



LAW SCIENCE TECHNOLOGY
Diritto Scienza Tecnologia

International Series edited by
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The intersection between social sciences, computational science and complexity science is the basis of a deep change in the way human beings and human societies are studied. The use of formal and mathematical methods, the gradual surmounting of disciplinary boundaries and tools provided by information and communication technologies are orienting social sciences, even through new interpretations of the experimental method, towards falsifiability and cumulativeness that are specific features of natural sciences.

The ongoing change also significantly involves legal culture. Legal phenomena are at the same time the outcome and the ordering factor of social life. The making, interpretation and application of legal rules conceived to regulate social life cannot ignore the scientific knowledge and methodologies illuminating social dynamics at both individual and collective level.

Wide and innovative research perspectives are opening up. They will offer new challenges to the «scientific investigation of legal problems», the research path that, with *Jurimetrics*, has plotted the origins and evolution of legal informatics. At the same time, legal issues arise concerning, on the one hand, the impact that digital technologies have on society and the economy and, on the other, on the emergence of new techniques and tools which jurists are called upon to reflect on.

Publications in the *Law Science Technology* series will deal, from one point of view, with looking more closely at and revisiting classical topics of legal Informatics, and from another, at innovative topics arising out of the dialogue between legal science and a range of research areas ranging from cognitive sciences to complexity science, from computer science to computational social science and biological sciences. The series aims at fostering an interdisciplinary debate at international level. Methodological considerations will be combined with focusing specific attention on the impact that the knowledge and methodologies taken into account may have on legal processes and activities involving legal rules (from drafting to enforcement).

The main topics the series will focus on are: law and cognitive science; law and complexity science; law and social simulation; law, social network analysis, data mining; advanced applications in legal informatics; new frontiers of ICT law.

The series unfolds along two separate paths: «Issues» and «Materials and Tools». The former collects monographs and collective works devoted to the analysis of specific issues of relevance not only from the theoretical view point but also for their impact on legal practice. The latter brings together volumes specifically addressing educational and training needs.

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NETWORK ANALYSIS IN LAW

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Cover image by Nicola Lettieri

WINKELS, Radboud; LETTIERI, Nicola; FARO, Sebastiano (*Eds*)
Network Analysis in Law
Collana: Diritto Scienza Tecnologia/Law Science Technology – Temi, 3
Napoli: Edizioni Scientifiche Italiane, 2014
pp. XII+212; 24 cm
ISBN 978-88-495-2769-8

© 2014 by Edizioni Scientifiche Italiane s.p.a.
80121 Napoli, via Chiatamone 7

Internet: www.edizioniesi.it
E-mail: info@edizioniesi.it

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Preface

This volume contains extended papers from a workshop held during the 14th International Conference on Artificial Intelligence and Law (ICAIL-2014) in Rome, 10-14 June 2013. The workshop aimed to bring together researchers from computational social science, computational legal theory, network science and related disciplines in order to discuss the use and usefulness of network analysis in the legal domain.

Two obvious strands of research came to mind:

1. Analysing and visualizing networks of people and institutions: Law is made by people, about and for people and institutions. These people (or institutions) form networks, be it academic scholars or criminals and these networks can be detected, mapped, analysed and visualised;

2. Analysing and visualizing the network of law: Law itself forms a network. Sources of law refer to other sources of law and together constitute (part of) the core of the legal system. In the same way as above, we can represent, analyse and visualise this network.

A third area of research is where these two networks meet:

3. People or institutions create sources of law or appear in them: Research on the network of one may shed light on the other. Two examples:

- a. Legal scholars write commentaries on proposed legislation or court decisions. Sometimes they write these together. These commentaries may provide information on the network of scholars; the position of an author in the network of scholars may provide information on the authority of the comment.

- b. ‘Criminals’ appear in court decisions and may appear in more than one. Information on the network of criminals may help in finding related cases and decisions. Criminals that appear together in a court case may help in building the network of criminals.

We invited papers on and demonstrations of original work on these and other aspects of network analysis in the legal field. Eight papers

were presented and are collected in this volume, together with one extended version of a paper from the main conference.

