70</sup> are the

70. *Carbice Corp.*, 283 U.S. 27 (1931); *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502 (1917).

same in both 1954 and 2019. The marked shift to a focus on patent & antitrust, observable in 1954, remains in 2019. In 2019, six of the patent & antitrust cases (38%) come from a *single* decade, the 1940s; in 1954, four (25%) do.

Table 8. Top 20 Cases by Authority Score in the 1822–1922, 1822–1954, and 1822–2019 Citation Networks

Rank	Authority Score Metric		
	1822–1922 Network	1822–1954 Network	1822–2019 Network
1	Miller v. Bridgeport Brass (1882)	Motion Picture Patents v. Universal Film Mfg. Co. (1917)*	Motion Picture Patents v. Universal Film Mfg. Co. (1917)*
2	James v. Campbell (1882)	Carbice Corp. v. Am. Pats. (1931)*	Carbice Corp. v. Am. Pats. (1931)*
3	Gill v. Wells (1874)	Standard Sanitary v. United States (1912)†	Ethyl Gasoline v. United States (1940)†
4	Mahn v. Harwood (1884)	Straus v. Victor Talking (1917)*	Morton Salt v. Suppiger (1942)*
5	Atl. Works v. Brady (1883)	Bauer & Cie v. O'Donnell (1913)*	Mercoide v. Mid-Continent Inv. Corp. (1944)*
6	Prouty v. Ruggles (1842)	United States v. Gen. Elec. (1926)†	Bauer & Cie v. O'Donnell (1913)*
7	Brown v. Piper (1875)	Bos. Store of Chi. v. Am. Graph. (1918)*	Adams v. Burke (1873)
8	Heald v. Rice (1882)	Cont'l Paper Bag v. E. Paper Bag Co. (1908)	Henry v. A.B. Dick Co. (1912)*
9	Giant Pwdr. v. Cal. Pwdr. (1878)	Ethyl Gasoline v. United States (1940)†	United States v. Gen. Elec. (1926)†
10	Seymour v. Osborne (1871)	Bement v. Nat'l Harrow (1902)*	Straus v. Victor Talking (1917)*
11	Hotchkiss v. Greenwood (1851)	Adams v. Burke (1873)	Standard Sanitary v. United States (1912)†
12	Penn. R.R. v. Locomotive (1884)	United Shoe v. United States (1922)†	Cont'l Paper Bag v. E. Paper Bag Co. (1908)
13	Dunbar v. Myers (1876)	Bloomer v. McQuewan (1853)	United States v. Univis Lens (1942)†
14	Smith v. Nichols (1875)	Henry v. A.B. Dick Co. (1912)*	Bloomer v. McQuewan (1853)
15	Hailes v. Van Wormer (1874)	Morton Salt v. Suppiger (1942)*	Bos. Store of Chi. v. Am. Graph. (1918)*
16	Slawson v. Grand St. (1883)	Dr. Miles v. J.D. Park (1911)*	United Shoe v. United States (1922)†
17	Gould v. Rees (1872)	Kendall v. Winsor (1859)	Bement v. Nat'l Harrow (1902)*
18	Burr v. Duryee (1864)	Mercoide v. Mid-Continent Inv. Corp. (1944)*	Kendall v. Winsor (1859)
19	Reckendorfer v. Faber (1876)	Leitch Mfg. v. Barber (1938)*	United States v. Masonite Corp. (1942)†
20	Vance v. Campbell (1862)	United States v. Socony-Vacuum (1940)†	Sola v. Jefferson (1942)*

Notes: There are 17 cases that appear in the top 20 for both the 1822–1954 and 1822–2019 networks. Three 1954-network cases—*Dr. Miles*, *Leitch*, and

*Socony-Vacuum*—drop off in favor of three 2019-network cases—*Univis Lens*, *Masonite*, and *Sola Electric v. Jefferson Electric*. In this table, a dagger (†) marks antitrust enforcement cases and an asterisk (\*) marks patent-misuse-doctrine cases.<sup>71</sup>

In the PageRank Score table, two things, beyond the case identities themselves, are notable. First, *all* the cases are from the 1800s, even in the top 20 cases for the 1822–2019 network. Second, the lists are remarkably stable over time. The first 12 cases in all three lists are the same, though there are some changes in rank order. Among the last eight cases in each list, six are common to all three lists but in differing orders. In other words, in all the lists, 18 of the top 20 cases (90%) are the same. These cases are truly the classics of the Supreme Court’s 210-year IP jurisprudence to date. And they are living, not dead, classics: The median year of most recent inward citation among the 1822–2019 network’s PageRank Score top 20 is 2005/06 (in a range from 1920 to 2019), and ten of the top 20 have a most-recent-inward-citation year after 2003.

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71. *Sola Elec. Co. v. Jefferson Elec. Co.*, 317 U.S. 173 (1942); *United States v. Masonite Corp.*, 316 U.S. 265 (1942); *United States v. Univis Lens Co.*, 316 U.S. 241 (1942); *United States v. Socony-Vacuum Oil Co.*, 310 U.S. 150 (1940); *Leitch Mfg. v. Barber Co.*, 302 U.S. 458 (1938); *Dr. Miles Med. Co. v. John D. Park & Sons Co.*, 220 U.S. 373 (1911).

Table 9. Top 20 Cases by PageRank Score in the 1822–1922, 1822–1954, and 1822–2019 Citation Networks

Rank	PageRank Score Metric		
	1822–1922 Network	1822–1954 Network	1822–2019 Network
1	Pennock v. Dialogue (1829)	Pennock v. Dialogue (1829)	Pennock v. Dialogue (1829)
2	Grant v. Raymond (1832)	Grant v. Raymond (1832)	Grant v. Raymond (1832)
3	McClurg v. Kingsland (1843)	Miller v. Bridgeport Brass (1882)	McClurg v. Kingsland (1843)
4	Miller v. Bridgeport Brass (1882)	McClurg v. Kingsland (1843)	Miller v. Bridgeport Brass (1882)
5	Wilson v. Rousseau (1846)	Wilson v. Rousseau (1846)	Hotchkiss v. Greenwood (1851)
6	Hotchkiss v. Greenwood (1851)	Hotchkiss v. Greenwood (1851)	Wilson v. Rousseau (1846)
7	Seymour v. Osborne (1871)	Seymour v. Osborne (1871)	O'Reilly v. Morse (1854)
8	O'Reilly v. Morse (1854)	O'Reilly v. Morse (1854)	Seymour v. Osborne (1871)
9	Gayler v. Wilder (1851)	Gayler v. Wilder (1851)	Gayler v. Wilder (1851)
10	Amoskeag v. Trainer (1879)	Mowry v. Whitney (1872) (#2)	Mowry v. Whitney (1872) (#2)
11	Mowry v. Whitney (1872) (#2)	Providence Rubber v. Goodyear (1870)	Providence Rubber v. Goodyear (1870)
12	Providence Rubber v. Goodyear (1870)	Amoskeag v. Trainer (1879)	Amoskeag v. Trainer (1879)
13	Prouty v. Ruggles (1842)	McLean v. Fleming (1878)	Le Roy v. Tatham (1853)
14	McLean v. Fleming (1878)	Mahn v. Harwood (1884)	McLean v. Fleming (1878)
15	Penn. R.R. v. Locomotive (1884)	Del. Canal v. Clark (1871)	Del. Canal v. Clark (1871)
16	Seymour v. McCormick (1853)	Prouty v. Ruggles (1842)	Mahn v. Harwood (1884)
17	Brown v. Piper (1875)	James v. Campbell (1882)	Prouty v. Ruggles (1842)
18	James v. Campbell (1882)	Le Roy v. Tatham (1853)	Bloomer v. McQuewan (1853)
19	Del. Canal v. Clark (1871)	Penn. R.R. v. Locomotive (1884)	James v. Campbell (1882)
20	Mahn v. Harwood (1884)	Hailes v. Van Wormer (1874)	Penn. R.R. v. Locomotive (1884)

Notes: Each of the three lists has a pair of cases that do not match the other two. The 1922 list has *Seymour v. McCormick* and *Brown v. Piper*; the 1954 list has *Le Roy v. Tatham* and *Hailes v. Van Wormer*; and the 2019 list has *Le Roy v.*

*Tatham* and *Bloomer v. McQuewan*. In this table, a dagger (†) marks antitrust enforcement cases and an asterisk (\*) marks patent-misuse-doctrine cases.<sup>72</sup>

With the Betweenness Score metric, there is neither the stability of the PageRank Score lists nor the pronounced and durable shift of the Authority Score lists to patent & antitrust cases. There are, however, two cases with consistently high Betweenness Scores. First, *Continental Paper Bag Co. v. Eastern Paper Bag Co.* (1908)<sup>73</sup> was the top-ranked Betweenness-Score case in the 1954, 1986, and 2019 network snapshots (Tables 4, 5, & 6), and it was the second-ranked Betweenness-Score case in the 1922 network (Table 3). The Supreme Court's most recent citation to *Continental Paper Bag* is in *eBay, Inc. v. MercExchange, LLC*.<sup>74</sup> Second, *Mercoid Corp. v. Mid-Continent Investment Corp.* (1944)<sup>75</sup>—a patent misuse case—was the second or third-ranked Betweenness Score case in the 1954, 1986, and 2019 network snapshots (Tables 4, 5, & 6). The Supreme Court's most recent citation to *Mercoid Corp. v. Mid-Continent Investment Corp.* is in *Quanta Computer, Inc. v. LG Electronics, Inc.*<sup>76</sup>

### C. The Co-Citation Networks

“Bibliometric networks,” such as co-citation networks, “provide a useful approach for understanding the relational structure of knowledge within a discipline, typically through examining the strength of relationships between authors, articles, journals, or topics.”<sup>77</sup> Here, snapshots of the co-citation network among the Supreme Court's IP cases show, from the bottom up, how the cases cluster into groups. Moreover, because co-citation patterns can change as new cases add new frequency counts to co-cited pairs, or create new co-citation pairs, this analytic method sheds new light on the pace and direction of doctrinal change (even if only retrospectively).

In a co-citation network, the nodes signify texts and the edges that connect them join them in pairs (showing that one later thing cited both earlier things). In contrast to a citation network, then, a co-citation network is undirected. Moreover, the edges in a co-citation network vary in weight score, or *edge weight*, indicating how often the joined pair of nodes is co-cited in the underlying citation network;<sup>78</sup> in the underlying case citation network, every edge has the same weight—namely, one. Each co-citation node also has, as a result, a *Weighted Degree* score, which is equal to the sum of the weights of the edges

72. *Brown v. Piper*, 87 U.S. 37 (1875); *Hailes v. Van Wormer*, 87 U.S. (20 Wall.) 353 (1874); *Seymour v. McCormick*, 57 U.S. (How.) 480 (1854); *Bloomer v. McQuewan*, 55 U.S. (14 How.) 539 (1853); *Le Roy v. Tatham*, 55 U.S. (14 How.) 156 (1853).

73. *Cont'l Paper Bag Co. v. E. Paper Bag Co.*, 210 U.S. 405 (1908).

74. 547 U.S. 388, 393 (2006).

75. *Mercoid Corp. v. Mid-Continent Inv. Corp.*, 320 U.S. 405 (1908).

76. 553 U.S. 617, 635 (2008).

77. Victor et al., *supra* note 23, at 12–13.

78. Todeschini & Baccini, *supra* note 22, at 40–41.

connected to that node.<sup>79</sup> One can also compute a Betweenness Score for a co-citation network's nodes.

I derived the co-citation networks examined here from the citation-network nodes with an in-degree score of two or above. I present the co-citation network data in two ways, first by successive snapshots in time, and then by Weighted Degree and Betweenness Scores over time. In addition, for each co-citation snapshot in time, I provide force-directed-layout maps of the top 100 nodes for the Weighted Degree and Betweenness.

