A model of common law adjudication

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Abstract

Interpreting judicial decision-making in terms of a realistic optimization problem has been a longstanding challenge for economic theories of adjudication. This article develops a theory of value for a fundamental decision facing an appellate court: the choice of whether to follow, distinguish, or overrule precedent. Extending the framework of reason-based choice into a dynamic model of jurisprudence, the theory illustrates distinctive judicial phenomena such as the practice of 'stealth overruling', and also sheds new light on judicial minimalism, legal completeness, and the constraint of precedent.

Keywords Reason-based choice · Dynamic consistency · Jurisprudence

1 Introduction

Common law systems are characterized by two institutional practices which have resisted formalization from classical decision theory. First is the discipline of writing judicial opinions, whereby a judge[1] provides both a *ruling* which decides the case at hand, and offers *reasons* which justify their choice of ruling.[2] From a decision-theoretic perspective, their 'action variable' is therefore both a choice of ruling,

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[1] We will assume that a court consists of a single judge, to bypass social choice (and game-theoretic) concerns arising from multi-member courts (e.g. Kornhauser & Sager, 1993).

[2] We encompass all legal materials - precedents, rules, doctrines, principles, etc. - under the umbrella term 'reasons'. Dworkin (1967) argues that rules obey a different logic from principles: whereas rules are all-or-nothing, and thus inconsistent if they conflict, principles are often in conflict and are therefore assessed by their relative weights. However, Raz (1972) offers several examples where rules can be in conflict and also require weight-based adjudication, and thus Raz (1979) treats legal reasons as the primary unit of analysis.

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as well as a choice of which reasons to include in their opinion. Formalizing this choice, and the manner in which justificatory reasons lend support to case outcomes, without logically entailing them, has been a longstanding challenge for economic theories of adjudication.[3]

Second is the adherence to the principle of *stare decisis* ('to stand by things decided'), whereby judicial rulings and reasons stated in opinions are constrained to be consistent with those from previous cases (precedents). This complicates the structure of judicial preferences: on the one hand, judges have a second-order preference (indeed, it is their institutional duty) to decide cases in a manner consistent with precedent. On the other hand, judges are also empowered to modify, or even overrule precedent. Choosing between these options often presents a dilemma, and the challenge for a theory of value is to characterize the considerations and objectives which explain how such choices are made. Abstractly, "[the] choice for the judge is that of change or the status quo, following the precedents or attempting to make new law[.]" (Deutsch, 2007, p. 16). This choice is ubiquitous in the practice of common law adjudication, and yet, a theory of how judges make such decisions, and even more fundamentally what they are valuing when they do so, has thus far evaded formal analysis.[4]

The present article meets this challenge by first demonstrating that common law adjudication is a paradigm case of 'reason-based choice', which was pioneered in a series of papers by Dietrich and List (2013, 2016, 2017), and expanded upon significantly by Sher (2019), who in turn applied insights from propositional decision theory (Jeffrey 1965, Spohn 2012, Bradley 2016). We introduce a model of common law adjudication which applies the Sher (2019) framework for reason-based choice to the institutional particulars of the common law. The model formalizes Dworkin's influential 'chain novel metaphor' for the law (Dworkin, 1982), whereby the law is created by the co-authorship of a succession of judges who each contribute their own 'chapter' after reflecting on the reasons presented in the opinions of their predecessors.

The manner in which judges balance the often conflicting demands of precedent with their own, idiosyncratic principles, determines the path of legal development. If one follows Shapiro (2011) in treating legal propositions as *plans* for guiding action, the fundamental decision for the judge can be conceptualized as the choice of whether to reaffirm or to "reconsider" (Bratman, 1992) the legal plan. Thus, unlike classical decision theory, which typically treats each decision problem 'de novo', common law adjudication is an example of 'resolute choice' (McClennen, 1990), because the judge "does not treat each subsequent choice point as a new occasion for

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[3] See, for example, Chapman (1994) who considers a variety of case studies before concluding that "legal reasoning...contradicts the most basic consistency axioms of rational choice theory." (p. 46) This is in large part due to the fact that classical decision theory typically assumes that choice functions are monotonic, while legal reasoning is a form of defeasible reasoning (Tur, 2001) which is non-monotonic.

[4] "...The inability to identify a plausible objective function to impute to judges has frustrated economic analysis from the outset." (Kornhauser, 1992a, p. 169)

evaluation and deliberation - unless, of course, he has received new information that requires him to reassess his original decision" (McClennen, 1990, p. 159).[5]

Judges therefore require what Bratman (1992) calls "habits of non-reconsideration", and judges can be placed on a spectrum by the extent to which they are willing to 'reconsider' precedent when it conflicts with their own principles. On one end of the spectrum is the 'legalist' conception of jurisprudence, which considers judges to be rule-followers with little to no discretion in deciding cases. This view "requires that the law contain[s] a preexisting solution for every conceivable case. Consequently, the law is complete, consistent, and determinate."[6] Legalism is consistent with the social norm that judges "pride themselves on the rationality of their rulings and the suppression of their personal proclivities[.]"[7] However, legalism has difficulty accounting for the evolution of common law, whereby reasons introduced (effectively legislated) in judicial opinions carry precedential 'weight' in future cases, and even sometimes overrule previous decisions. On the other end of the spectrum are the 'legal realists', who view judges as having exogenous preferences over the objects of their choice, whether case outcomes or legal reasons, and decide cases in accordance with these preferences (subject to social constraints). On this view, the constraint of precedent and the determinacy of the law is exaggerated: "... [the] apparently strict obligation to follow precedent [is] highly misleading...for later judges [have] tremendous leeway in being able to redefine...the precedential cases. This leeway enable[s] judges, in effect, to rewrite the rules of law on which earlier cases had been decided."[8]

The realist perspective has fit comfortably into the classical decision theory paradigm (Gennaioli & Shleifer, 2007a), but it has difficulty framing the legalistic constraints judges face when deciding cases. Our model contributes to this perennial debate by illustrating a middle-ground between these views.[9] Inspired by Dworkin (1982), we characterize judges as having preferences over case outcomes *conditional on* the strength of the justificatory reasons stated in the respective case's judicial opinion. In a nutshell, judges prefer the ruling which they consider to be most justified by legal propositions. Each judge takes into account the set of reasons and rulings of previous cases (precedents), but they are also equipped with their own personal 'reason-structure' which includes reasons not stated in the opinions of precedents, on the basis of which they may disagree with previous rulings. The details of the interaction between the judge's personal reason-structure and their commitment to various institutional constraints are shown to explain the direction of legal change and its determinacy.

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[5] In the context of our model, judges are resolute in their commitment to *stare decisis* (Assumption 3), and in their discipline of only distinguishing or overruling precedents when they can provide a novel legal proposition as a justification for doing so. This is encapsulated in the definition of a 'Distinguishing Case', as well as Assumption 5 of Sect. 4.

[6] Schauer, 1981, p. 311.

[7] Scalia & Garner, 2008, p. 32.

[8] Altman, 1986, p. 186.

[9] Our model is sufficiently general that we can remain neutral between legalism and realism: both can be accommodated into the framework depending on the restrictions placed on the judicial preferences.

By occupying a middle-ground between legalism and realism, the model illustrates the dual purposes of the common law: providing stability while evolving incrementally. In particular, it endogenizes a fundamental dilemma facing an appellate court: the choice of whether to follow, distinguish, or overrule precedent. The resulting theory of value accounts for distinctive judicial phenomena such as the practice of 'stealth overruling' (Friedman, 2010), whereby a court considers a precedent to be erroneously decided but instead of overruling it, the court narrows its scope to such an extent that it has little remaining applicability. The model also provides a novel argument in favor of judicial minimalism (Sunstein, 1999): it is shown that although broad opinions are often thought to enhance legal determinacy, the logic of common law adjudication entails that broad opinions are prone to rendering future cases which would have been covered by precedent into indeterminate 'Cases of First Impression'. However, we show that the Raz-Simpson distinguishing condition (Horty, 2015), which is in line with a minimalist approach to adjudication, prevents Cases of First Impression from arising in this way.