Most papers dealt with the second topic above, representing, analysing and visualizing the network of law. *Whalen* compares overruled US Supreme Court cases with matched peers by including citation network centrality measures. He demonstrates that those decisions which go on to be overruled tend to occupy more central citation network positions, cite more central cases, and depreciate at a slower rate than similarly influential decisions. *Zhang et al.* describe a new type of data derived from the case corpus: the Library of Legal Issues. This new type of metadata is collected through a data-mining process based on semantics-based network traversing. *Hoekstra* applies network analysis to a linked data representation of *all* Dutch regulations and presents preliminary results, e.g., that the citation network of Dutch law is not a scale free network. *Szöke et al.* propose an automatic knowledge extraction framework that converts natural language written legal document into a rich multi-domain knowledge base. Part of this knowledge base is a linked data model that enables network analysis of the domain. They present a prototype that models Hungarian law. *Gultemen & van Engers* present an approach to process Turkish law and use network analysis to help check the consistency of the legal system. *Winkels & Boer* describe research on automatically determining relevant context to display to a user of a legislative portal given the article they are retrieving, purely based on ‘objective’ criteria inferred from the network of sources of law. They present two prototype systems using different visualizations with small formative user evaluation. Finally, *Mimouni et al.* propose a new semantic information retrieval approach that allows for the mining of legal documents on inter-textual and relational criteria. It models the collection as a lattice of document classes, in which documents are clustered on the basis of their types as well as the semantic descriptors and the relations they share. The whole approach is illustrated on a use case related to French laws and local administration acts.

Two papers concern the first topic, the analysis of networks of people and institutions. *Sweeney et al.* present a methodology for applying network analysis to explore relationships within civil networks established by state law and to compare similarly-purposed legal systems across states in the US. *Lettieri et al.* discuss a framework – CrimeMiner – that combines information extraction, network analysis and visualization methods to support investigation of and the fight against criminal organizations.

Acknowledgements

We would like to thank the reviewers of the workshop papers:

- Michael Bommarito, ReInvent Law Lab, USA
- Romain Boulet, University of Lyon, France
- Daniel Katz, Michigan State University, USA
- Marc Lauritsen, Capstone Practice, USA
- Bill Speros, Speros & Associates LLC, USA
- Innar Liiv, Tallinn University of Technology, Estonia
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RYAN WHALEN

Bad Law Before It Goes Bad: Citation Networks and the Life Cycle of Overruled Supreme Court Precedent

ABSTRACT. This essay expands the empirical analysis of overruled Supreme Court decisions by including citation network centrality measures and comparative depreciation analysis to compare overruled decisions to matched peers. It demonstrates that those decisions which go on to be overruled tend to occupy more central citation network positions, cite more central cases, and depreciate at a slower rate than similarly influential decisions. These empirical demonstrations of how bad law is distinct in both the way it cites and in the way it is cited help shed light on how the judiciary affects legal change. We see that judges reserve the power of overrulings for decisions that are both significantly more central than their peers and for decisions that remain salient for longer than their peers.

KEYWORDS: Citation networks, precedent depreciation, legal change, overruled decisions, US Supreme Court.

1. INTRODUCTION

In common law systems the norm of *stare decisis*¹ promotes consistency within the application of the law. If a case's facts are equivalent to those of a case previously decided, a judge who assiduously follows the normative requirements of *stare decisis* is obliged to apply the law in the same manner as it was previously applied. This allows those subject to the law a degree of surety that would be impossible were legal rules not consistently applied. *Stare decisis* also lends efficiency to the legal system by allowing judges to contribute to and draw from a common stock of precedent. As Cardozo (1921) wrote: "[T]he labor of judges would be increased almost to the breaking point if every past

¹ *Stare decisis et non quieta movere*: to stand by decisions and not disturb the undisturbed.

decision could be reopened in every case, and one could not lay down one's own course of bricks on the secure foundation of the courses laid by others who had gone before him" (p. 149).

However, *stare decisis* is not determinative. Judges are not *forced* to recognize the binding nature of precedent, and indeed new decisions often implicitly or explicitly overturn previous findings. When a decision is overturned by a court at the same or a higher level than the court that issued the original decision, it ceases to be "good law." An overruling decision brands a precedent "bad law" whereupon it joins the ranks of overturned decisions similarly stripped of their authority.

By definition, every precedent deemed bad law was at some point in time good law. While some cases are overturned almost immediately after they are decided and thus have little opportunity to exert any influence on subsequent decisions, the majority remain good law for years during which time they are eligible to be cited as authoritative sources of law. We can think of the period between when a decision that will go on to be overruled is originally issued and when it is overturned as its lifespan. During this period, these precedents are eligible sources of law, and each will have a unique biography that tells the story of how it was used – or not used – by the legal system before eventually being overruled.

2. OVERRULED DECISIONS AND LEGAL CHANGE

The overruling of precedent is a type of legal change, but it is only one of many. Most avenues for legal change have developed in manners that encourage stability. While many disagree on what makes a good legal system, most agree on one point: a just legal system is a relatively constant legal system. If laws are overruled too frequently "people will find it difficult to find out what the law is at any given moment and will be constantly in fear that the law has been changed since they last learnt what it was" (Raz, 1977, p. 214). That said, there come times when legal change is required and when those times come there are a number of forms those changes can take.