### 1. Snapshots in Time

The first co-citation snapshot covers the 1822 to 1890 timespan. That period yields a co-citation network of 172 nodes and 1532 edges, where the edges have weights from one to nine and the nodes have Weighted Degree Scores from 1 to 111 (as Table 1, above, reports). Table 10 reports the top ten cases, in rank order, by Weighted Degree Score and Betweenness Score. Three cases appear on both lists: *Atlantic Works v. Brady* (1883), *Gill v. Wells* (1874), and *Phillips v. Page* (1860).<sup>80</sup> Figures 20 and 21 map the nodes with the top Weighted Degree and Betweenness Scores, respectively. The nodes cluster more plainly in these co-citation maps, relative to the citation networks for the same time span. Figure 20 shows there are five distinct clusters—two larger clusters, in blue and orange, and three smaller clusters above them. The top ten by weighted degree are spread among the three largest clusters (*i.e.*, blue, orange, and pink), though five of the cases—*Atlantic Works*, *Hotchkiss*, *Slawson*, *Phillips v. Page*, and *Smith v. Nichols*—are in the blue cluster.<sup>81</sup>

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79. Alirezi Abbasi, *h-Type Hybrid Centrality Measures for Weighted Networks*, 96 SCIENTOMETRICS 633, 635–36 & tbl.1 (2013).

80. *Atl. Works v. Brady*, 107 U.S. 192 (1883); *Gill v. Wells*, 89 U.S. 1 (1874); *Phillips v. Page*, 65 U.S. 164 (1860); *see infra* Table 10.

81. *Brady*, 107 U.S. at 192; *Hotchkiss v. Greenwood* 52 U.S. 248 (1851); *Phillips*, 65 U.S. at 164; *Smith v. Nichols*, 88 U.S. 112 (1875); *see infra* Table 10.

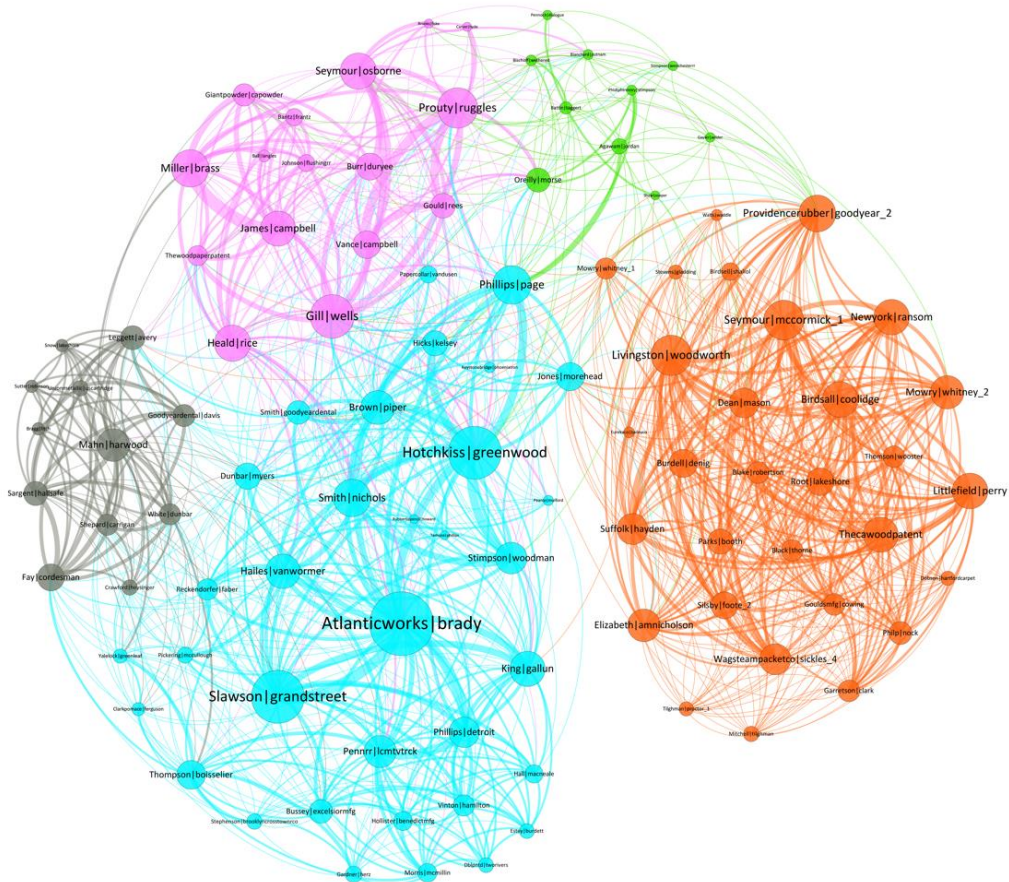
Table 10. Top Ten Cases in the 1822–1890 Co-Citation Network, Using Two Centrality Metrics

<i>Rank</i>	<i>Centrality Metrics for Ranking</i>	
	<i>Weighted Degree Score</i>	<i>Betweenness Score</i>
1	ATL. WORKS v. BRADY (1883)	Mowry v. Whitney (1872) (#1)
2	Hotchkiss v. Greenwood (1851)	Jones v. Morehead (1863)
3	Slawson v. Grand St. R.R. (1883)	Elizabeth v. Am. Nicholson Pavement (1878)
4	GILL v. WELLS (1874)	Providence Rubber v. Goodyear (1870)
5	Livingston v. Woodworth (1853)	Seymour v. Osborne (1871)
6	Prouty v. Ruggles (1842)	Littlefield v. Perry (1875)
7	Seymour v. McCormick (1853)	ATL. WORKS v. BRADY (1883)
8	PHILLIPS v. PAGE (1860)	PHILLIPS v. PAGE (1860)
9	Miller v. Bridgeport Brass (1882)	Wilson v. Sandford (1851)
10	Smith v. Nichols (1875)	GILL v. WELLS (1874)

Notes: Three cases appear in both top ten lists; the three are indicated with boldface type.

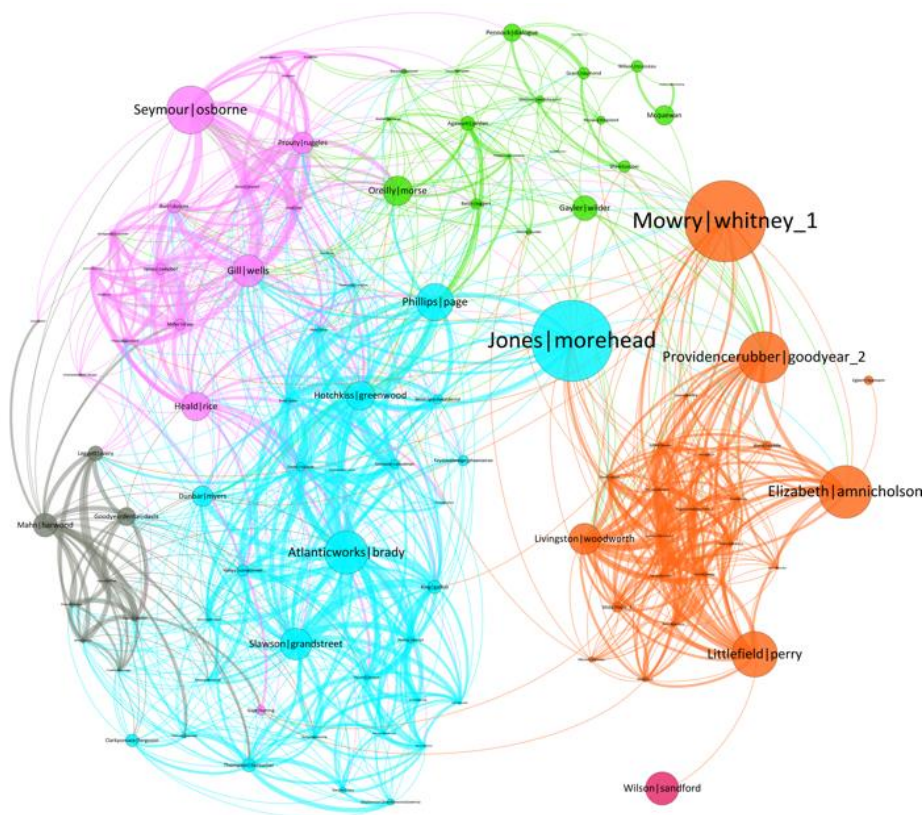


Figure 20: Top 102 Cases, by Weighted Degree Score, in the 1822–1890 Co-Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Weighted Degree Score, and edge thickness varies by weight. All ten of the top-ranked nodes by weight are in the three clusters in the left of the figure.

Figure 21: Top 102 Cases, by Betweenness Score, in the 1822–1890 Co-Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score, and edge thickness varies by weight.

The second co-citation snapshot covers the 1822 to 1922 span. That period yields a co-citation network of 438 nodes and 5305 edges, where the edges have weights from 1 to 13 and the nodes have Weighted Degree Scores from 1 to 183. Table 11 reports the top ten cases, in rank order, by Weighted Degree Score and Betweenness Score. There is a good bit of change from the 1890 snapshot. In both top ten lists, only three of the cases from 1890 appear in 1922, and in different rank order: for Weighted Degree, *Atlantic Works*, *Prouty*, and *Miller*; and for Betweenness, *Elizabeth*, *Providence Rubber*, and *Seymour*.<sup>82</sup> Four cases appear on both lists and are shown in bold. Figures 22 and 23 map the nodes with the top Weighted Degree and Betweenness Scores, respectively.

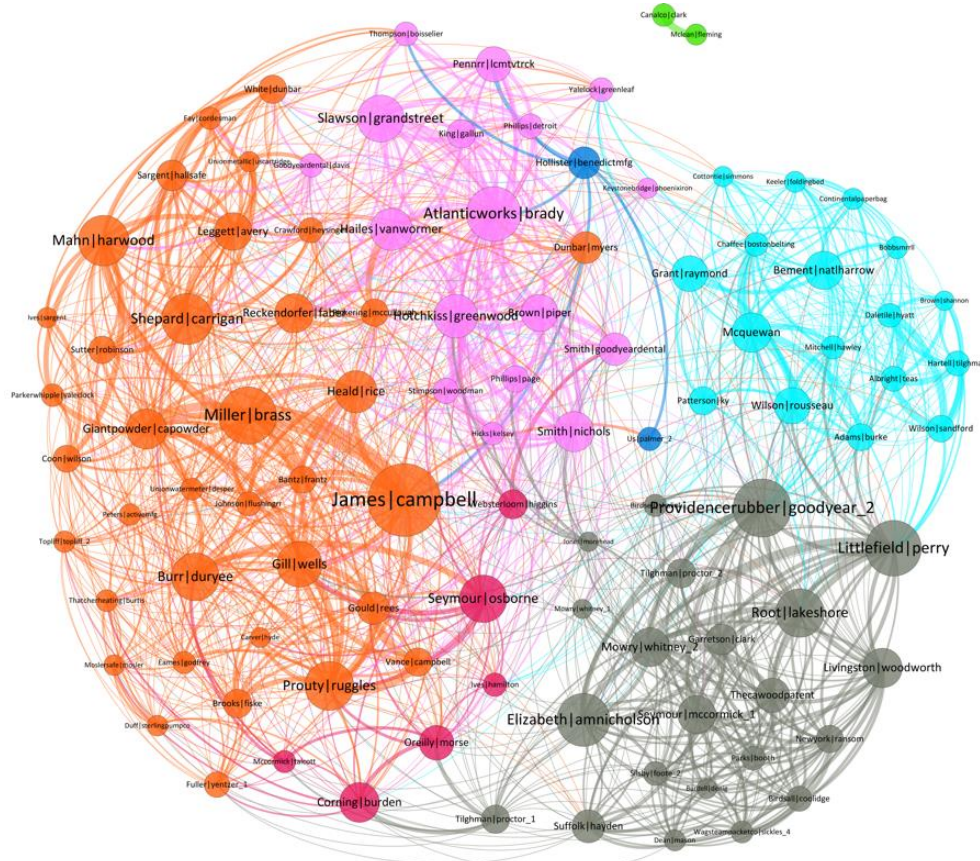
82. *Brady*, 107 U.S. at 192; *Miller v. Bridgeport Brass*, 104 U.S. 350 (1882); *Elizabeth v. Am. Nicholson Pavement*, 97 U.S. 126 (1878); *Providence Rubber Co. v. Goodyear*, 73 U.S. 153 (1870); *Seymour v. McCormick*, 57 U.S. 480 (1853); *Prouty v. Ruggles*, 41 U.S. 336 (1842); see *infra* Table 11.