2 Related literature

Our study of judicial decision-making intersects with lines of scholarship in political economy, law and economics, artificial intelligence and law, decision theory, and jurisprudence (which is discussed in the next section). The political economy literature has primarily been interested in how the common law evolves over time, particularly with regards to its efficiency and corresponding welfare effects. In service of this aim, these models have tended to simplify the judicial objective function: Gennaioli and Shleifer (2007a) assume judges have exogenous preferences over rules, Baker and Mezzetti (2012) assume judges have preferences over case dispositions but adhere to precedent because it is costly to decide cases on their specific features, and Callander and Clark (2017) further simplify the judicial reasoning process by assuming judges decide cases following a Brownian motion process. These models offer valuable insights into the impacts of 'micro' level judicial decisions on the 'macro' level evolution of the common law, but they do so at the cost of oversimplifying the judicial objective function. This has made it difficult for these frameworks to characterize important 'micro' level decisions which concern us in this article, such as the choice of overruling versus distinguishing when both options are on the table (Gennaioli & Shleifer, 2007b).

In law and economics, as well as in political science, a prominent model has been the 'case-space model' of Kornhauser (1992a). This framework emphasizes the role of case-facts in judicial decision-making: a case is treated as a collection of *facts* (typically modeled as a point in a metric space) and judges decide cases based on their preferences, whether these are defined over case outcomes (as in Baker & Mezzetti, 2012), outcomes and rules (Parameswaran et al., 2021), or social consequences (Parameswaran, 2018). Rules are modeled as functions from a set of *all possible* case-facts (along the dimensions of the given case) to case outcomes (typically 0 or 1). For example, if the case at hand involves eminent domain, then the dimensions of the case-space would likely include the value of the property, the value of the public

good, and several other dimensions. When a judge decides on a rule, they not only decide the case at hand; they decide, counterfactually, how every other *possible* case along the dimensions of the case facts would have been decided (for example, what the outcome would have been for every other value the property might have had).

The case-space model is not incompatible with ours, but our interest in legal reasons as they arise in judicial opinions in appellate courts leads us to de-emphasize the role of case-facts. As pointed out by the 18th century judge, Lord Mansfield, "...the law does not consist in particular cases, but in general principles, which run through the cases and govern the decision of them."[10] The demands of *stare decisis* pertain not to the collection of facts defining a case, but rather to the *reasons* given in the court's opinion, which bind together cases of differing fact patterns.[11] For example, in a case involving a particular automobile incident the court may justify their ruling with a reason pertaining to automobiles in general, or even more broadly in terms of all transportation modalities. Then, future cases involving automobiles will be constrained to take into account that reason. When a judge cites precedent, they do not embark on a dimension-by-dimension factual comparison between the case at hand and the precedential case. Instead, they identify a legal proposition shared between the cases. Sometimes, a case with a radically different fact-pattern can serve as a precedent because the general legal principle stated in its opinion applies to the case at hand. Thus, in our model, we ignore case-facts altogether and focus on the reasons stated in judicial opinions.[12]

A large body of work in artificial intelligence and law has studied judicial reasoning using tools from logic such as argumentation theory (Dung, 1995). In a review article, Franklin (2012) concluded that "While a good deal of [legal] reasoning has been successfully formalized, a crucial remaining problem concerns the 'balancing' of reasons[.] Suppose there are substantial reasons for a decision in a case, and a precedent that suggests an opposite decision. ...The balancing of reasons... leads inevitably into extra-logical considerations buried in the mind of the reasoner. Extracting and representing them remains one of the most serious obstacles to the formalization of commonsense and legal reasoning."[13] The major research program which has emerged since then is the 'reason-model' of Horty (2011, 2015, 2019). In the Horty model, judges consider a variety of 'factors' which intrinsically favor either the plaintiff or defendant, and they cite a subset of these factors as reasons supporting their case outcome. The reasons can then be interpreted as premises in a defeasible argument for their decision, and judicial decisions determine a priority ordering over reasons which constrain the arguments given by future judges.

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[10] Allen, 1966, p. 62.

[11] When cases are viewed as collections of facts, the concept of precedent itself becomes dubious, as no two cases are identical in their case facts.

[12] We use the term 'reason' in a very general sense: reasons may be explicitly stated in an opinion, or they may be the implied *reasoning* which led to what is explicitly stated. So as to not get caught up in issues of meaning indeterminacy, or whether it is explicit or implicit reasons which carry precedential weight, our model assumes that judges have a common understanding of what is meant by, and the scope of, each precedential opinion.

[13] Franklin, 2012, p. 236.

In contrast to the (defeasible) logic-based approach of Horty, we take a decision-theoretic approach: judges are viewed as maximizing a type of utility *conditional on reasons* rather than making defeasible arguments from reason-based premises. This enables us to define an optimization problem for the judge which explains their choice of following, distinguishing, or overruling precedent. Also, whereas the Horty model treats reasons as 'factors' which intrinsically favor one of the sides, the judges in our model ascribe value to the conjunction of reasons applying to a case in a manner which is not reducible to the weights of each reason independently of that particular context. For example, the reason 'the defendant was intoxicated' may in isolation be a reason in favor of a plaintiff; however, if in a particular case, intoxication is being used as an argument for diminished capacity, then that reason may be a factor in favor of a defendant. Thus, the judges in our model decide cases by assigning evaluative judgments to the conjunction of all relevant reasons, without decomposing that valuation into judgments about the reasons in isolation.[14]

In order to characterize the choice-theoretic foundations of judicial opinions, we build on recent work in reason-based choice. Following Sher (2019), we treat judges as having preferences over (case) outcomes conditional on the weight of reasons pertaining to those outcomes. We then extend the Sher framework to a diachronic setting, and place institutional constraints on judicial choice, such as a consistency requirement representing *stare decisis*, as well as a constrained optimization problem inspired by Dworkin (1982). The result is a theory of value over judicial opinions.

3 Jurisprudence

In this section we introduce the elements from jurisprudence which underlie the formal analysis of the next section. A fundamental decision facing an appellate court judge is the choice of whether to follow, distinguish, or overrule the guidance of precedent-setting opinions.[15] For example, the appellate judge may need to decide whether the actions of a defendant fall under the purview of negligence, and this decision must be informed and supported by general principles stated in the opinions of past cases where the issue of negligence arose. If past opinions "noncontroversially [generate] an answer to the question at hand ... in which the answer so generated is consistent ... with the social, political, and moral climate in which the question is answered",[16] then the case at hand (called the 'instant' case) is considered an *Easy Case* and is disposed of by citing the appropriate precedents.

However, there are often precedents which unambiguously point to a particular outcome, but which are still "morally, socially, or politically...hard to swallow".[17] In these cases, the judge may elect to *distinguish* the precedent from the instant case. A precedent is distinguished by a case (equivalently, we say that the case is a *Distinguishing*

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[14] This is a form of 'reasons holism' in the sense of Dancy (2004).

[15] A trial court judge is more likely to adhere to precedent, and will be more concerned with the details of fact-finding, which are outside the scope of our model.

[16] Schauer, 1985, p. 416.

[17] Schauer, 1985, p. 416.

Case) when a judge rules that although the reasons stated in the precedential opinion do apply to the instant case, and although the precedent was ruled 'correctly', there is an additional reason relevant to the instant case which has not been discussed in prior opinions, which is deserving of having legal status. Because of this, the judge is not bound to arrive at the same ruling as previous cases to which the novel legal proposition does not apply. For example, in the classic New York Court of Appeals case of *Riggs v. Palmer* (1889), the court held that "no man should profit by his own wrong" which became a binding precedent applying to the later New York State court case of *Youssoupoff v. Columbia Broadcasting System Inc.* (1965). However, the later court, while conceding the relevance of *Riggs*, found that there were reasons present in *Youssoupoff* which made the precedent "sufficiently distinguishable [so] that there was no obligation on the part of the court to have reached the same outcome as in *Riggs*."[18] The novel reasons pertaining to *Youssoupoff*, which were effectively legislated into law by the 1965 court, then became precedent-setting for future cases.