Perhaps the most familiar type of legal change comes from legislative bodies when they create new statutes or alter existing law. These sorts of changes are visible as they are debated in the

legislature and reported on in the media. Elections provide the primary motivating interest that drives legislated legal change. This is not to say that legislated change is simply a function of public opinion. Lobbying groups, special interests, and ideological commitments also play their roles, but the key unifying factor is that these changes are initiated, crafted, and approved by elected officials.

Changing social norms cause a slower and less visible sort of legal change. I mean here social changes that lead to alterations in legal practice that do not themselves lead to the overruling of laws and may not be reflected in the legal code. For the most part this sort of change is seen when technically enforceable laws cease to be enforced. Most of us are familiar with lists of seemingly absurd laws. The social changes that lead us to see these laws as absurd are themselves agents of legal change.

Laws are also created and altered by regulatory bodies that have been granted the authority to make and change binding regulations. These sorts of legal changes tend to be in more specialized areas of law and are often aimed at specific constituencies (e.g., telecommunication companies, or banks). Instead of being driven by electoral pressures or social changes, regulatory changes are a correction to a market system that, were it left unchecked, would lead to outcomes deemed unsavory to those in power and/or to those who put them there.

Like legislated, normative, and regulatory alterations, the overruling of precedent is another tool that can be used to bring legal change. That said, overruled precedent is distinct from these other types of legal change in a number of ways. It is more obvious, more sudden, oftentimes more contentious, and potentially more damaging to the legal system than other types of legal change.

Overruling precedent essentially changes the rules mid-game. The *ex post facto* authority of overruling decisions has long been asserted by the judiciary: “I know of no authority in this court to say that, in general, state decisions shall make law only for the future. Judicial decisions have had retrospective operation for near a thousand years” (Justice Holmes dissenting in *Kuhn v. Fairmont Coal Co.*, 1910). This combines with an unelected Supreme Court judiciary, and the suddenness and seeming finality of Supreme

Court decisions to breed contention and to possibly compromise the reputation and authority of the legal system.

The powerful and potentially dangerous nature of overruling decisions is the motivation for *stare decisis*. But why then are decisions overruled at all? Given that we have other avenues for legal change and judicial inconstancy threatens to weaken the legal system why do judges ever flout *stare decisis*? We know that, at least at the Supreme Court level, overrulings are relatively rare occurrences. They happen in exceptional cases, which present what we can only assume to be exceptional circumstances. But what makes these cases exceptions?

One element that determines when judges choose to ignore *stare decisis* depends on the nature of the law in question. As Justice Breyer puts it: “the rule for determining when to overrule a previous case ... is less strict in constitutional than in statutory matters” (Breyer, 2000, p. 766). This is due to both normative democratic ideals and practical considerations. Statutes are an expression of the democratic system, and as such unless there are severe problems with them deserve to be distinguished when possible rather than overruled outright. At the same time, statutes are more open to change. Unlike the constitution, the legislature is free to alter, repeal, or supersede legislation.

However, this rule of thumb provides only a very limited understanding of why some cases are overruled while others are not. While judges may be more willing to overrule constitutional cases rather than statutory cases, it still only occurs in a very small fraction of constitutional decisions. There must be other factors that determine when judges choose to use their powerful tool of legal change.

Social scientists have made some progress in improving our understanding of the process of overrulings and why some cases are overruled while others remain good law. Early empirical research provided descriptive analysis (Ulmer, 1959) or attempted to demonstrate a link between judicial backgrounds and a propensity to overturn cases (Schmidhauser, 1961).

More recently there has been renewed focus on overturned precedent with a number of studies attempting to explain why some decisions are overturned while others remain good law. Brenner and Spaeth (1995) argue that ideology is the most

important predictor of how a judge will vote when forced to choose whether or not to overrule precedent. Banks (1991) similarly points to changes in court composition as a central factor influencing precedent overruling trends. Building on both of these studies, Spriggs and Hansford (2001) add nuance, demonstrating that – while ideology is an important factor – it combines with issue type, past treatment, legal complexity, coalition sizes, and concurrences to influence the probability that a precedent will be overruled.

However, Spriggs and Hansford’s model, like Breyer’s distinction between statutory and constitutional law, tells us only part of the story. Despite the fact that there are thousands of existing Supreme Court precedents, with varying levels of Spriggs and Hansford’s model variables, only a very few cases are ever overruled.