Table 11. Top 10 Cases in the 1822–1922 Co-Citation Network, Using Two Centrality Metrics

Rank	Centrality Metrics for Ranking	
	Weighted Degree Score	Betweenness Score
1	JAMES V. CAMPBELL (1882)	Am. Constr. Co. v. Jacksonville Ry. (1893)
2	PROVIDENCE RUBBER V. GOODYEAR (1870)	JAMES V. CAMPBELL (1882)
3	Miller v. Bridgeport Brass (1882)	Stanley v. Schwalby (1893)
4	Littlefield v. Perry (1875)	PROVIDENCE RUBBER V. GOODYEAR (1870)
5	Atl. Works v. Brady (1883)	Estey v. Burdett (1884)
6	<b>ELIZABETH V. AM. NICHOLSON PAVEMENT (1878)</b>	<b>ELIZABETH V. AM. NICHOLSON PAVEMENT (1878)</b>
7	Shepard v. Carrigan (1886)	Seymour v. Osborne (1871)
8	Mahn v. Harwood (1884)	Grant v. Raymond (1832)
9	Prouty v. Ruggles (1842)	Bement v. Nat'l Harrow (1902)
10	ROOT V. LAKE SHORE RY. (1882)	ROOT V. LAKE SHORE RY. (1882)

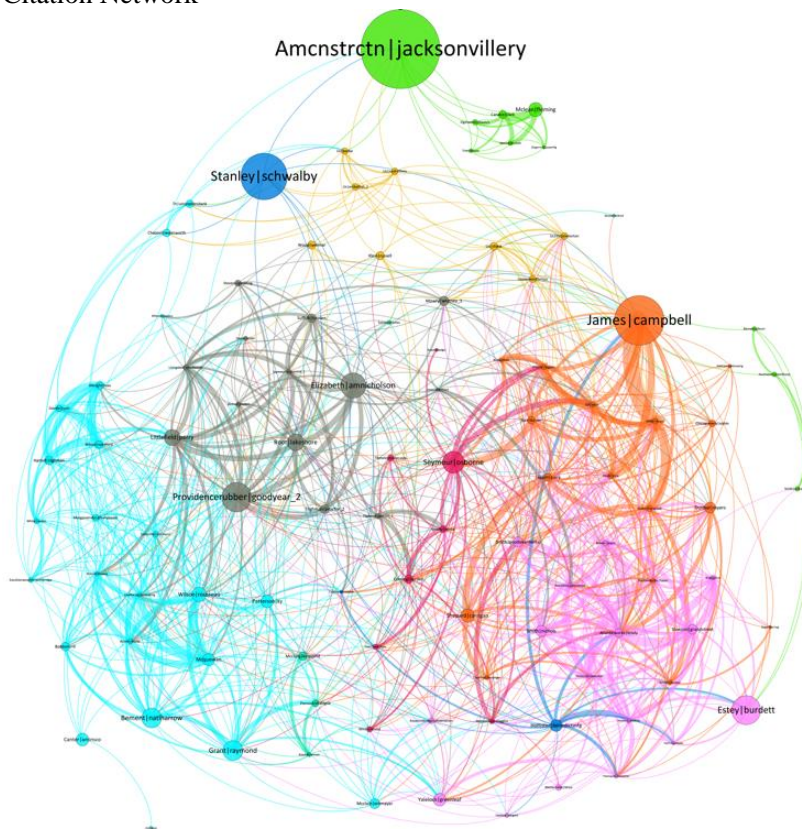
Notes: Four cases appear in both top ten lists; the four are indicated with boldface type.

Figure 22: Top 102 Cases, by Weighted Degree Score, in the 1822–1922 Co-Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Weighted Degree Score, and edge thickness varies by weight.

Figure 23: Top 104 Cases, by Betweenness Score, in the 1822–1922 Co-Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score, and edge thickness varies by weight.

The third co-citation snapshot covers the 1822 to 1954 span. That period yields a co-citation network of 767 nodes and 14989 edges, where the edges have weights from 1 to 14 and the nodes have Weighted Degree Scores from 1 to 402. Table 12 reports the top ten cases, in rank order, by Weighted Degree Score and Betweenness Score. Five cases appear on both lists and are shown in bold. Again, change is evident from the fact that only two of the 1922 top ten by Weighted Degree—*James v. Campbell* and *Providence Rubber*—appear in the 1954 top ten. (There is more continuity in the Betweenness top ten, which carries over not only *James* and *Providence Rubber*, but also *Seymour* and *Grant*.)<sup>83</sup>

83. *Providence Rubber*, 73 U.S. at 153; *Seymour*, 57 U.S. at 480; *James v. Campbell*, 104 U.S. 356 (1882); *Grant v. Raymond*, 31 U.S. 218 (1832); see *infra* Table 12.

Recall, most importantly, the shift to patent & antitrust cases, manifest in the underlying citation network in 1954 (Table 4 above). That same shift is also manifest in the co-citation network's top ten cases by Weighted Degree. Five of the top ten are either antitrust enforcement cases (two, marked with a dagger (†)) or patent misuse cases (three, marked with an asterisk (\*)).

Figures 24 and 25 map the nodes with the top Weighted Degree and Betweenness Scores, respectively. *Continental Paper Bag*<sup>84</sup> is the focal node, both in weight and betweenness. Although there are four clusters evident in Figure 24, the Weighted Degree Score map, the orange cluster on the left is more populous and more thickly interconnected in the map. Seven of the top ten cases, by Weighted Degree Score, are in the orange cluster: *Continental Paper Bag*, *Motion Picture Patents*, *Standard Sanitary*, *Bement*, *General Electric*, *Adams*, and *Straus*.<sup>85</sup> The left-hand cluster is, in other words, the patent & antitrust cluster. As the next two snapshots show, this 1954 Weighted Degree map sets a pattern that remains largely intact up to the present.

Table 12. Top Ten Cases in the 1822–1954 Co-Citation Network, Using Two Centrality Metrics

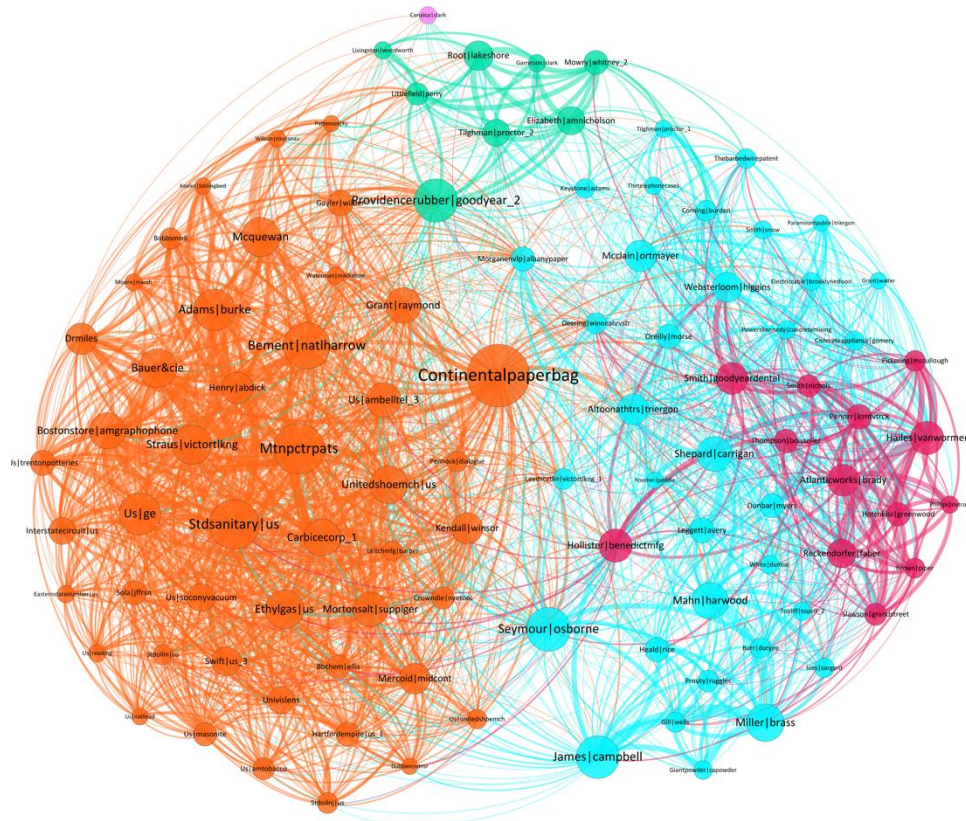
Rank	Centrality Metrics for Ranking	
	Weighted Degree Score	Betweenness Score
1	CONT'L PAPER BAG V. E. PAPER BAG CO. (1908)	CONT'L PAPER BAG V. E. PAPER BAG CO. (1908)
2	Motion Picture Patents v. Universal Film Mfg. Co. (1917)*	PROVIDENCE RUBBER V. GOODYEAR (1870)
3	Standard Sanitary v. United States (1912)†	JAMES V. CAMPBELL (1882)
4	BEMENT V. NAT'L HARROW (1902)*	SEYMOUR V. OSBORNE (1871)
5	SEYMOUR V. OSBORNE (1871)	Interior Constr. Co. v. Gibney (1895)
6	PROVIDENCE RUBBER V. GOODYEAR (1870)	BEMENT V. NAT'L HARROW (1902)*
7	JAMES V. CAMPBELL (1882)	Tilghman v. Proctor (1888)
8	United States v. Gen. Elec. (1926)†	Grant v. Raymond (1832)
9	Adams v. Burke (1873)	Hollister v. Benedict Mfg. (1885)
10	Straus v. Victor Talking (1917)*	Interstate Circuit v. United States (1939)†

Notes: Five cases appear in both top ten lists; the five are indicated with boldface type. In this table, a dagger (†) marks antitrust enforcement cases and an asterisk (\*) marks patent-misuse-doctrine cases.

*Figure 24:* Top 103 Cases, by Weighted Degree Score, in the 1822–1954 Co-Citation Network

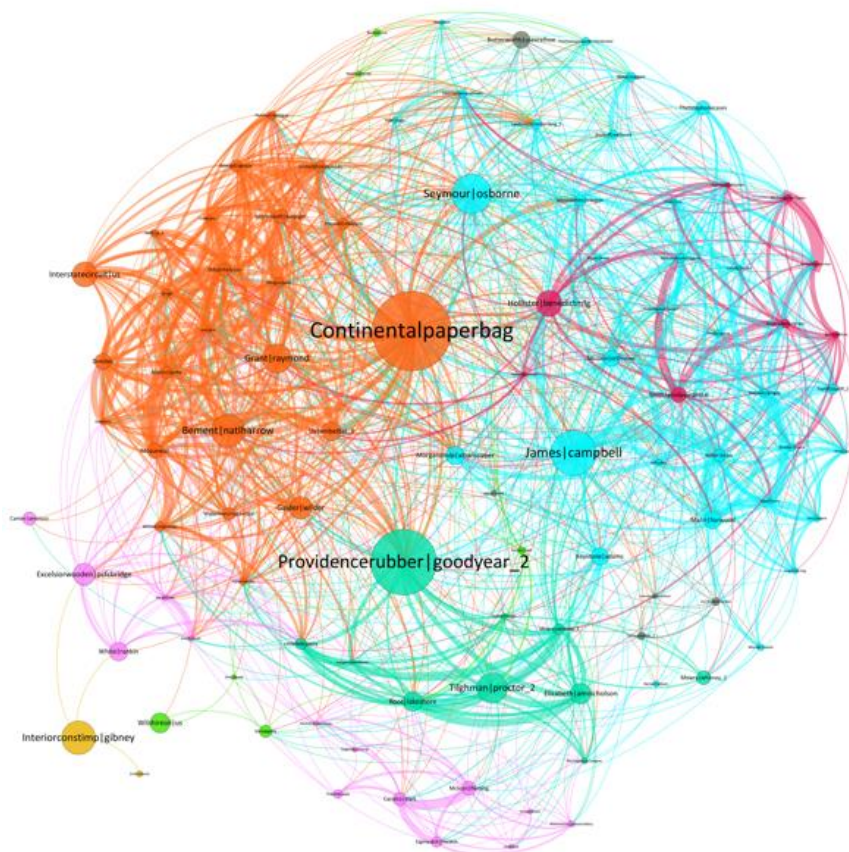
84. *Cont'l Paper Bag Co. v. E. Paper Bag Co.*, 210 U.S. 405 (1908).