Finally, in exceptional circumstances, the judge may decide to overrule the precedent, arguing that the precedent-case was incorrectly decided. Even then, the judge must present a reason which was not considered in the precedent-setting case; the judge is not free to assert that the precedent-setting case considered all the relevant reasons but came to the wrong conclusion.[19] This discipline will be shown to restrict the ability of judges to overrule precedent.[20] A formal analysis of why a court would choose to distinguish, when the option of overruling is on the table, has been a gap in the literature which our model helps to fill. Gennaioli and Shleifer introduce models of distinguishing (Gennaioli & Shleifer, 2007a), and of overruling (Gennaioli & Shleifer, 2007b) in isolation, but they do not offer a theory of value which explains why a court would distinguish, and not overrule a precedent it considers mistaken. In our model, the choice of following, distinguishing, or overruling precedent is endogenous to the judicial optimization problem we introduce in Sect. 6.

In addition to cases which are governed by precedent, some cases are referred to as *Cases of First Impression* to indicate that the case involves a novel question of law for which there is no precedent. There are a variety of ways that a case may be deemed to be one of first impression.[21] First, it may be a consequence of the 'open texture' of law as in Hart's (1956) famous hypothetical that the rule "no vehicles are

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[18] Schauer, 2009, p. 58.

[19] In *Dickerson v. United States* (2000) the Fourth Circuit Court of Appeals decided against overruling *Miranda* because the court did not find "special justification" to do so. Disagreeing with the ruling is not enough to overcome stare decisis: "the principle of stare decisis becomes meaningless if a court feels free to overrule all of those previous decisions it believes to be wrong (Schauer, 2009, p. 60).

[20] For example, in the recent *Dobbs v. Jackson Women's Health Organization* (2022) case which overruled *Roe v. Wade* (1973) and *Planned Parenthood v. Casey* (1992), the court claimed that the precedent-cases were based on a "faulty historical analysis": "By the time the Fourteenth Amendment was adopted, three-quarters of the States had made abortion a crime at any stage of pregnancy. This consensus endured until the day Roe was decided. Roe either ignored or misstated this history, and Casey declined to reconsider Roe's faulty historical analysis." (p. 3)

[21] Empirical investigations typically treat a case to be one of first impression when the judicial opinion refers to it as such, so as to bypass the need for a formal definition. See Lindquist & Cross (2005) for an empirical study of the relationship between Cases of First Impression and Dworkin's chain novel metaphor.

to be taken into the park" underdetermines whether scooters are permitted. Such Cases of First Impression do not arise in our model because we assume that there is no vagueness about whether a legal proposition applies to a given case. Second, a case may be deemed to be one of first impression when it involves a legal issue from a precedential case which is now being considered in the context of a different legally recognized category of cases. For example, the aforementioned case of *Riggs* was the *first* time the question arose of whether a will is voided after a beneficiary murders the testator. Since both 'inheritance' and 'murder' are legally recognized categories of cases which had not previously arisen in tandem, the law provided indeterminate guidance on how to decide such a case. Another example along these lines is *Nixon v. Fitzgerald* (1982), which decided the scope of presidential immunity and whether the president is in some sense "above the law" (Forry, 1983).

A Case of First Impression may also be a case in which a set of *conflicting* legal propositions stated in the opinions of precedents intersect in a particular case in a manner which has not been previously ruled on. In such cases, a judgment needs to be made as to which proposition is to be given greater 'weight'. For example, in *Henningsen v. Bloomfield Motors* (1960) the New Jersey Supreme Court was faced with a Case of First Impression in which the ruling according to the principle of 'freedom of contract' conflicted with the ruling according to the principle of 'duty of care'. The court "balanced them against each other, and declared the principles that supported recognizing a duty of care ... outweighed those that supported recognizing [freedom of contract]" (Shapiro, 2011, p. 263).

A Case of First Impression may or may not have a *morally* obvious outcome, but it cannot, in virtue of being ungoverned by precedent, be decided by a mechanical reaffirming of 'plans' set forth in prior decisions. There is a longstanding debate within jurisprudence as to whether, and to what degree, judges exercise discretion when deciding cases (Dworkin, 1963). Judicial discretion is at odds with the ideal that legal propositions have determinate truth values prior to adjudication, which is seen as a rule of law virtue as it constrains the arbitrary exercise of state and judicial power (Fuller, 1964), and it enhances efficiency by enabling economic agents to coordinate expectations. In Cases of First Impression, judges are by definition unable to defer to the guidance of precedent; as such, the legal propositions involved in these cases are 'gaps' in the law - indeterminacies which require judges to decide, rather than to discover, the content of the law. In the jurisprudence literature, this is known as the 'problem of legal indeterminacy': "...if the law were indeterminate...it would not be much more than a pious fraud: judges would be "legislating" ... in all cases. Judges would always be creating law, in flagrant violation of their institutional duty to apply preexisting law."[22] The common law practices of reason-giving and *stare decisis* are thought to mitigate legal indeterminacy by ensuring that the law is coherent, non-arbitrary, and 'speaks with one voice' (Raz, 1992). The hope is that once a large enough body of case law develops, the reasons set forth in past decisions will 'determine' the 'right' ruling in future cases (Dworkin, 1963).

In the next section we provide a formal treatment of these concepts from jurisprudence. Our initial results are independent of the specific functional form of the judicial

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[22] Altman, 1986, p. 188.

objective; we therefore postpone the analysis of the judge's optimization problem to Sect. 6.

4 Setting

Let the natural numbers $\mathbb{N} = \{1, 2, 3, \ldots\}$ represent a time-ordered set of cases from an appellate court. There is a corresponding time-indexed sequence of individual judges $(j_t)_{t \geq 1}$, each of whom decides cases by choosing a 'ruling function' $r^t : \{1, \ldots, t\} \to \{0, 1\}$. We assume judge j_t chooses the full ruling function at time t, rather than just deciding the ruling of case t (denoted $r^t(t)$), because j_t may choose to overrule precedent which involves modifying rulings in r^{t-1} rather than simply extending the function to time t.[23]

Judges are characterized by the reasons they consider, and the weights they place over reasons: $(j_t)_{t \geq 1} = (\mathcal{R}_t, w_t)_{t \geq 1}$.

- We call $\mathcal{R}_t$ the judge's 'reason-structure'. It is a finite set of non-empty subsets of $\mathbb{N}$ which is closed under non-empty intersections in the sense that for all subsets $S \subseteq \mathcal{R}_t$, if $\cap S \neq \emptyset$ then $\cap S \in \mathcal{R}_t$. Note that this implies that for all $t \in \mathbb{N}$, $\mathbb{N} \in \mathcal{R}_t$ because for all $t \in \mathbb{N}$, $\emptyset \subseteq \mathcal{R}_t$ and $\cap \emptyset = \mathbb{N}$.
- The judge's 'weight function' $w_t : \mathcal{R}_t \to \mathbb{R}$ is interpreted as the 'weight in favor of the plaintiff' when $w_t(R) > 0$ (i.e., in favor of ruling $r^t(c) = 1$), as the 'weight in favor of the defendant' when $w_t(R) < 0$ (i.e., in favor of ruling $r^t(c) = 0$), and $w_t(R) = 0$ is to be interpreted as R having neutral weight, i.e., as being neither in favor of the plaintiff nor defendant. We assume that the tautological proposition has neutral weight, i.e., $w_t(\mathbb{N}) = 0$ for all $t \in \mathbb{N}$.