The majority of empirical overruled precedent studies examine case and judge attributes in attempts to explain why some cases are overturned while others are not. This fits them into the judicial behavior studies paradigm, where they contribute to the debate about the key motivators of court activity – whether judicial behavior is motivated by legal or extralegal factors (George & Epstein, 1992; Perry, 1991; Segal & Spaeth, 2002). The prevailing focus on judicial behavior leads to a perspective on good/bad law that leaves many aspects of overturned law relatively understudied, aspects that could improve our understanding of why some cases go on to be overruled while others do not.

Prior studies that have examined overturned precedent have almost exclusively focused on the two most obvious instances of judicial interaction with good/bad law: the writing of the original decision and subsequently the decision that ultimately overturns it. For a study intent on testing judicial behavior hypotheses these are naturally the most salient points to focus upon. However, good/bad laws often exist for decades before they are overturned (Brenner & Spaeth, 1995), during their tenure as good law they help shape the law that itself helps shape society.

While empirical studies of overturned precedent have been few and focused on questions of judicial behavior, more traditional legal scholarship has produced many highly detailed commentaries on the distinctions between good and bad law.

University law reviews publish no shortage of articles about laws that should be overturned (e.g., Loewy, 1988), laws that should not be overturned (e.g., Frankel, 1989), and laws that have been overturned (e.g., Kang, 2010). While these focused pieces help us understand specific areas of law, their keen focus also prevents us from seeing overturned law as a whole.

If we are to truly understand good/bad law, and the effect overturned precedent has on the legal system we need a more holistic approach. We need to examine large samples of overturned laws, analyze their entire lifespan, compare them with laws that are not overturned, and measure the influence they have in the legal system.

The question remains as to how we can analyze overturned decisions in a more fine-grained manner than the previous empirical studies that have focused on only the overturned and overturning decisions. When examining hundreds of decisions we cannot address each individually, exploring the influence it has or does not have within the relevant areas of law. Any study attempting such a feat of scholarship would drown in details, offering little in the way of generalizable observations. While such an extensive qualitative assessment of how overturned decisions influence legal development would be prohibitively difficult, there are quantitative measures of decision influence that we can use to better understand the phenomenon of good law that eventually goes bad.

3. ANALYZING OVERRULED DECISIONS

When decisions cite one another the common law system leaves a record of its functioning that we can utilize to measure decision influence. While there are many potential motivations for citation, those made by the Supreme Court to other Supreme Court decisions are almost always used to invoke – or in some cases qualify – the authority of the cited case (Posner, 1999). This leaves a record of each case's authority in the years after it is originally published. If a case is often cited we can infer that it has relatively more influence on the legal system than a case that is never cited. Recent progress in precedent network analysis has extrapolated this inference to account for heterogeneity of cases, demonstrating that citations from important cases are in a sense worth more than

citations from less important cases (Fowler, Johnson, Spriggs, Jeon, & Wahlbeck, 2007; Fowler & Jeon, 2008).

3.1. Depreciation

One aspect of precedent that seems relatively universal is the fact that as a decision ages its influence within the legal system depreciates (Landes & Posner, 1976). As Salmond (1900) writes: “A moderate lapse of time will give added vigour to a precedent, but after a still longer time the opposite effect may be produced, not indeed directly, but indirectly through the accidental conflict of the ancient and perhaps partially forgotten principle with later decisions”. Black and Spriggs (2009) demonstrate that, regardless of some initial differences in the rate at which precedents depreciate, after about a decade almost all cases attract citations at a similarly decreasing rate. However, no study has compared the depreciation rates of cases that go on to be overturned to those that do not.

There are three possible ways overruled cases could depreciate vis-à-vis cases that remain good law. First, they could depreciate at the same rate. This would suggest that there is no quantitative difference in the ways good and bad laws are cited. Second, overruled cases could depreciate more quickly than non-overruled cases. This could come about if there is generally a delay between a case being recognized as bad law and its eventual overruling. In the interim, judges may be less inclined to cite the bad law, thus leading to faster depreciation. The third possibility is that overruled cases could depreciate more slowly than their non-overruled counterparts. This outcome could come about if the issues covered by overruled laws increase in salience as an overruling becomes imminent. Increased salience or controversy around cases that will be overruled could lead to citations that distinguish the bad law, thus putting off an overruling. In order to understand better which of these three scenarios is in fact the case, research question one asks:

RQ1: Do Supreme Court decisions that go on to be overturned have different rates of depreciation than decisions that do not?