85. *Cont'l Paper Bag*, 210 U.S. at 405; *United States v. Gen. Elec. Co.*, 272 U.S. 476 (1926); *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502 (1917); *Straus v. Victor Talking Mach. Co.*, 243 U.S. 490 (1917); *Standard Sanitary Mfg. Co. v. United States*, 226 U.S. 20 (1912); *Bement v. Nat'l Harrow Co.*, 186 U.S. 70 (1902); *Adams v. Burke*, 84 U.S. 453 (1873).



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Weighted Degree Score, and edge thickness varies by weight.

Figure 25: Top 101 Cases, by Betweenness Score, in the 1822–1954 Co-Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score, and edge thickness varies by weight.

The fourth co-citation snapshot covers the 1822 to 1986 span. That period yields a co-citation network of 885 nodes and 19012 edges, where the edges have weights from 1 to 16 and the nodes have Weighted Degree Scores from 1 to 475. Table 13 reports the top ten cases, in rank order, by Weighted Degree Score and Betweenness Score. Four cases appear on both lists, including the focal *Continental Paper Bag*.<sup>86</sup> There is less change in the Weighted Degree top ten, with five of the 1954 group carrying over to the 1986 group; all five are from the orange cluster in the 1954 map. The change that has occurred among the top ten cases by Weighted Degree Score makes the doctrinal importance of the patent & antitrust cases more pronounced. Five of the 1986 Weighted Degree top ten are patent misuse cases, and two are antitrust enforcement cases,

86. *Cont'l Paper Bag*, 210 U.S. at 405.



bringing the total to seven. And of those seven, four are from the 1930s and 1940s. Note, too, that seven of the top eight Weighted Degree top ten are patent & antitrust cases.

Figures 26 and 27 map the nodes with the top Weighted Degree and Betweenness Scores, respectively. *Continental Paper Bag*<sup>87</sup> remains the focal node in betweenness, but now a patent misuse case, *Motion Picture Patents*,<sup>88</sup> has the highest Weighted Degree Score. All the Weighted Degree top ten cases are in the orange cluster on the left. What were, in the 1954 map, four distinct clusters, have become two prominent clusters (orange, and blue) and two smaller groupings (green and gray). A map of the top 301 co-citation nodes by weighted degree, in Appendix B, looks much the same.

Table 13. Top 10 Cases in the 1822–1986 Co-Citation Network, Using Two Centrality Metrics

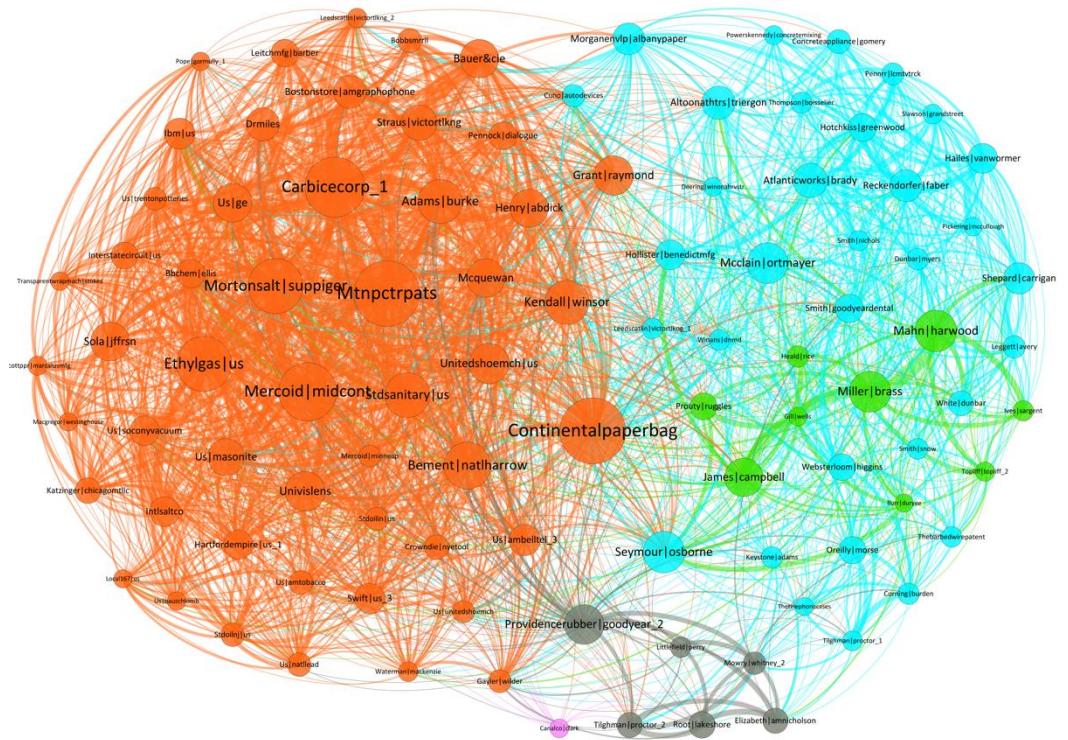
Rank	Centrality Metrics for Ranking	
	Weighted Degree Score	Betweenness Score
1	CONT'L PAPER BAG V. E. PAPER BAG CO. (1908)	CONT'L PAPER BAG V. E. PAPER BAG CO. (1908)
2	Motion Picture Patents v. Universal Film Mfg. Co. (1917)*	Providence Rubber v. Goodyear (1870)
3	Carbice Corp. v. Am. Pats. (1931)*	Grant v. Raymond (1832)
4	MERCOID V. MID-CONTINENT INV. CORP. (1944)*	James v. Campbell (1882)
5	Ethyl Gasoline v. United States (1940)†	Truly v. Wanzer (1847)
6	MORTON SALT V. SUPPIGER (1942)*	MERCOID V. MID-CONTINENT INV. CORP. (1944)*
7	Bement v. Nat'l Harrow (1902)*	Seymour v. Osborne (1871)
8	Standard Sanitary v. United States (1912)†	MORTON SALT V. SUPPIGER (1942)*
9	Adams v. Burke (1873)	United States v. Am. Bell Tel. (1888) (#1)
10	KENDALL V. WINSOR (1859)	KENDALL V. WINSOR (1859)

Notes: Four cases appear in both top 10 lists; the three are indicated with boldface type. In this table, a dagger (†) marks antitrust enforcement cases and an asterisk (\*) marks patent-misuse-doctrine cases.

87. *Id.*

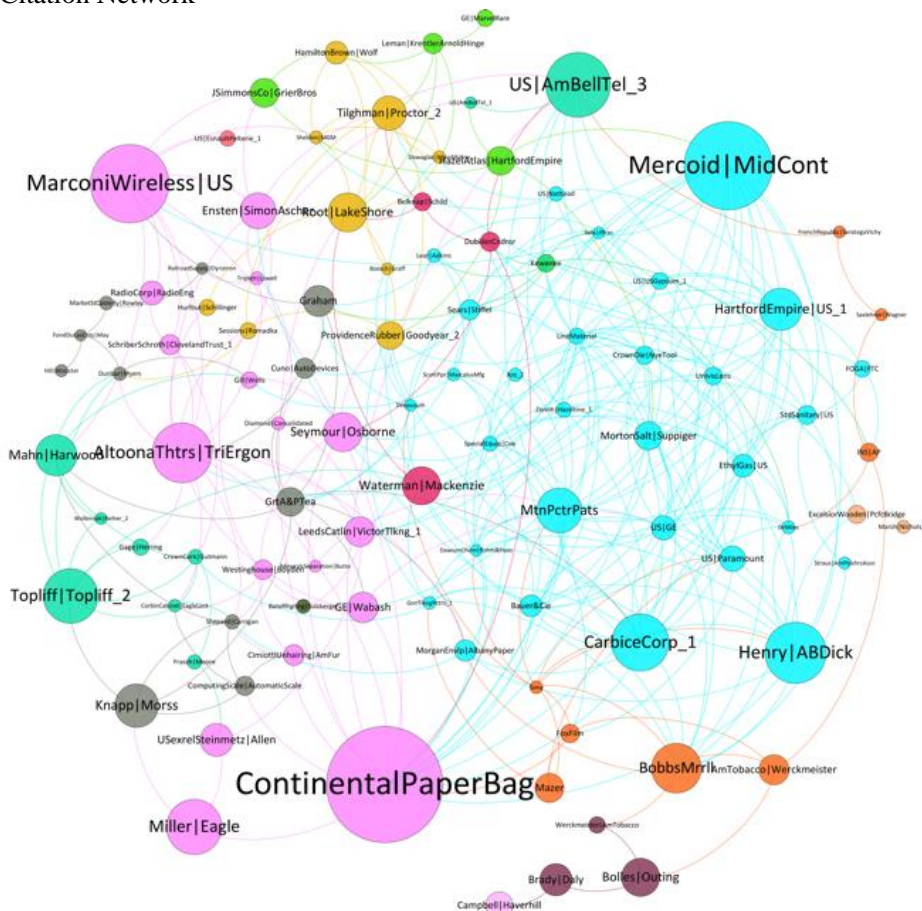
88. *Motion Picture Patents*, 243 U.S. at 502.

Figure 26: Top 100 Cases, by Weighted Degree Score, in the 1822–1986 Co-Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Weighted Degree Score, and edge thickness varies by weight.

Figure 27: Top 101 Cases, by Betweenness Score, in the 1822–1986 Co-Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score, and edge thickness varies by weight.

The fifth, and final, co-citation snapshot covers the 1822 to June 2019 span. That period yields a co-citation network of 1124 nodes and 24761 edges, where the edges have weights from 1 to 17 and the nodes have Weighted Degree Scores from 1 to 569. Table 14 reports the top ten cases, in rank order, by Weighted Degree Score and Betweenness Score. Five cases appear on both lists, including—again—the focal *Continental Paper Bag*.<sup>89</sup> There is little change in the Weighted Degree top ten, with seven of the 1986 group carrying over to the 2019 group. Indeed, the top six in 2019 are the same as the top six in 1986, with some changes in rank order. There are also seven of the 1986 Betweenness top ten in the 2019 Betweenness top ten, and the top three in both lists are the same

89. See Tables 13 and 14.

and in the same order. Some change, at least, is afoot: With the 2019 snapshot, *Grant v. Raymond* (1832)<sup>90</sup>—in the Betweenness top 10 in 1922, 1954, 1986, and now—appears, for the first time in the Weighted Degree top ten.<sup>91</sup> *Grant*, moreover, is *not* in the dominant patent & antitrust cluster that is home to seven of the top ten; it is, instead, the lead node of a cluster that emerges with the 2019 data (more of which below, in the next subsection).

Figures 28 and 29 map the nodes with the top Weighted Degree and Betweenness Scores, respectively. Despite the passage of 32 years since the 1986 snapshot, they tell much the same story as the co-citation network maps in Figures 26 and 27. The orange cluster has 23 of the top 35 cases (66%) by Weighted Degree Score, a veritable who's who of patent misuse and antitrust enforcement cases. All sixteen patent & antitrust cases that appear in the top 20 Authority Scores list of the underlying 2019 citation network, in Table 8 above, also appear in the co-citation network's top 35 by weighted degree, in the orange cluster.<sup>92</sup> A map of the top 305 co-citation nodes by weighted degree, in Appendix C, looks much the same.