We follow Sher (2019) in defining reasons extensionally, as properties of cases, and we require closure under non-empty intersection so that judges may consider the weight in favor of a ruling when a given reason *and* others are simultaneously present in a given case.[24] This setup is a dynamic extension of the static choice framework in Sher (2019); we now proceed to place constraints on this structure which reflect the institutional particulars of common law adjudication.

The public record of the judge's private reasoning is their written opinion. At each time period t, the corresponding judge writes a judicial opinion $P_t \in \mathcal{R}_t$, where $t \in P_t$ for all $t \in \mathbb{N}$.[25] The *precedent-reasons set at time t*, denoted P^t, is interpreted

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[23] r^t 'extends r^{t-1} to time t' when $r^t(c) = r^{t-1}(c)$ for all $c \in \{1, \ldots, t-1\}$.

[24] Sher (2019) requires the set of reasons to have a σ-algebra structure so that a probability measure can be defined. It is true that the propositions of judicial opinions often contain disjunctions and negations; for example, a party did *not* have the capacity to make a contract and therefore the contract is *not* valid. However, since our results only rely on reason-structures being closed under non-empty intersection, we do not include the full σ-algebra structure.

[25] The assumption that judicial opinions only involve first-order reasons (properties of cases) is an important limitation of our model. Judicial opinions which make second-order claims about reasons, for example that only certain *types* of reasons are permissible forms of evidence, are outside the scope of our current model. However, our current framework does have the resources to formalize Raz's (Raz, 1979)

as the set of propositions which can be formed by taking non-empty intersections of the reasons stated in the opinions of past judges. More formally, P^t is the set of non-empty intersections of sets in $\{P_1, ..., P_{t-1}\}$, i.e., $P^t = \{\cap S : S \subseteq \{P_1, ..., P_{t-1}\}, \cap S \neq \emptyset\}$. Note that this entails $P^1 = \{\mathbb{N}\}$, which is tantamount to there being no pre-existing legal framework prior to common law adjudication, such as a constitution (beyond the tautological proposition $\mathbb{N}$ which 'says nothing'). We require the precedent-reasons set to be closed under non-empty intersections so that judicial opinions are only considered to contribute to the precedent-reasons set when they express a proposition which goes beyond conjunctions of what has already been stated in past opinions.

Assumption 1 For all $t \in \mathbb{N}$, $P^t \subseteq \mathcal{R}_t$.

In other words, judge j_t takes into account all precedent-reasons before making their ruling: "when...a court gives a reason for a decision, it is expected to follow that reason in subsequent cases falling within the scope of the reason articulated by the court on the first occasion" (Schauer, 2009, p. 177).[26] Note that a staunch legalist will have a reason-structure which coincides exactly with the precedent-reasons set, i.e., $\mathcal{R}_t = P^t$.

Definition 1 The set of legal propositions from P^t which 'apply' to case $c \in \mathbb{N}$ is denoted by $P^t(c) =^{df} \{p \in P^t | c \in p\}$.

Each judge j_t chooses two things: first, a judicial opinion (a reason) $P_t \in \mathcal{R}_t$, and second, a ruling function r^t. We can envision judge j_t as having access to the case history $\{1, ..., t\}$, precedent-reasons set P^t, and prior rulings r^{t-1}, then making their fundamental decision which is, recall, the choice of "status quo...or attempting to make new law" (Deutsch, 2007, p. 16). We may imagine the judge choosing to write their opinion by adding to a default template which already cites the relevant legal propositions from precedents. The "status quo" choice is to let $P^{t+1} = P^t$, which can be accomplished by writing an opinion which repeats reasons from the template, or conjunctions thereof, or by stating the tautology $P_t = \mathbb{N}$. These are equivalent from the perspective of maintaining the status quo, and this equivalence will be clear once we introduce the judicial optimization problem in Sect. 6. However, the judge may also choose to "make new law", by introducing a novel reason with their opinion which changes the precedent-reasons set so that $P^{t+1} \neq P^t$.[27] The *content* of the judicial opinion P_t is therefore to be conceptualized in terms of whether it expresses a proposition

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beyond conjunctions of what has already been said. We postpone the discussion of how judges make this choice to Sect. 6; however, based on the following assumption, the judge's ruling function is determined once the choice of opinion is made.

Assumption 2 For all $t \in \mathbb{N}$, and all $c \in \{1, ..., t\}$, $r^t(c) = 1$ if and only if $w_t(\cap P^{t+1}(c)) > 0$.

A ruling function, r^t, is said to *agree with* a weight function, w_t, when the equivalence in Assumption 2 is satisfied.[28] Thus, the value of the judge's ruling function for a particular case is determined by the conjunction of all the reasons applying to that case from the precedent-reasons set which results from their opinion. This assumption ensures that judges decide 'like cases alike': the ruling function must be 'consistent' in the sense that judges decide cases with the same conjunction of reasons in the same way. Assumption 2 also entails a default presumption in favor of the defendant, as when the weight of reasons which apply to a case is neutral, i.e., $w_t(\cap P^{t+1}(c)) = 0$, the ruling is determined to be in favor of the defendant.[29]

We now place an important restriction on the weight function of judges which represents the institutional discipline of *stare decisis* ('to stand by things decided'):

Assumption 3 For all $t \geq 2$, and all $t^* < t$, $w_t(\cap P^t(t^*))$ agrees with $r^{t-1}(t^*)$.

This assumption will play a central role in what follows: it formalizes the sense in which judges are 'resolute choosers' who do not re-evaluate whether their immediate predecessor arrived at the correct ruling *given* the precedent-reasons set which arose from their opinion. Thus, if a judge's immediate predecessor held that a particular conjunction of reasons entails a particular ruling, then that judge will ensure that their weight function agrees with this decision. They may not *really* believe this, but they internalize this mindset and rule accordingly. For example, in *Ring v. Arizona* (2002), Justice Anthony Kennedy was forced to uphold the reasoning behind a precedent case he dissented to, as a matter of judicial discipline: "[t]hough it is still my view that [the earlier case of] *Apprendi* was wrongly decided, *Apprendi* is now the law, and its holding must be implemented in a principled way."[30] Crucially, this does not mean that j_t agrees with the ruling of their immediate predecessor; it implies that if the judge disagrees with their immediate predecessor's ruling it is in virtue of the judge believing that their predecessor omitted relevant reasons from their analysis which would have changed the ruling.

It is convenient to summarize the setting of a *Common Law System* with the tuple $\mathcal{L} = \langle \mathbb{N}, (r^t)_{t \geq 1}, (\mathcal{R}_t)_{t \geq 1}, (w_t)_{t \geq 1}, (P_t)_{t \geq 1} \rangle$ which satisfies the above properties. In Sect. 6 we will introduce a 'judicial objective function' which explains how judges

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[28] Note that $\cap P^{t+1}(c) \in \mathcal{R}_t$ since $P_t \in \mathcal{R}_t$, $P^t \subseteq \mathcal{R}_t$ (Assumption 1), and $\mathcal{R}_t$ is closed under non-empty intersections, so the weight $w_t(\cap P^{t+1}(c))$ is well-defined for all $t \in \mathbb{N}$ and for all $c \in \{1, ..., t\}$.

[29] We let the cutoff for a ruling in favor of the plaintiff be any positive amount of weight. We could have also had a threshold value above zero as the cutoff, which would be more realistic, but would not have affected the main results of the paper.

[30] Cited in Schauer (2009, p. 89).

choose $(P_t)_{t \geq 1}$ (which, recall, by Assumption 2 determines $(r^t)_{t \geq 1}$). In the remainder of this section, we characterize some essential jurisprudential concepts using the language of our framework.

Assumption 4 For all $t \in \mathbb{N}$, P_t is not a singleton.