3.2. Centrality

As mentioned above, by including not only how many citations a case receives, but also taking into account the source of the citations, we can generate a more nuanced sense of how important a case is. Fowler and Jeon (2008) demonstrate that both inward and outward network centrality are excellent predictors of whether or not experts deem a case important (p. 23)². They also show that the inward authority scores of overruled cases tend to be much higher than the global average (p. 25). However, this comparison is somewhat unfair as it includes in the global average all those thousands of cases that receive zero or close to zero citations. A better comparison would match overruled cases against cases that receive a similar number of citations. This would allow us to know more definitively how the importance of overruled decisions compares to that of cases with a similar profile.

If both overruled and non-overruled cases have similar authoritativeness, it would suggest that authority or importance is not a distinguishing feature of bad law. If overruled cases have higher authority scores, it would suggest that bad laws tend to come from important or “hot” legal areas. Finally, if the opposite is true and overruled precedents have lower authority scores than similar counterparts it would suggest either that bad laws are seen as such and are thus less likely to attain those very high centrality scores, or alternately that judges are disinclined to overrule cases in particularly central positions – perhaps because their authority lends them such gravitas that overruling them is more difficult. To better understand which of these scenarios is the case, research question two asks:

RQ2: Are Supreme Court decisions that go on to be overturned cited by more or less authoritative law than similar counterparts?

²Fowler and Jeon compare their hub and authority measures with sources like the Congressional Quarterly’s *Guide to the Supreme Court*, the Legal Information Institute, and the *Oxford Guide to Supreme Court Decisions*.

The flip side to how authoritative the laws that cite a case are is how authoritative their own body of cited precedent is. Fowler and Jeon define a “hub” score that takes into account the network position of each precedent cited to determine how much outward authority each decision has. We can examine these scores to determine whether or not those laws that go on to be overruled cite precedents that are themselves more or less authoritative than those cited by similar cases. As with the authority scores, using a global average is not the best comparison measure. Rather, because hub authority is a function of not only the authority of cases cited but also to the number of cases cited, we must match overruled cases with decisions issued in the same year that cite a similar number of precedents and then compare the overruled cases to their matches.

If we find that the hub authority of overruled cases is not significantly different from that of their matches, we can infer that the strength of the precedential justification for a decision has little relationship to whether it is good or bad law. If instead we find that overruled cases have greater hub authority than their matches it could perhaps suggest that contentious laws feel the need to buttress their position by citing widely and authoritatively. Finally, if cases that go on to be overruled have lower hub authority than their matches, it could be that the relative weakness in precedential justification for these findings contributes to their eventual overturning. This leads to research question three:

RQ3: Do Supreme Court decisions that go on to be overturned rely on more or less authoritative law than their counterparts?

4. METHOD

The Supreme Court citation and precedent centrality data used in the analysis below comes from a set provided by Lexis-Nexis and used originally in Fowler et al.’s (2007) analysis of precedent centrality measures. It includes complete data on citations between Supreme Court cases from 1791 to 2005. The data started as a full-network edge list that was then parsed into a complete network. The Government Printing Office report on overruled decisions was used to identify Supreme Court decisions that go on

to be overturned and the decisions that overturn them (“Supreme Court decisions overruled by subsequent decisions”, 2002)

Because this study aims to expand the analysis of overruled precedent beyond the point of original decision and overruling decision, it focuses on cases that survive long enough to have measurable lifespans. Precedents that are overruled quickly have fewer opportunities to influence the legal system. While important in their own manner, these flash-in-the-pan precedents are qualitatively different from precedents that exist for decades as good law before they are overruled. For these reasons we focus on precedents that have a lifespan of at least ten years in the analysis below.

4.1. Depreciation and Authority Matches

Each overruled case is matched to two other decisions written in the same year. In order to find suitable matches for depreciation and authority score comparisons the total number of citations received by each overruled decision before it is overruled is tallied. Every decision issued in the same year as the overruled decision is then inspected, choosing as a match that decision with the smallest absolute value difference in citations received over the same period.

Matching cases by the number of citations received provides a set of matches that we can expect to be reasonably similar in importance to the set of overruled cases. There will of course be differences between the area of law covered by the overruled case and its match, but there is little reason to expect that these differences are systematic. Given a large enough sample of overruled cases and their matches, the primary distinction between them will be that the overruled cases go on to become bad law, whereas their matches do not. Thus, any significant differences we observe between the two populations are most likely to be due to this underlying difference.

4.2. Hub Matches

Because hub authority is a function of both the authority of cited cases as well as the number of cases cited, matching based on in-citations does not provide an adequate comparison. In order to compare hub scores of overruled cases with those of cases that do