Table 14. Top Ten Cases in the 1822–2019 Co-Citation Network, Using Two Centrality Metrics

Rank	Centrality Metrics for Ranking	
	Weighted Degree Score	Betweenness Score
1	Motion Picture Patents v. Universal Film Mfg. Co. (1917)*	CONT'L PAPER BAG V. E. PAPER BAG CO. (1908)
2	CONT'L PAPER BAG V. E. PAPER BAG CO. (1908)	Providence Rubber v. Goodyear (1870)
3	Carbice Corp. v. Am. Pats. (1931)*	GRANT V. RAYMOND (1832)
4	Mercoid v. Mid-Continent Inv. Corp. (1944)*	SEYMOUR V. OSBORNE (1871)
5	MORTON SALT V. SUPPIGER (1942)*	MORTON SALT V. SUPPIGER (1942)*
6	Ethyl Gasoline v. United States (1940)†	James v. Campbell (1882)
7	SEYMOUR V. OSBORNE (1871)	United States v. Am. Bell Tel. (1888) (#1)
8	Bement v. Nat'l Harrow (1902)*	Tilghman v. Proctor (1888)
9	GRANT V. RAYMOND (1832)	Graham v. John Deere (1966)
10	MCCLAIN V. ORTMAYER (1891)	MCCLAIN V. ORTMAYER (1891)

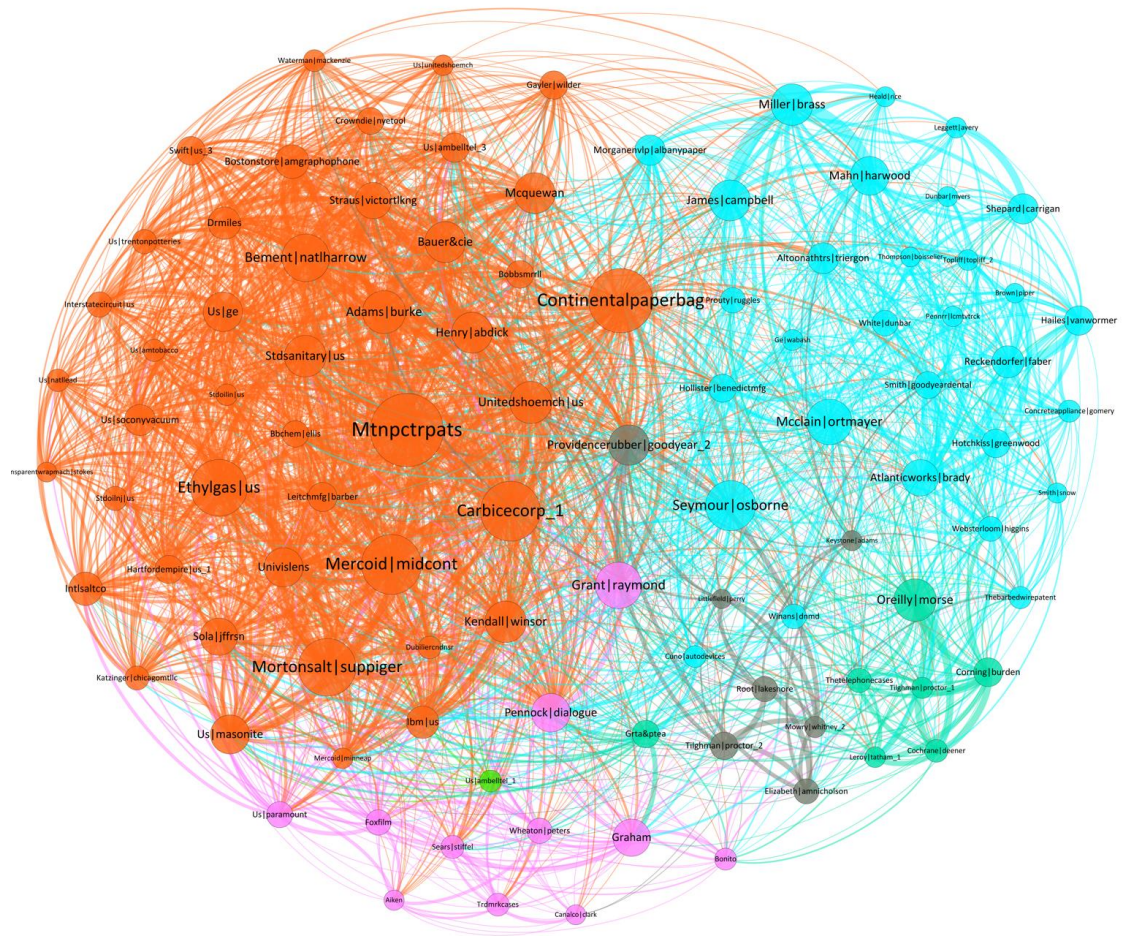
Notes: Five cases appear in both top 10 lists; the five are indicated with boldface type. In this table, a dagger (†) marks antitrust enforcement cases and an asterisk (\*) marks patent-misuse-doctrine cases.

*Figure 28: Top 100 Cases, by Weighted Degree Score, in the 1822–2019 Co-Citation Network*

90. See Table 14.

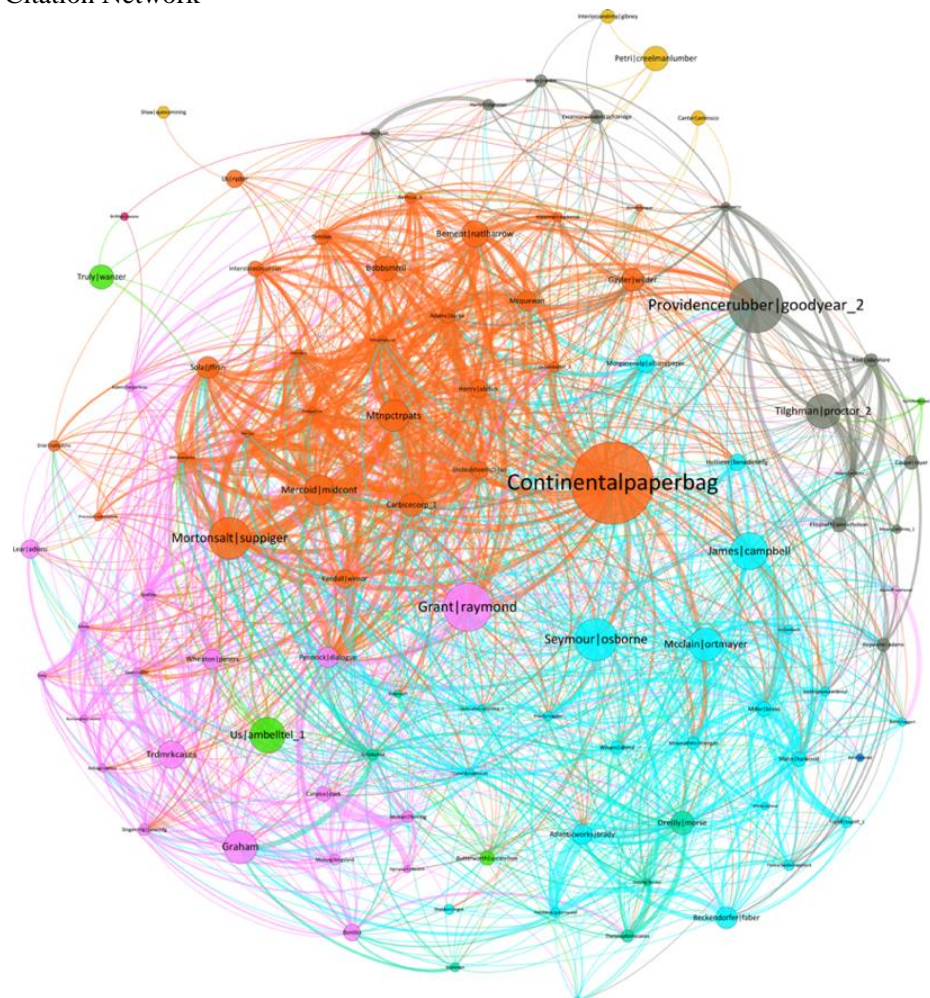
91. *Grant v. Raymond*, 31 U.S. 218 (1832). *Grant* was ranked 18<sup>th</sup> in Weighted Degree Score in 1986, 19<sup>th</sup> in 1954, 30<sup>th</sup> in 1922, and 103<sup>rd</sup> in 1890.

92. The only one missing from the top 30 by weighted degree, *Bos. Store of Chi. v. Am. Graphophone Co.* (1918), is ranked 35<sup>th</sup>.



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Weighted Degree Score, and edge thickness varies by weight.

Figure 29: Top 100 Cases, by Betweenness Score, in the 1822–2019 Co-Citation Network



Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Betweenness Score, and edge thickness varies by weight.

The co-citation network snapshots from 1954, 1986, and 2019 robustly confirm what the underlying citation network snapshots indicate. Within the whole of the Supreme Court's IP jurisprudence, the Court's patent & antitrust decisions, especially from the 1920s to the 1940s, make up a significant share of the knowledge stock that the totality of the IP cases' citation patterns reveals.

## 2. Centrality Metrics Through Time

The second vantage point from which to view the Supreme Court's IP co-citation network is by centrality metric, across different timespans. Taking

Betweenness Score centrality first, it is evident that—just as was true in the underlying citation networks—the *Continental Paper Bag*<sup>93</sup> case is the top scoring Betweenness case in the 1954, 1986, and 2019 co-citation snapshots. Moreover, *Seymour v. Osborne*,<sup>94</sup> which ranks second in Betweenness Score in those same three co-citation snapshots, was the top scoring Betweenness case in the 1890 and 1922 snapshots. These two cases, from a co-citation network perspective, are key flow points.

With respect to Weighted Degree Score, to chart the change in co-citation node centrality over time, it is useful to take a cue from the coherent clustering that the nodes display in the Weighted Degree Score maps (in Figures 20, 22, 24, 26, & 28). Each of these network visualizations shows that the cases cluster into about four or five groups. If, for each snapshot, one computes each constituent cluster's total Weighted Degree Score (*i.e.*, the sum of the cluster's member nodes' Weighted Degree Scores), it becomes evident that there are five major clusters at all five snapshot points. Table 15 reports—for all five points in time—the top five clusters' total weight, node count, and principal case. The clusters are listed in descending order of their lead cases' Weighted Degree.

Table 15. Top 5 Node Clusters, by Lead Node's Weighted Degree Score, in the 1822–1890, 1822–1922, 1822–1954, 1822–1986, and 1822–2019 Co-Citation Networks

Cluster & Rank	Cluster Characteristics		
	Total Weight	Node Count	Weightiest Case Node
1890, Cluster 1	1578	45	Atl. Works v. Brady (1883), wd = 111
1890, Cluster 2	863	33	Gills v. Wells (1874), wd = 76
1890, Cluster 3	1393	40	Livingston v. Woodworth (1853), wd = 70
1890, Cluster 4	435	14	Mahn v. Harwood (1884), wd = 57
1890, Cluster 5	338	29	O'Reilly v. Morse (1854), wd = 42
1922, Cluster 1	4150	83	James v. Campbell (1882), wd = 183
1922, Cluster 2	2306	41	Providence Rubber Co. v. Goodyear (1870), wd = 146
1922, Cluster 3	2156	54	Atl. Works v. Brady (1883), wd = 137
1922, Cluster 4	1091	32	Seymour v. Osborne (1871), wd = 119
1922, Cluster 5	2303	93	Bloomer v. McQuewan (1853), wd = 99
1954, Cluster 1	1311	151	Cont'l Paper Bag v. E. Paper Bag Co. (1908), wd = 402
1954, Cluster 2	1346	231	Seymour v. Osborne (1871), wd = 281
1954, Cluster 3	3201	53	Providence Rubber Co. v. Goodyear (1870), wd = 277
1954, Cluster 4	4404	68	Hailes v. Van Wormer (1874), wd = 213
1954, Cluster 5	2313	94	Del. & Hudson Canal Co. v. Clark (1871), wd = 110

93. Cont'l Paper Bag Co. v. E. Paper Bag Co., 210 U.S. 405 (1908).

94. Seymour v. Osborne, 78 U.S. (11 Wall.) 516 (1871).

1986, Cluster 1	1926	200	Cont'l Paper Bag v. E. Paper Bag Co. (1908), wd=475
	3		
1986, Cluster 2	1755	276	Seymour v. Osborne (1871), wd = 299
	0		
1986, Cluster 3	5089	97	Mahn v. Harwood (1884), wd = 299
1986, Cluster 4	4649	94	Providence Rubber Co. v. Goodyear (1870), wd = 285
1986, Cluster 5	2813	104	Del. & Hudson Canal Co. v. Clark (1871), wd = 133
2019, Cluster 1	2060	204	Motion Picture Patents Co. v. Universal Film Mfg. Co. (1917), wd=569
	5		
2019, Cluster 2	2065	299	Seymour v. Osborne (1871), wd = 389
	5		
2019, Cluster 3	7884	164	Grant v. Raymond (1832), wd = 359
2019, Cluster 4	3722	50	O'Reilly v. Morse (1854), wd = 329
2019, Cluster 5	6232	122	Providence Rubber Co. v. Goodyear (1870), wd = 313

Notes: A cluster's total weight is the sum of its member nodes' Weighted Degree Scores.