This is the assumption of the 'generality' of legal reasons: "...if a reason were no more general than the outcome it purports to justify, it would scarcely count as a reason. The act of giving a reason, therefore, is an exercise in generalization. The lawyer or judge who gives a reason steps behind and beyond the case at hand to something more encompassing."[31] The generality of reasons is what enables the constraint of *stare decisis*, and with this idealizing assumption we place a strong epistemic constraint on judicial reasoning. The assumption effectively says that judges only decide the case before them with reasons which *certainly* apply to other cases, whether previously or in the future. This does not mean that the judge at time t 'knows' what all future cases will be, but they do know that their opinion is *sure* to apply to cases other than their own. This implies that when a judge introduces a new reason at time t which does not apply to previous cases, they are able to correctly predict that their opinion will apply to a future case.

> ...implicit in the common-law method is the belief that the case before the court may be representative of cases of that type. When the deciding court comes up with the best resolution of that particular case, therefore, it has in the process located the best resolution for the type of case in which the particular case before it is an example. ...it is in effect deciding a whole bunch of cases, but in the process it is required to guess about what those other cases might look like. - Schauer, 2009, p. 110, p. 199

As discussed in Sect. 3, cases governed by precedent can be classified by whether precedent is followed, distinguished, or overruled.

Definition 2 We say that case $t \in \mathbb{N}$ is an *Easy Case* if $P^{t+1} = P^t$, and either $P^t(t) = \{\mathbb{N}\}$, or $P^t(t) = P^t(t^*)$ for some $t^* < t$.

Intuitively, an Easy Case is one in which precedent is followed, so that no new reasons are introduced into the precedent-reasons set. In the special case of $t = 1$, the definition reduces to simply $P_1 = \mathbb{N}$.[32]

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[31] Schauer (1995, p. 635).

[32] Note that we consider a case t to be Easy, and a precedent case t^* to be followed, whatever the opinion P_t is, as long as P_t does not introduce reasons beyond non-empty conjunctions of reasons already introduced in previous opinions. In particular, our model does not permit judges to write that a subset of reasons is *sufficient* for arriving at the same ruling in future cases. Such an opinion would consist of second-order reasons which are outside the scope of our baseline model.

Definition 3 We say that case $t \in \mathbb{N}$ is a *Distinguishing Case* if the following conditions are satisfied:

1. $P^{t+1} \neq P^t$
2. Either $P^t(t) = \{\mathbb{N}\}$ or $P^t(t) = P^t(t^*)$ for some $t^* < t$
3. r^t extends r^{t-1} for $t \geq 2$

Distinguishing is thus "a form of law-making" (Raz, 1979, p. 186) which expands the precedent-reasons set while extending the ruling function in cases which are governed by precedent. Aside from overruling, "Distinguishing...is the central mechanism...through which common law evolves despite binding precedents" (Gennaioli & Shleifer, 2007a, p. 46). Note that $t = 1$ is a Distinguishing Case if and only if $P_1 \neq \mathbb{N}$, or in other words if $t = 1$ is not an Easy Case.

Definition 4 We say that case $t \geq 2$ is an *Overruling Case* when $r^t(c) \neq r^{t-1}(c)$ for some $c < t$.

We then say that case c 'was overruled' at time t, or 'overruled by' j_t, or that opinion P_t is an 'overruling opinion'.

Assumption 5 For all $t \geq 2$, case $c < t$ can only be overruled at time t if $P^{t+1}(t) = P^{t+1}(c)$.

This assumption disciplines the ability of judges to overrule precedent: j_t may only modify rulings in r^{t-1} if the *same* set of legal propositions from P^{t+1} govern both the precedent and the instant case. Note that an Overruling Case t must expand the precedent-reasons set, i.e., $P^{t+1} \neq P^t$, because by Assumption 3, j_t agrees with the ruling of the precedent *given* the reasons from the previous precedent-reasons set, and by Assumption 2, their ruling function must agree with their weight function.

Recall from Sect. 3 that in addition to cases governed by precedent there are also Cases of First Impression, which can be formalized in a natural way.

Definition 5 We say that case $t \in \mathbb{N}$ is a *Case of First Impression* if $P^t(t) \neq \{\mathbb{N}\}$ and $P^t(t) \neq P^t(t^*)$ for all $t^* < t$.

Intuitively, a Case of First Impression is a case in which the combination of legal propositions which apply to it have not occurred together in a previous case (it is the *first* occurrence of a particular combination of reasons from a precedent-reasons set).[33] The following example illustrates these case-types.

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[33] Note that we do not consider the case $t = 1$, in which $P^1(1) = \{\mathbb{N}\}$, to be a Case of First Impression because the case has a determinate ruling on account of Assumption 2 coupled with the institutional norm that $w_t(\mathbb{N}) = 0$ for all $t \in \mathbb{N}$, whereas a Case of First Impression is by definition a case in which the law offers indeterminate guidance. More broadly, a case in which the only applicable legal proposition is the tautological proposition is in practice likely to be settled before reaching litigation (due to considerations along the lines of Priest & Klein (1984)), so the inclusion of such cases in our definitions is primarily for the sake of theoretical completeness.

Example 1 Let $P_1 = \{1, 2, 4, 5\}$, $r^1(1) = 1$, $P_2 = \{1, 2, 4, 5\}$, $r^2(1) = 1, r^2(2) = 1$, $P_3 = \{3, 4\}, r^3(1) = 1, r^3(2) = 1, r^3(3) = 0, P_4 = \{3, 4\}, r^4(1) = 1, r^4(2) = 1, r^4(3) = 0, r^4(4) = 1$, $P_5 = \{1, 2, 5\}, r^5(1) = 0, r^5(2) = 0, r^5(3) = 0, r^5(4) = 1, r^5(5) = 0$. Then $t = 1$ is a Distinguishing Case, $t = 2$ is an Easy Case, $t = 3$ is a Distinguishing Case, $t = 4$ is a Case of First Impression, and $t = 5$ is an Overruling Case.

The next proposition enables us to partition the case set $\mathbb{N}$ into the Easy Cases $E \subseteq \mathbb{N}$, Distinguishing Cases $D \subseteq \mathbb{N}$, Overruling Cases $O \subseteq \mathbb{N}$, and Cases of First Impression $F \subseteq \mathbb{N}$, where $E \sqcup D \sqcup O \sqcup F = \mathbb{N}$.

Proposition 1 Given a Common Law System $\mathcal{L}$ satisfying Assumption 5, every case $t \in \mathbb{N}$ is exactly one of an Easy Case, Distinguishing Case, Overruling Case, or Case of First Impression.

Proof First, if $P_1 \neq \mathbb{N}$ then $1 \in D, 1 \notin E, 1 \notin O, 1 \notin F$. Otherwise, $1 \in E$, and $1 \notin D$, $1 \notin O, 1 \notin F$. Next, pick an arbitrary $t \geq 2$. Either r^t extends r^{t-1} or it doesn't. If it doesn't, then $t \in O$, and by definition $t \notin D$. It also follows that $t \notin E$ because then $P^{t+1} = P^t$, but by Assumptions 2 and 3 this entails that r^t extends r^{t-1}. Furthermore, $t \notin F$ because by Assumption 5, if case c is overruled at t, then $P^{t+1}(c) = P^{t+1}(t)$, but since $P^t \subset P^{t+1}$ it follows that $P^t(c) = P^t(t)$. In other words, Overruling Cases must have precedent, so they cannot be Cases of First Impression. If r^t extends r^{t-1}, then $t \notin O$ and either $P^{t+1} = P^t$ or not. Suppose $P^{t+1} = P^t$; then $t \notin D$. If additionally $P^t(t) = \{\mathbb{N}\}$ or $P^t(t) = P^t(t^*)$ for some $t^* < t$ then $t \in E$ and $t \notin F$. If $P^t(t) \neq \{\mathbb{N}\}$ and $P^t(t) \neq P^t(t^*)$ for all $t^* < t$ then $t \in F$ and $t \notin E$. Finally, if $P^{t+1} \neq P^t$ then $t \notin E$. If, additionally, either $P^t(t) = \{\mathbb{N}\}$ or $P^t(t) = P^t(t^*)$ for some $t^* < t$ then $t \in D$ and $t \notin F$. If not, then $t \in F$ and $t \notin D$. This exhausts all possibilities.

5 The problem of legal indeterminacy

On the legalist conception of jurisprudence, common law adjudication is not a matter of deciding cases according to the judge's idiosyncratic preferences, but rather according to the preferences of *the law itself*, personified. Cases of First Impression pose a problem for the legalist conception because if judges are meant to decide cases in accordance with the preferences of the law itself, guided by precedent, then in Cases of First Impression they are by definition unable to do so because these cases have no precedent.[34] There has long been a desire (e.g., Kelsen, 1945) to ensure that the law is "complete, consistent, and determinate"[35] in the sense that all cases are governed by precedent, so that Cases of First Impression never arise. By analogy with mathematical completeness, the idea of 'legal completeness' is that for every combination of legal reasons which *might* arise in a future case, there should

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[34] There is some empirical debate as to how frequently such cases arise in practice, e.g., Fischman (2021).

[35] Schauer (1981, p. 311).

already be a precedent where a judge has decided the outcome for that combination of legal reasons. Since we have not characterized a probability distribution over cases and reasons, we cannot interpret 'might arise' probabilistically. However, in light of the fact that at any time period there are always an infinite number of future cases, if we assume that any combination of reasons which 'might arise', *will* eventually arise, then we may define legal completeness in the context of our model as follows:

Definition 6 A precedent-reasons set P^t is said to be *complete* if for all $c \geq t$, if $P^t(c) \neq \{\mathbb{N}\}$ then there exists a case $t^* < t$ such that $P^t(t^*) = P^t(c)$. Otherwise, P^t is said to be *incomplete*.

Much of the jurisprudence literature (e.g., Bobbio, 1960) considers it a truism that legal completeness is equivalent to the absence of future Cases of First Impression (usually referred to as legal 'gaps'). The first of these is a property of a *precedent-reasons set*, and the second is a property of a *case set*: a test of whether our definitions of these concepts are faithful to their traditional meaning is whether we are also licensed in using them interchangeably.

Proposition 2 Given a Common Law System $\mathcal{L}$, $F = \emptyset$ if and only if, for all $t \in \mathbb{N}$, P^t is complete.

Proof ($\rightarrow$) Suppose $F = \emptyset$ and for purposes of contradiction that P^t is incomplete for some $t \in \mathbb{N}$. Then the set of cases $C_t = \{c \geq t: \text{for all } t^* < t, P^t(c) \neq P^t(t^*) \text{ and } P^t(c) \neq \{\mathbb{N}\}\}$ is non-empty. Consider the case $\min(C_t)$. If $\min(C_t) = t$ then $t \in F$, contradicting $F = \emptyset$. If $\min(C_t) > t$, then $\min(C_t) \notin F$ entails that $P^{\min(C_t)}(\min(C_t)) = P^{\min(C_t)}(s)$ for some $s < \min(C_t)$. Then for all p in $P^{\min(C_t)}$, $\min(C_t) \in p$ if and only if $s \in p$. Since $P^t \subseteq P^{\min(C_t)}$, it follows that $P^t(s) = P^t(\min(C_t))$. But if $s \geq t$, this contradicts the definition of $\min(C_t)$, and if $s < t$, it contradicts the definition of C_t. Thus, P^t is complete.

($\leftarrow$) Suppose P^t is complete for all $t \in \mathbb{N}$, and for purposes of contradiction let $t \in F$. Then since P^t is complete, $P^t(t) = P^t(t^*)$ for some $t^* < t$, contradicting $t \in F$. Thus, $F = \emptyset$.

In other words, when the precedent-reasons set is complete at all times, cases do not arise on which the law is silent in the sense that the legal issues presented by those cases have yet to be litigated (and vice-versa). Completeness of a precedent-reasons set entails that all legal issues which *will* arise have already been litigated. Thus, if the problem of legal indeterminacy is to be avoided, then precedent-reasons sets must always be complete. However, this presents each judge with an epistemic challenge: how is j_t supposed to know, when they introduce their reason P_t, that this reason will not in the future give rise to a Case of First Impression, given that they cannot know what all future cases will look like? Recall that Example 1 illustrated how a Case of First Impression ($t = 4$) can arise as a consequence of a prior ($t = 3$) distinguishing. When judges introduce new reasons into the precedent-reasons set

by distinguishing,[36] these reasons can sometimes 'take on a life of their own' outside of what has already been litigated on, which can result in incomplete precedent-reasons sets, or equivalently in Cases of First Impression.

Addressing this challenge leads us to the main formal result of this paper, which shows that judges can ensure that Cases of First Impression never arise by following a discipline of distinguishing precedents in a sufficiently 'narrow' manner. Interestingly, this form of distinguishing has already been recommended in the jurisprudence literature, but its relation to legal completeness has not been discussed. It is known as the 'Raz-Simpson distinguishing condition' (Horty, 2015), which requires that courts distinguish precedents by introducing "new restricting conditions" (Raz, 1979, p. 186) which narrow the scope of the governing precedent. For example, suppose previous courts found that a medical professional was negligent when that professional satisfied three properties. A Raz-Simpson distinguishing ('narrowing' for short) could rule that when those three properties are present, *and* that medical professional is still in training, then they are not to be found negligent. Thus, when a precedent governs a case which has some novel property not applying to previous cases, a court may distinguish the precedent narrowly by restricting the application of the novel property to cases governed by the precedent.

The next definition formalizes the Raz-Simpson condition within the framework of our model. We then show that when there is no overruling, and distinguishing abides by the Raz-Simpson condition, Cases of First Impression never arise.

Definition 7 We say that case $t \in \mathbb{N}$ 'distinguishes narrowly' if $t \in D$ and $P_t \subseteq \{c \geq t : P^t(t) = P^t(c)\}$.

Proposition 3 Given a Common Law System $\mathcal{L}$, if $O = \emptyset$, and all cases $D \subseteq \mathbb{N}$ distinguish narrowly, then $F = \emptyset$.

Proof In light of Proposition 2, it suffices to show that P^t is complete for all $t \in \mathbb{N}$. We proceed by induction. For the base case, consider $t = 1$. If $1 \in E$ then $P^2 = P^1 = \{\mathbb{N}\}$ which is complete. If $1 \in D$, then $P^2 = \{\mathbb{N}, P_1\}$. Then, for all $c \geq 2$, if $P^2(c) \neq \{\mathbb{N}\}$ then $P^2(c) = \{\mathbb{N}, P_1\} = P^2(1)$, and so P^2 is complete.

For the inductive step, consider an arbitrary case $t \in \mathbb{N}$ and suppose P^t is complete. Then if $t \in E$, it trivially follows that $P^{t+1} = P^t$, which is complete. If $t \in D$, then since t distinguishes narrowly, $P_t \subseteq \{c \geq t : P^t(t) = P^t(c)\}$ and $\min(P_t) = t$. Then, for all $s > t$, either $s \in P_t$ or $s \notin P_t$. If $s \notin P_t$, then completeness of P^t ensures that there exists $t^* < t$ such that $P^t(t^*) = P^t(s)$. But then since $s \notin P_t$ by assumption, and $t^* \notin P_t$ since $\min(P_t) = t$, it follows that $P^{t+1}(t^*) = P^{t+1}(s)$.

If $s \in P_t$, then since t distinguishes narrowly, $P^{t+1}(s) = P^{t+1}(t)$. Thus, P^{t+1} is complete, and by induction P^t is complete for all $t \in \mathbb{N}$, which is equivalent, by Proposition 2, to $F = \emptyset$.

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[36] Note that judges can also introduce new reasons into the precedent-reasons set in Overruling Cases or Cases of First Impression, and it is possible to derive results analogous to those in this section for these types of cases as well.