Taking this cluster-based approach, one can also array each snapshot's top five clusters, using the top 15 cases (by weighted degree) for each cluster, to visualize how the 2019 co-citation network's cluster emerged over time. Figure 30 presents this multi-stage view of the co-citation clusters, with the 2019 patent & antitrust co-citation cluster in the upper right corner (shaded pale blue). Assigning a color to each 2019 cluster's individual cases, arranging the snapshots from most current (2019) on the right to most remote (1890) on the left, and tracing each case using its 2019-group color backward and forward through time, the color bands show the 2019 clusters dispersing or coalescing. Similarly, by assigning a different color—a darker shade of blue—to the top three 1890 clusters' cases that would otherwise be unshaded, different bands show the dispersal and dropping away of all but one the 1890 clusters; the one that persists, from 1890 on, is in grey.



Figure 30: Top Four Case Clusters, in Descending Order by Principal Case’s Weighted Degree Score, in the 1822–1890, 1822–1922, 1822–1954, 1822–1986, and 1822–2019 Co-Citation Networks

ClusterRank	Top 15 cases, for a given time period				
	to1890	to1922	to1954	to1986	to2019
1	Atlanticworksbrady	James campbell	Continentalpaperbag	Continentalpaperbag	Mtnpctrpats
	Hotchkiss greenwood	Miller brass	Mtnpctrpats	Mtnpctrpats	Continentalpaperbag
	Slawson grandstreet	Shepard carrigan	Stdsanitary us	Carbicecorp_1	Carbicecorp_1
	Phillips page	Mahn harwood	Bement natharow	Mercoid midcont	Mercoid midcont
	Smith nichols	Prouty ruggles	Us lige	Ethylgas us	Mortonsalt suppiger
	King gallun	Burr duryee	Adams burke	Mortonsalt suppiger	Ethylgas us
	Hailes vanwormer	Gill wells	Straus victortlking	Bement natharow	Bement natharow
	Brown piper	Heald rice	Mcquewan	Stdsanitary us	Adams burke
	Pennr cmtvtrck	Giantpowder capowder	Bauer&cie	Adams burke	Unitedshoemchlus
	Stimpson woodman	Reckendorfer faber	Ethylgas us	Kendall winsor	Stdsanitary us
	Phillips detroit	Leggett lavery	Unitesshoemchlus	Unitesshoemchlus	Kendall winsor
	Thompson boisselier	Gould rees	Carbicecorp_1	Univistens	Mcquewan
	Jones morehead	Dunbar myers	Bostonstore amgraphophone	Grant raymond	Bauer&cie
	Dunbar myers	Sargent hallsafe	Grant raymond	Solaj frsn	Henry abdick
	Hicks kelsey	Brooks fiske	Us lambelitel_3	Bauer&cie	Us lige
2	Gill wells	Providencerubber goodyear_2	Seymour osborne	Seymour osborne	Seymour osborne
	Prouty ruggles	Littlefield perry	James campbell	Mcclean ortmayer	Mcclean ortmayer
	Miller brass	Elizabeth amnicholson	Miller brass	Atlantcworks brady	Miller brass
	Heald rice	Root lakeshore	Mahn harwood	Altoonathrs trnrgon	James campbell
	Seymour osborne	Livingston woodworth	Shepard carrigan	Reckendorfer faber	Mahn harwood
	James campbell	Mowry whitney_2	Mcclean ortmayer	Morganenv plalbanypaper	Atlantcworks brady
	Yance campbell	Seymour mccormick_1	Altoonathrs trnrgon	Shepard carrigan	Reckendorfer faber
	Burr duryee	Thecawoodpatent	Websterloom higgins	Hailes vanwormer	Altoonathrs trnrgon
	Gould rees	Suffolk hayden	Leggett lavery	Hollister benedictmfg	Morganenv plalbanypaper
	Giantpowder capowder	Garretson clark	Heald rice	Smith goodyeardental	Shepard carrigan
	Thewoodpaperpatent	Tilghman proctor_2	Morganenv plalbanypaper	Hotchkiss greenwood	Hailes vanwormer
	Bantz frantz	Tilghman proctor_1	Oreilly morse	Oreilly morse	Hotchkiss greenwood
	Johnson lushingrr	Newyork ransom	Dunbar myers	Websterloom higgins	Hollister benedictmfg
	Ball angles	Birdsall coolidge	Prouty ruggles	White dunbar	Smith goodyeardental
	Brooks fiske	Parks booth	Deering winonahrstr	Concreteappliance gomery	White dunbar
3	Livingston woodworth	Atlanticworks brady	Providencerubber goodyear_2	Mahn harwood	Grant raymond
	Seymour mccormick_1	Slawson grandstreet	Root lakeshore	Miller brass	Pennock dialogue
	Providencerubber goodyear_2	Hotchkiss greenwood	Elizabeth amnicholson	James campbell	Graham
	Birdsall coolidge	Hailes vanwormer	Tilghman proctor_2	Prouty ruggles	Us paramount
	Littlefield perry	Smith nichols	Mowry whitney_2	Heald rice	Foxfilm
	Newyork ransom	Brown piper	Littlefield perry	Ives sargent	Wheaton peters
	Thecawoodpatent	Pennr cmtvtrck	Livingston woodworth	Topliff topliff_2	Sears stiffel
	Mowry whitney_2	Smith goodyeardental	Garretson clark	Gill wells	Trdmrkcases
	Elizabeth amnicholson	King gallun	Silsby foote_2	Burr duryee	Bonito
	Suffolk hayden	Phillips page	Suffolk hayden	Giantpowder capowder	Aiken
	Wagsteampacketco sickles_4	Stimpson woodman	Seymour mccormick_1	Gould rees	Canalco clark
	Dean mason	Phillips detroit	Thecawoodpatent	Battin taggart	Kewanee
	Burdell denig	Yalelock greenleaf	Wagsteampacketco sickles_4	Fuller ventzer_1	MccLurg kingsland
	Root lakeshore	Thompson boisselier	Parks booth	Coon wilson	Burrowgiles sarony
	Silsby foote_2	Goodyeardental davis	Birdsall coolidge	Brooks fiske	Compco daybrite
4	Mahn harwood	Seymour osborne	Hailes vanwormer	Providencerubber goodyear_2	Oreilly morse
	Fay cordesman	Corning burden	Hollister benedictmfg	Root lakeshore	Corning burden
	Leggett lavery	Oreilly morse	Atlanticworks brady	Elizabeth amnicholson	Grta&ptea
	Sargent hallsafe	Websterloom higgins	Smith goodyeardental	Tilghman proctor_2	Thetelephonecases
	Goodyeardental davis	Ives hamilton	Reckendorfer faber	Mowry whitney_2	Cochrane deener
	Shepard carrigan	Mccormick laccott	Pennr cmtvtrck	Littlefield perry	Tilghman proctor_1
	White dunbar	Thetelephonecases	Hotchkiss greenwood	Livingston woodworth	Leroy atham_1
	Crawford heysinger	Winans dnmd	Thompson boisselier	Garretson clark	Expandedmetal bradford
	Unionmetallic uscartridge	Hoyt thorne	Smith nichols	Wilson rousseau	Funkbros
	Bragg fitch	Morley sewingmch lancaster	Slawson grandstreet	Patterson ky	Mackayradio
	Snow lakeshore	Roemer peddie	Pickering mccullough	Silsby foote_2	Gottschalk
	Sutter robinson	Unionpaperbag murphy	Brown piper	Suffolk hayden	Chakrabarty
	Chicagowry sayles	Brown guild	Phillips detroit	Seymour mccormick_1	Rubbertipencil howard
	Wollensak reiherr_2	Risdon iron medart	Hicks kelsey	Daletile hyatt	Risdon iron medart
	--	Sessions romadka	Thatcher heating burtis	Thecawoodpatent	Deepsouth
5	Oreilly morse	Mcquewan	Canalco clark	Canalco clark	Providencerubber goodyear_2
	Agawam jordan	Bement natharow	Mclean fleming	Mclean fleming	Tilghman proctor_2
	Battin taggart	Wilson rousseau	Albright teas	Wheaton peters	Root lakeshore
	Bischoff wethered	Grant raymond	Daletile hyatt	Trdmrkcases	Elizabeth amnicholson
	Blanchard putnam	Patterson ky	Elgin watch llwatch	Kalem harpersbros	Mowry whitney_2
	Phld phtnrntny stimpson	Adams burke	Wilson sandford	Whitesmith lapollo	Keystone adams
	Gayler wildner	Wilson sandford	Hartell tilghman	Elgin watch llwatch	Littlefield perry
	Pennock dialogue	Albright teas	Columbiamil alcorn	Columbiamil alcorn	Livingston woodworth
	Stimpson westchesterr	Hartell tilghman	Brown shannon	Singermf junemfg	Seymour mccormick_1
	Shaw cooper	Daletile hyatt	Cottontie simmons	Burrowgiles sarony	Garretson clark
	Grant raymond	Chaffee bostonbelting	Amcnstrctn jacksonvillery	Thompson hubbard	Wilson rousseau
	Corning burden	Mitchell hawley	Manhattanmed wood	Amcnstrctn jacksonvillery	Patterson ky
	Teese huntingdon	Bobbs mrlt	Amoskeag trainer	Nt cottonoil tx	Daletile hyatt
	MccLurg kingsland	Keeler foldingbed	Excelsiorwooden pc cb bridge	Manhattanmed wood	Silsby foote_2
	Wilson rousseau	Continentalpaperbag	White frankin	Amoskeag trainer	Suffolk hayden

Notes: Each column contains co-citation network clusters, from the 1890 network on the left to the 2019 network on the right. The clusters in a column are arranged in descending order by weightiest principal case node.

Indeed, the color bands in Figure 30 reveal an important facet of the Supreme Court's IP decisions in the period from 1987 to 2019, *i.e.*, from the early Rehnquist Court through the fourteenth year of the Roberts Court. Again, the pale blue band, on the upper right, shows the patent & antitrust cluster that sprang into view in 1954.<sup>95</sup> Its case membership has changed little in the intervening 64 years. Both the 2019 yellow cluster (led by *Seymour*)<sup>96</sup> and the 2019 grey cluster (led by *Providence Rubber*)<sup>97</sup> have clear forerunners in every prior period, including in 1890; this is especially so for the grey cluster, with nine of its 15 cases in one group (the third cluster) in 1890. The grey cluster stayed intact, even as it sank in relative importance. The yellow cluster consolidated in its current form in 1986. But the 2019 green and rose clusters, anchored by *Grant v. Raymond*<sup>98</sup> and *O'Reilly v. Morse*<sup>99</sup> respectively, are different. Before 2019, neither cluster had more than a few members (sometimes only one) in a given snapshot. In 1986, only one case from the 2019 rose cluster, *O'Reilly*,<sup>100</sup> appeared at all; it's in the yellow *Seymour*<sup>101</sup> group. That same year, the 2019 green cluster had one case—*Grant*,<sup>102</sup> its lead—among the patent & antitrust group up top, and four other cases in the bottom most cluster (among other trademark and copyright cases). In 2019, by contrast, these two clusters are each consolidated and expanded, and together they push the *Providence Rubber*<sup>103</sup> cluster down to fifth place. They thus embody, as of 2019, two newly formed doctrinal sub-groups within contemporary IP law. For the 15 cases the green *Grant*<sup>104</sup> cluster, the median year of most recent Supreme Court inward citation in the network is 2015. For the rose *O'Reilly*<sup>105</sup> cluster, the median year is 2013.

How else might we visualize these two groups of cases, arising in 2019? Consider the 2019 Weighted Degree top 100 map, in Figure 28. The *Grant*<sup>106</sup> cluster on this map is in pink. *Grant*<sup>107</sup> is on the central vertical axis, just below the grey node for *Providence Rubber*.<sup>108</sup> The *O'Reilly*<sup>109</sup> cluster on this map is in green. How these clusters in Figure 28 appear if we isolate them from the

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95. There is a hint of the 1954 top cluster in 1922, in the fifth-ranked cluster (containing *Bement v. Nat'l Harrow Co.*, 186 U.S. 70 (1902); *Adams v. Burke*, 84 U.S. 453 (1873)).

96. *Seymour*, 78 U.S. (11 Wall.) at 516.

97. *Providence Rubber Co. v. Goodyear*, 76 U.S. (9 Wall.) 788 (1870).