This proposition sheds new light on debates between advocates of narrow versus broad opinion writing (Fox & Vanberg, 2014, Parameswaran, 2018). Judicial 'minimalists' such as US Supreme Court Chief Justice John Roberts advocate for narrow opinions which do not extend beyond the issues of the case at hand, whereas 'nonminimalists' such as former US Supreme Court Justice Antonin Scalia advocate for greater generality in opinions (Fox & Vanberg, 2014). Broad rulings are thought to enhance the predictability of law by constraining a wider class of future rulings. However, our results indicate that this can come at a cost: broad rulings can render cases which would have been governed by precedent, by the lights of the previous precedent-reasons set, into Cases of First Impression. On the other hand, if opinions are written narrowly, in accordance with the Raz-Simpson condition, then Cases of First Impression will not arise as a consequence of distinguishing. Thus, both schools of thought have a claim on reducing legal indeterminacy.

6 The constraint of precedent

We are now in a position to characterize an optimization problem for the fundamental decision facing the judge: the choice of whether to follow, distinguish, or overrule precedent. Essentially all prevailing models take for granted that "a lone judge deciding all cases herself could ... simply decide all cases as she saw fit according to whatever rule she thought correct."[37] There is a trivial sense in which this must be true, but the devil is in the details of the judicial objective function. It is important to emphasize that the setting of a Common Law System $\mathcal{L} = \langle \mathbb{N}, (r^t)_{t\geq1}, (\mathcal{R}_t)_{t\geq1}, (w_t)_{t\geq1}, (P_t)_{t\geq1} \rangle$ is compatible with a variety of judicial objectives. For example, judges may choose to write their opinions $(P_t)_{t\geq1}$ in a manner which conveys the totality of considerations from their reason-structure (assuming this satisfies Assumption 4 on 'generality'), since this may be thought to result in the best 'all things considered' judgment. While this is certainly a plausible objective, there are important institutional constraints which make "the dominant characteristics of legal reasoning...a route towards reaching a decision *other than* the best all-things-considered decision for the matter at hand" (Schauer, 2009, p. 7). For instance, if a judge wrote in their opinion that the best all-things-considered ruling was 'epsilon' in favor of a particular outcome, it would signal that their decision was based on discretion rather than firm legal grounds, which could delegitimate their authority.[38] In light of the fact that every judicial objective has its shortcomings, and adjudicating between theories of jurisprudence is beyond the scope of this paper, for our purposes we are content to formalize one prominent theory of value as a 'proof of possibility' that qualitative discussions from jurisprudence, including debates over the appropriate objective function, can be conducted in a more formal arena.

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[37] Landa & Lax, 2009, p. 946.

[38] "So far as a sound, workable judicial system is concerned...It is imperative...that judges create the impression that their opinions are correct beyond any possibility of doubt - and sacrosanct besides. Sometimes a judge becomes so expert in concealing all doubts about the correctness of his opinions that no one would suspect he had any - not even his psychiatrist!" (Levitan, 1957, p. 630).

Our theory of value was inspired by Dworkin's aforementioned chain-novel metaphor:[39]

> ...a judge should decide fresh cases in the spirit of a novelist in the chain writing a fresh chapter. The judge must make creative decisions, but must try to make these decisions "going on as before" rather than by starting in a new direction as if writing on a clean slate. ...[The] best interpretation of past judicial decisions is the interpretation that shows these in the best light[.]
> - Dworkin (1982, p. 147)

In later work, Dworkin defended his jurisprudence against the objection that he advocates for interpreting past decisions through "rose-colored glasses" and with a "principle of charity", rather than "accurately", by insisting that "all interpretation strives to make an object the best it can be" (Dworkin, 1986, p. 53). Dworkin further interprets "the best" in terms of "best justification" (Lyons, 1986, p. 486), and in the context of our model we interpret 'justification' as 'weight in favor of a ruling function' in the following precise sense.

Definition 8 The justification of ruling r^t, according to judge j_t, is given by

$$J_t(r^t) = \sum_{i=1}^{t} |w_t(\cap P^{t+1}(i))|$$

When a judge j_t chooses their opinion P_t they seek to maximize the sum of the absolute values of weights in favor of the ruling function induced by that opinion. In the spirit of the chain-novel metaphor, the judge does not only write their opinion so as to maximize the justification of *their* chapter (case), they write the opinion which makes the novel up to that point the most justifiable, for example by making disparate events of previous chapters more unified and compelling. This attitude whereby the judge asks themselves whether the reasons they introduce would alter the strength of past rulings is central to adjudication[40] and represents the ideal of the backward-looking judge.[41]

However, the judge might think that the most justified ruling function is one which overrules a large body of precedent. When presented with the dilemma of whether to follow, distinguish, or overrule precedent, the Dworkinian judge must trade off their desire to present the law in its best (most justified) light with a discipline of ensuring that their ruling function *fits* with the decisions of past judges:

> ...[A] particular interpretation must fit the record of judicial ... decisions in order to count as acceptable. ...How many decisions (roughly) can an interpretation set aside as mistakes, and still count as an interpretation of the string of

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[39] Because of this, we give Dworkin significant attribution in what follows, but we do not claim that the specific functional form chosen is the best exegesis of Dworkin's jurisprudence.

[40] Indeed, Dworkin (1986) argued that such 'integrity' defines the nature of law itself.

[41] "Law characteristically faces backward. Unlike most forms of policy-making which are concerned with a proposed policy's future consequences, legal decision-making is preoccupied with looking over its shoulder." (Schauer, 2009, p. 36)

decisions that includes those "mistakes"? ... A thoughtful judge might estab-
lish for himself, for example, a rough "threshold" of fit which any interpreta-
tion of data must meet in order to be "acceptable" on the dimension of fit,
and then suppose that if more than one interpretation ... meets this threshold,
the choice among these should be made, not through further and more precise
comparisons between the two along that dimension, but by choosing the inter-
pretation which ... better promotes the ... ideals he thinks correct.
- Dworkin (1982, p. 149)

Thus, a judge should consider a tradeoff between two dimensions of value when
deciding cases: 'fit' and 'justification'. Although Dworkin describes the process of
adjudication informally, his conception clearly points to a more formal characteriza-
tion. His advocating that a judge first ensure that their ruling meet a 'threshold of
fit' before deciding among the remaining possibilities in accordance with what they
deem to be most justifiable has the feel of a constrained optimization problem which
we now formalize in the context of our model.

Definition 9 The fit of ruling r^t (relative to r^{t-1}) is given by the expression

$$F(r^t|r^{t-1}) = \frac{1}{1 + \#\{c \in \{1, ..., t-1\} : r^t(c) \neq r^{t-1}(c)\}}$$

This 'fit function' has some desirable properties: first, it is convenient that fit
is a normalized index ($F(r^t|r^{t-1}) \in (0,1]$) so that a judge's 'threshold of fit' can be
defined by $\tau_t \in (0,1]$. Furthermore, fit equals one for non-overruling cases, and as
the number of cases overruled increases, fit approaches zero.

In the 'Dworkinian optimization problem', judge j_t chooses the opinion which
best justifies their ruling function, subject to a threshold of fit. We formalize this
with the following:

Definition 10 A Common Law System $\mathcal{L}$ is said to be 'Dworkinian' if for all $t \in \mathbb{N}$,
P_t solves:

$$P_t \in \underset{R \in \mathcal{R}_t : t \in R}{\operatorname{argmax}} \sum_{i=1}^{t} |w_t(\cap P^{t+1}(i))|$$

Subject to:

- $F(r^t|r^{t-1}) \geq \tau_t$, for r^t induced (via Assumption 2) by P_t.
- (Assumption 4) P_t is not a singleton.
- (Assumption 5) P_t may only overrule a case $c < t$ for which $P^{t+1}(t) = P^{t+1}(c)$.