98. See Figure 30, at 76.

99. *Id.*

100. *Id.*

101. See *Seymour*, 78 U.S. (11 Wall.) at 516.

102. See *Grant v. Raymond*, 31 U.S. 218 (1832).

103. *Id.*

104. *O'Reilly v. Morse*, 56 U.S. 62 (1854).

105. *Id.*

106. See *Grant*, 31 U.S. at 218.

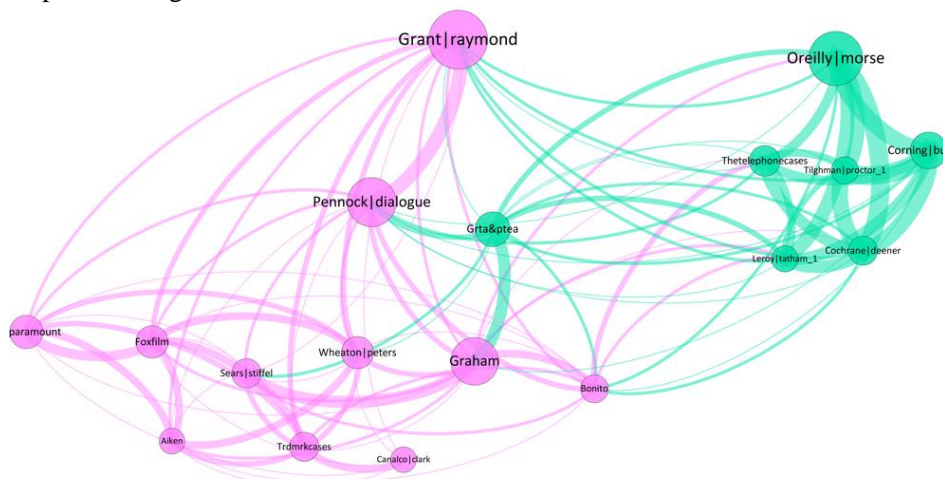
107. *Id.*

108. *Providence Rubber Co. v. Goodyear*, 76 U.S. 788 (1869).

109. *O'Reilly*, 56 U.S. at 62.

2019 top 100 map? Figure 31 depicts these two clusters excerpted from Figure 28.

*Figure 31: Top Grant-Cluster and O'Reilly-Cluster Cases, by Weighted Degree Score, Excerpt from the 1822–2019 Co-Citation Network Top-100 Map Depicted in Figure 28*



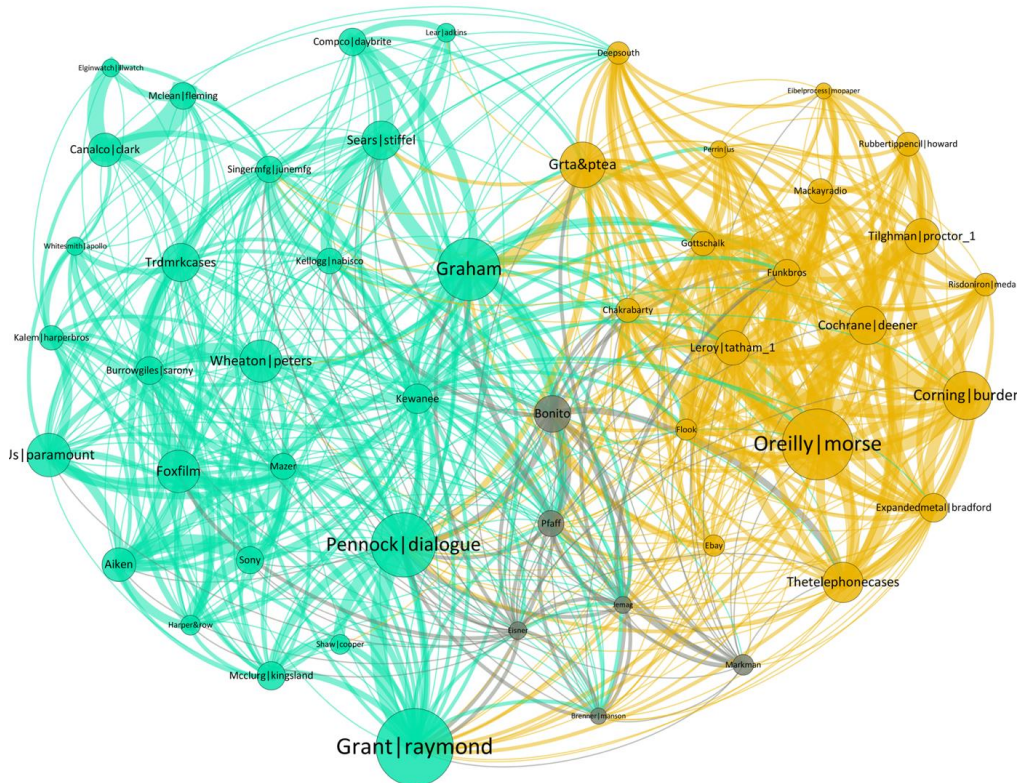
Notes: Node color signifies cluster, computed across the full network. Node and text size vary by Weighted Degree Score, and edge thickness varies by weight.

We can, further, take the entirety of the *Grant*<sup>110</sup> and *O'Reilly*<sup>111</sup> clusters' cases, rank order them by weighted degree, and re-apply both the mapping and community-detection algorithms to map the top 50 cases in the combined set. When one does so, the map in Figure 32 is the result. In a sense, the map in Figure 32 reflects citation behavior in all the Supreme Court's IP cases since 1810. But, at the same time, it reflects the doctrinal sub-groups in the Court's IP cases that most strongly distinguish the last 32 years of the Court's IP decisions from those of the pre-1987 period.

110. *Grant*, 31 U.S. at 218.

111. *O'Reilly v. Morse*, 56 U.S. 62, 62 (1854).

Figure 32: Top 50 Grant-Cluster and O'Reilly-Cluster Cases, by Weighted Degree Score, in the 1822–2019 Co-Citation Network



Notes: Node color signifies cluster, computed within the top 50 cases, by Weighted Degree Score, of the *Grant*-cluster subset of the network. Node and text size vary by Weighted Degree Score, and edge thickness varies by weight.

## II. TAKING STOCK

The Supreme Court's IP jurisprudence is not all of United States IP law. State law has been the chief locus of both trade secret law<sup>112</sup> and publicity rights,<sup>113</sup> as well as an important influence in trademark law.<sup>114</sup> Indeed, the Supreme

112. See Sharon K. Sandeen & Christopher B. Seaman, *Toward a Federal Jurisprudence of Trade Secret Law*, 32 BERKELEY TECH. L.J. 829, 835–42 (2017) (describing the state-law foundations of trade secret law).

113. See JENNIFER E. ROTHMAN, *THE RIGHT OF PUBLICITY: PRIVACY REIMAGINED FOR A PUBLIC WORLD* 11–44 (2018) (describing the state-law foundations of publicity rights).

114. See Mark P. McKenna, *The Normative Foundations of Trademark Law*, 82 NOTRE DAME L. REV. 1839, 1849–73 (2007) (describing the common-law foundations of trademark law); Mark P. McKenna, *Trademark Law's Faux Federalism*, in *INTELLECTUAL PROPERTY AND THE COMMON LAW* 288, 289–305 (Shyamkrishna Balganeshe ed., 2013) (describing state and federal trademark law's interactions from the late 1800s to the 2010s).

Court's IP jurisprudence is not even all of United States IP appellate case law. The United States Circuit Courts of Appeals decide many appeals in copyright, trademark, and patent matters every year. And those cases are part of the regular diet of United States law professors and law students, for they fill the pages of every major IP casebook. State and federal IP statutes shape innumerable private acts that never produce any disputes, much less litigated disputes. The Supreme Court's IP jurisprudence, even in its entirety, is the top of the proverbial iceberg. Given the norms of vertical precedent,<sup>115</sup> however, we know that this body of cases is critically important to United States IP law.

What has network analysis taught us about the stock of legal knowledge this body of cases inscribes? Most important are the data tables and visualizations themselves, which are new and illuminating in their own right. In addition, perhaps the most obvious teaching is the extent to which patent cases dominate the Court's IP jurisprudence. A case count alone conveys some of that story, of course, so long as one tracks the IP right germane to a given case.<sup>116</sup> The network analyses reveal, though, just how overwhelming that dominance is. In the simple citation network, through 2019, all the top 20 cases by Authority score are patent cases or patent-centered antitrust cases,<sup>117</sup> as are all the top 11 cases by PageRank score.<sup>118</sup> Similarly, in the co-citation network, through 2019, all the top ten cases by Weighted Degree score are patent cases or patent-centered antitrust cases.<sup>119</sup> And only one of the five top clusters in the 2019 co-citation network—the cluster anchored by *Grant v. Raymond*—has any trademark or copyright cases among its top 15 cases (by Weighted Degree).<sup>120</sup>

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115. See BRYAN A. GARNER ET AL., *THE LAW OF JUDICIAL PRECEDENT* 27 (2016) (describing those norms).

116. See *supra* Figure 1.

117. See *supra* Table 8, right-most column. In the 1822–2019 network, ranking the cases by Authority Score, the first case that is neither a patent case nor a patent-focused antitrust case is 35<sup>th</sup>-ranked *Bobbs-Merrill Co. v. Straus*, 210 U.S. 339 (1908), which announced the copyright first-sale doctrine (copyright's counterpart to the patent exhaustion doctrine). See *id.* at 350.

In our view the copyright statutes, while protecting the owner of the copyright in his right to multiply and sell his production, do not create the right to impose, by notice, such as is disclosed in this case, a limitation at which the book shall be sold at retail by future purchasers, with whom there is no privity of contract.

*Id.*; Herbert Hovenkamp, *Innovation and the Domain of Competition Policy*, 60 ALA. L. REV. 103, 110–11 (2008) (explaining the connection between copyright's first-sale doctrine and patent's exhaustion doctrine).

118. See *supra* Table 9, right-most column. The 12<sup>th</sup>-ranked case, by PageRank score, is a trademark case—*Amoskeag Mfg. v. Trainer*, 101 U.S. 51 (1879). None of the top 20 by PageRank, 1822–2019, is a copyright case. Indeed, no copyright case appears among the top-scoring PageRank cases until one hits the 50<sup>th</sup>-ranked *Bobbs-Merrill* case (again).

119. See *supra* Table 14, right-hand column. The same is true for the top ten Betweenness score cases, also in Table 14.

120. See *supra* Figure 30, right-most column. Indeed, among the 75 cases in the right-most column in Figure 30, only ten, or 13.3%—all in the *Grant v. Raymond* cluster—are trademark or copyright cases.

The Supreme Court's IP jurisprudence, in short, largely a patent-law jurisprudence.

The second most obvious teaching, and perhaps the most surprising, is the 65-year dominance in the networks of patent-misuse and patent-centered-antitrust cases decided from the 1910s to the 1940s—dominance that continues today, as the Court continues to cite these cases in its justifications for current outcomes.<sup>121</sup> I say “surprising,” though in some sense estimating degree of surprise is a fool's game; the experience is both subjective and context-specific, quite apart from the surprise-negating effect that hindsight bias may play (as those steeped in patent law can surely appreciate).<sup>122</sup> What, then, might explain surprise at the continuing dominance of these pre-1945 patent & antitrust cases? Consider the following: Congress included, in its 1952 major recodification of the Patent Act, a new provision—35 U.S.C. § 271—that both defined direct and indirect infringement (in subsections (a) to (c)) and cabined the misuse doctrine (in subsection (d)). A key rationale for subsection (d)'s cabining of patent misuse was, as the Supreme Court itself has recognized, “an intent . . . to expand significantly the ability of patentees to protect their rights against contributory infringement” without fear of drawing improvident accusations of misuse.<sup>123</sup> Congress further cabined patent misuse in 1988 “by adding new subsections (4) and (5) to the three then-existing patent misuse safe harbors of 35 U.S.C. § 271(d).”<sup>124</sup> On the antitrust enforcement side, successive administrations have moved antitrust analysis of IP licensing to a more permissive posture. Acting far below “[t]he high point of patent aggressiveness . . . [of] 1970, when the Antitrust Division articulated its ‘nine no-nos’” of patent licensing,<sup>125</sup> both federal enforcement arms have twice jointly issued licensing-congenial<sup>126</sup>

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121. See *supra* Tables 6, 8 & 14; Figures 14 & 28; Appendix C.

122. Cf. *Webster Loom Co. v. Higgins*, 105 U.S. 580, 591 (1882) (“Now that it has succeeded, it may seem very plain to anyone that he could have done it as well. This is often the case with inventions of the greatest merit.”).

123. *Dawson Chem. Co. v. Rohm & Haas Co.*, 448 U.S. 176, 203, 207–13 (1980) (recounting the legislative history of 35 U.S.C. § 271(d)). See also P.J. Federico, *Commentary on the New Patent Act*, 75 J. PAT. & TRADEMARK OFF. SOC'Y 161, 214 (1993) (originally published in 1954) (stating that “[p]aragraph (d) [of the new § 271] makes such exceptions to the case law of misuse as are necessary to render [§ 271] effective as a basis of recovery” for indirect infringement); Hovenkamp, *Antitrust*, *supra* note 65, at 473 (noting that “patent law was amended in 1952 in order to counter what Congress perceived as overly restrictive rules on patent issuance and excessively quick findings of misuse”).

124. JANICE M. MUELLER, *PATENT LAW* 809 (5th ed. 2016).

125. Hovenkamp, *Antitrust*, *supra* note 65, at 469–70 (describing the nine no-nos, and the larger context of patent misuse doctrine). See also Reynolds, *supra* note 65, at 141 (comparing “the famous ‘nine no-nos’” to the patent & antitrust “high water mark of the 1940s”); Willard K. Tom & Joshua A. Newberg, *Antitrust and Intellectual Property: From Separate Spheres to Unified Field*, 66 ANTITRUST L.J. 167, 178–83 (1997) (detailing the nine no-nos and relevant cases).

126. See 2 ABA Section of Antitrust Law, *Antitrust Law Developments* 1058–59 (8th ed. 2017) (describing the agencies' repudiation of the “nine no-nos” and subsequent move to the *Guidelines'* more licensing-friendly analytical approach).

*Antitrust Guidelines for the Licensing of Intellectual Property*—first in April 1995<sup>127</sup> and again in January 2017.<sup>128</sup> It is striking to realize that, although the 2017 *Guidelines* cites 29 different Supreme Court cases over the course of its 36 pages of text, not one of those cases is among the 1822–2019 co-citation network’s top ten cases by Weighted Degree score. Similarly, the 1995 *Guidelines* cites 22 Supreme Court cases over its 32 pages, and only one of the 2019 co-citation top ten—*Ethyl Gasoline Corp. v. United States*<sup>129</sup>—is among them.<sup>130</sup> From both Congress and the Executive, then, the plain signal over a number of decades is that the Supreme Court’s pre-1945 patent & antitrust cases should have less bearing on the contours of contemporary IP law. Nothing in the network analyses reported here suggests that the Supreme Court has received that signal.

### III. CONCLUSION

Quantitative study of large case-law citation networks is still relatively new. Indeed, “until recently, large-scale analysis of citation practices were impractical; data was difficult to acquire, analysis methods were rudimentary, and computational power was insufficient.”<sup>131</sup> Happily, “[i]n the last decade, all three of the barriers to large-scale empirical citation analysis have been greatly reduced.”<sup>132</sup>

The first wave of judicial case citation network analyses have demonstrated that apex courts’ decisional outputs, taken as a group, show citation-network properties akin to those of the World Wide Web or a scholarly discipline’s research literature. The first-wave analyses have also demonstrated the utility of specific metrics for measuring case centrality in citation networks, and, more recently, of visualizing citation networks using a force-directed mapping algorithm. Because the first-wave studies stay at the highest aggregate level of court output, however, the networks they examine cover the full range of a court’s doctrinal reach. This is a strength, for the questions those studies pose and the findings they establish.

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127. See U.S. DEP’T JUST. & FED. TRADE COMM’N, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY (April 6, 1995), <https://www.justice.gov/sites/default/files/atr/legacy/2006/04/27/0558.pdf>.

128. See U.S. DEP’T JUST. & FED. TRADE COMM’N, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY (Jan. 12, 2017), <https://www.justice.gov/atr/IPguidelines/download>.

129. See *supra* Table 14.

130. U.S. Dep’t. of Justice & Fed. Trade Comm’n, *Antitrust Guidelines for the Licensing of Intellectual Property* 25 (Apr. 6, 1995) <https://www.justice.gov/sites/default/files/atr/legacy/2006/04/27/0558.pdf> (citing *Ethyl Gasoline Corp. v. United States*, 309 U.S. 436 (1940)).

131. Ryan Whalen et al., *Common Law Evolution and Judicial Impact in the Age of Information*, 9 ELON L. REV. 115, 120 (2017).

132. *Id.*

This paper introduces a second wave, focusing on a selected doctrinal field within a given apex court's output, through the court's entire history. By holding the temporal reach the same, but changing the topical focus, this paper shows that citation-network analysis offers field-specific insights from an approach that is as synoptic as it is granular. The tools and techniques are perfectly general, though I have applied them, for illustrative purposes, to one doctrinal area. The Supreme Court's IP jurisprudence, as the working example studied here, shows continued reliance on a core set of patent & antitrust cases that situate IP law within a broader fabric of competition-law principles. Moreover, by augmenting citation networks with co-citation networks, this paper breaks new methodological ground for second-wave case-law network analysis. The distinctive topical clusters that the co-citation maps show here provide more evidence of the prominence of the patent & antitrust domain within the knowledge stock that the Supreme Court's IP jurisprudence embodies—a stock on which the Court and the parties before it can continue to draw to determine and explain the Court's resolution of IP questions.

#### APPENDIX A

- Adams v. Burke*, 84 U.S. (17 Wall.) 453 (1873).  
*Alexander Milburn Co. v. Davis-Bournonville Co.*, 270 U.S. 390 (1926).  
*Altoona Publix Theatres, Inc. v. American Tri-Ergon Corp.*, 294 U.S. 477 (1935).  
*American Construction Co. v. Jacksonville, Tampa & Key West Ry.*, 148 U.S. 372 (1893).  
*Amoskeag Manufacturing Co. v. Trainer*, 101 U.S. 51 (1879).  
*Atlantic Works v. Brady*, 107 U.S. 192 (1883).  
*B.B. Chemical Co. v. Ellis*, 314 U.S. 495 (1942).  
*Bauer & Cie v. O'Donnell*, 229 U.S. 1 (1913).  
*Bement v. National Harrow Co.*, 186 U.S. 70 (1902).  
*Bloomer v. McQuewan*, 55 U.S. (14 How.) 539 (1853).  
*Bobbs-Merrill Co. v. Straus*, 210 U.S. 339 (1908).  
*Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141 (1989).  
*Bourjois & Co. v. Katzel*, 260 U.S. 689 (1923).  
*Boston Store of Chicago v. American Graphophone Co.*, 246 U.S. 8 (1918).  
*Burr v. Duryee*, 68 U.S. (1 Wall.) 531 (1864).  
*Brown v. Piper*, 91 U.S. 37 (1875).  
*Delaware & Hudson Canal Co. v. Clark*, 80 U.S. (13 Wall.) 311 (1871).  
*Carbice Corp. v. American Patents Development Corp.*, 283 U.S. 27 (1931).  
(*Carbice 1*).  
*Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U.S. 405 (1908).  
*Cuno Engineering Corp. v. Automatic Devices Corp.*, 314 U.S. 84 (1941).  
*Dr. Miles Medical Co. v. John D. Park & Sons Co.*, 220 U.S. 373 (1911).



- Dunbar v. Myers*, 94 U.S. 187 (1876).  
*Edward Katzinger Co. v. Chicago Metallic Manufacturing Co.*, 329 U.S. 394 (1947).  
*Elizabeth v. American Nicholson Pavement Co.*, 97 U.S. 126 (1878).  
*Estey v. Burdett*, 109 U.S. 633 (1884).  
*Ethyl Gasoline Corp. v. United States*, 309 U.S. 436 (1940).  
*Evans v. Hettich*, 20 U.S. (7 Wheat.) 453 (1822).  
*Fourth Estate Public Benefit Corp. v. Wall-Street.com, LLC*, 139 S. Ct. 881 (2019).  
*Gage v. Herring*, 107 U.S. 640 (1883).  
*Gayler v. Wilder*, 51 U.S. (10 How.) 477 (1851).  
*General Electric Co. v. Wabash Appliance Corp.*, 304 U.S. 364 (1938).  
*Giant Powder Co. v. California Powder Works*, 98 U.S. 126 (1878).  
*Gill v. Wells*, 89 U.S. (22 Wall.) 1 (1874).  
*Gould v. Rees*, 82 U.S. (15 Wall.) 187 (1872).  
*Graham v. John Deere Co.*, 383 U.S. 1 (1966).  
*Grant v. Raymond*, 31 U.S. (6 Pet.) 218 (1832).  
*Hailes v. Van Wormer*, 87 U.S. (20 Wall.) 353 (1874).  
*Hall v. Macneale*, 107 U.S. 90 (1883).  
*Hartford-Empire Co. v. United States*, 323 U.S. 386 (1945). (*Hartford 1*).  
*Hazel-Atlas Glass Co. v. Hartford-Empire Co.*, 322 U.S. 238 (1944).  
*Heald v. Rice*, 104 U.S. 737 (1882).  
*Helsinn Healthcare S.A. v. Teva Pharmaceuticals USA, Inc.*, 139 S. Ct. 628 (2019).  
*Henry v. A.B. Dick Co.*, 224 U.S. 1 (1912).  
*Hollister v. Benedict & Burnham Manufacturing Co.*, 113 U.S. 59 (1885).  
*Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248 (1851).  
*Interior Constr. & Improvement Co. v. Gibney*, 160 U.S. 217 (1895).  
*International Business Machines Corp. v. United States*, 298 U.S. 131 (1936).  
*International Salt Co. v. United States*, 332 U.S. 392 (1947).  
*Interstate Circuit, Inc. v. United States*, 306 U.S. 208 (1939).  
*Inwood Laboratories, Inc. v. Ives Laboratories, Inc.*, 456 U.S. 844 (1982).  
*James v. Campbell*, 104 U.S. 356 (1882).  
*Jones v. Morehead*, 68 U.S. (1 Wall.) 155 (1863).  
*Kendall v. Winsor*, 62 U.S. (21 How.) 322 (1859).  
*Knapp v. Morss*, 150 U.S. 221 (1893).  
*Le Roy v. Tatham*, 55 U.S. (14 How.) 156 (1853).  
*Leeds & Catlin Co. v. Victor Talking Machine Co.* (No. 2), 213 U.S. 325 (1909).  
*Leitch Manufacturing. v. Barber Co.*, 302 U.S. 458 (1938).  
*Littlefield v. Perry*, 88 U.S. (21 Wall.) 205 (1875).

- Livingston v. Woodworth*, 56 U.S. (15 How.) 546 (1853).  
*MacGregor v. Westinghouse Electric & Manufacturing Co.*, 329 U.S. 402 (1947).  
*Mahn v. Harwood*, 112 U.S. 354 (1884).  
*Marconi Wireless Telegraph Co. v. United States*, 320 U.S. 1 (1943).  
*McClain v. Ortmyer*, 141 U.S. 419 (1891).  
*McClurg v. Kingsland*, 42 U.S. (1 How.) 202 (1843).  
*McLean v. Fleming*, 96 U.S. 245 (1878).  
*Mercoird Corp. v. Mid-Continent Investment Corp.*, 320 U.S. 661 (1944).  
*Mercoird Corp. v. Minneapolis-Honeywell Regulator Co.*, 320 U.S. 680 (1944).  
*Miller v. Bridgeport Brass Co.*, 104 U.S. 350 (1882).  
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*Morgan Envelope Co. v. Albany Perforated Wrapping Paper Co.*, 152 U.S. 425 (1894).  
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#### APPENDIX B

Below is a map of the top 301 nodes, by weighted degree, in the co-citation network from the 1822 to 1986 time frame. Node color signifies cluster, computed across the full network. Node and text size vary by Weighted Degree Score, and edge thickness varies by weight.



## APPENDIX C

Below is a map of the top 303 nodes, by weighted degree, in the co-citation network from the 1822 to 2019 time frame. Node color signifies cluster, computed across the full network. Node and text size vary by Weighted Degree Score, and edge thickness varies by weight.