Thus, every judge is a 'constrained justification maximizer': they write an opinion
P_t which maximizes their justification function $J_t(r^t)$, subject to constraints about fit,
generality, and overruling. The choice of whether to follow, distinguish, or overrule
precedent is endogenous to this optimization problem: the judge will distinguish or

overrule precedent if they are able to introduce reasons which improve the justification function, subject to the constraints.

Dworkinian optimization has important implications for judicial behavior: a judge will not necessarily include all relevant reasons in their opinion, because some of these reasons may reduce the justification function. Crucially, however, it does not entail that judges only include reasons which support their ruling, as including counterarguments can strengthen the justification function if these can be dealt with convincingly. For example, if a judge acknowledges that their opinion restricts free speech, but that the case is an instance of threatening speech which should be restricted, this may bolster the justification function. However, on the margin, when considering whether to include one final reason in their opinion, the judge will omit the reason if it lowers the justification function, and this is the sense in which the judges in our model seek the most decisive, *not* the best 'all things considered' ruling. This also formalizes the aforementioneed criticism of Dworkin's jurisprudence - that he advocates for judges to present the law through the lens of "rose-colored glasses" rather than "accurately".

Nevertheless, our model of a Dworkinian Common Law System captures important features of judicial decision-making. For example, one often hears judges lament the fact that they are bound by legal materials to decide cases in a manner conflicting with their personal preferences: "The concept of a system of precedent is that it constrains judges in some cases to follow decisions they do not agree with."[42] The next example illustrates this 'constraint of precedent'.

Example 2 Given a Dworkinian Common Law System, suppose $P^4 = \{\mathbb{N}, P_1\} = \{\mathbb{N}, \{1, 2, 3, 4, 5, 6\}\}$ with $r^3(1) = r^3(2) = r^3(3) = 1$. A judge at time $t = 4$ is deciding how to adjudicate their case, with their reason-structure $\mathcal{R}_4 = \{\mathbb{N}, P_1, R_2\}$ where $R_2 = \{3, 4, 5, 6\}$. Suppose $\tau_4 > \frac{1}{2}$ and $w_4(P_1) = 10$ and $w_4(R_2) = -20$. Then judge j_4 considers case $t = 3$ to have been ruled incorrectly: there was a stronger argument in favor of $r^3(3) = 0$, but judge j_4 is neither able to distinguish nor overrule $t = 3$ with R_2 because if the judge distinguishes with $P_4 = R_2$ then $r^4(4) = 0$ but $r^4(3) = 1$ which violates Assumption 2 (since $w_4(P_1 \cap R_2) < 0$). But the judge cannot overrule case $t = 3$ with $P_4 = R_2$ because then $F(r^4|r^3) = \frac{1}{2}$ which is below the threshold. Thus, their optimal action is to follow precedent with either $P_4 = \mathbb{N}$ or $P_4 = P_1$, illustrating the constraint of precedent.

Thus, the judge disagrees with a prior ruling, but they are unable to conceive of a reason to distinguish it which is compatible with their commitment to deciding 'like cases alike', and their commitment to a threshold of fit prevents them from overruling it as well. In such cases it is said that the preferred opinion "just won't write":[43]

There are times when a precedent cannot be distinguished away even under the narrowest approach consistent with fair argument[.]
- Shapiro (1987, p. 734)

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[42] Atiyah & Summers (1987, p. 27).
[43] Wald (1995, p. 1375).

Our model also has the resources to illustrate how a court may circumvent a precedent which it considers mistaken. In cases where overruling is deemed too costly (in other words, when overruling does not satisfy the threshold of fit), a court may "destroy a precedent without overruling it by distinguishing precedents in ways that practically nullify them..." (Gerhardt, 1991, p. 108).[44] Typically, a court will narrow the scope of a precedent by narrowly distinguishing the precedent where it applies. Sometimes, such narrowing can arrive at the same outcome as if the precedent had been followed, but by distinguishing narrowly the court effectively states that the precedent was "decided on an overbroad ground" (Re, 2014, p. 1895). However, when the distinguishing repeatedly arrives at the opposite case outcome, it can be an indication that the court is intentionally "reducing a precedent to essentially nothing...without justifying its de facto overturning" (Friedman, 2010, p. 12,17). Such 'stealth overruling' "is a distinctive feature of Supreme Court practice that has been accepted and employed by virtually every justice" (Re, 2014, p. 1861); as such, a theory of judicial value should be able to rationalize the practice. The next example illustrates that this phenomenon is a natural consequence of a Dworkinian Common Law System:

Example 3 Given a Dworkinian Common Law System, suppose $P_1 = \{1, 2, 3, 4, 5, 6\}$ with $r^1(1) = 1$, and further suppose $j_2 = j_3$ with thresholds $\tau_2 = \tau_3 > \frac{1}{2}$. Let the reason-structure $\mathcal{R}_2 = \{\mathbb{N}, P_1, \{1,2\}, \{1,3\}, \{2,4,6\}, \{3,5\}, \{1\}, \{2\}, \{3\}\}$, and $w_2(P_1) = 5$, $w_2(\{1,2\}) = -10$, $w_2(\{2,4,6\}) = -7$, $w_2(\{3,5\}) = -7$, $w_2(\{1,3\}) = -10$. Then at $t = 2$, judge j_2 believes that case $t = 1$ was decided incorrectly, because any general, non-tautological reason (other than P_1) applying to case $t = 1$ would have had higher justification in favor of the defendant than P_1 is in favor of the plaintiff. The strongest justification at $t = 2$ is for reason $\{1,2\}$, but this would require overruling $t = 1$, in which case $F(r^2|r^1) = \frac{1}{2}$ which is below the threshold of fit. Thus, the optimal action for the judge is to narrowly distinguish at $t = 2$ with $P_2 = \{2,4,6\}$ (and rule $r^2(2) = 0$). Then similarly, at $t = 3$, even though the strongest justification would be for $\{1,3\}$, this would require overruling case $t = 1$ which would again not satisfy the threshold of fit. Thus, Dworkinian Optimization again requires the judge to narrowly distinguish at $t = 3$ with $P_3 = \{3,5\}$ (ruling $r^3(3) = 0$), which results in the original 'mistaken' precedent P_1 governing no future cases, illustrating the desired phenomenon of stealth overruling.

Another consequence of this framework is that a court which inherits a precedent-reasons set and decides cases forever thereafter may still retain decisions they consider mistaken without ever overruling them. This is a sort of 'escape velocity' where the possible reasons for distinguishing the precedent 'run out', and the possible reasons for overruling the precedent never satisfy the threshold of fit, so the erroneously decided precedent persists. Re (2014) identifies this equilibrium which we may think of as an 'equilibrium error rate':

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[44] For an empirical investigation of the relationships between distinguishing and overruling, see Spriggs & Hansford (2001).

> ...the Court may have narrowed [precedent] down to what it will regard as an equilibrium point, where the reasons to retain a precedent are counterbalanced by opposing reasons to engage in additional narrowing or to overrule.
> - Re (2014, p. 1890)

Thus, as an addendum to the original quotation of this section, our results point to the proviso that "precedent-respecting judges produce outcomes that they would not choose if they were writing on a clean slate".[45]

7 Conclusion

The legalistic constraints on judicial choice have resisted formalization from classical decision theory, but they fit comfortably into a framework of reason-based choice. We have characterized the institutional setting of common law adjudication, and formulated a judicial objective function inspired by Dworkin (1982) which endogenizes the decision to follow, distinguish, or overrule precedent. The resulting theory of value illustrates both the constraint of precedent, and the well-documented phenomenon of 'stealth overruling'. We have also shown that although distinguishing can produce Cases of First Impression, the Raz-Simpson distinguishing condition prevents Cases of First Impression from arising as a consequence of distinguishing. More broadly, by incorporating insights from jurisprudence into a rigorous decision-theoretic framework, we demonstrate the possibility of a systematic 'judicial decision theory'.

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[45] Sunstein (2009, p. 1067–1068).

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