Legal Evidence of Inconsistency and Inattention*

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April 18, 2018

Abstract

Consider a decision-maker (a judge) who repeatedly issues binary (Guilty or Innocent) verdicts in a series of ex ante similar cases. Suppose we observe, besides the verdict, a record of evidence, testifying to the facts of the case, based on which the determination is made. Such a record would allow us to associate with each verdict an event observed by the decision-maker. We provide a theoretical characterization of restrictions on such data consistent with a simple evidence-based Bayesian model of judicial decision-making and use the data to reveal the underlying parameters of the model. We proceed to study the empirical implications for such a data set of various models of costly attention. We then propose to apply our results to an empirical data set derived from a sample of case files produced by a labor court in Mexico.

1 Introduction and outline

"What do judges do?" In this paper we ask this question in a very specific setting, considering the decisions of a small group of judges, resolving cases in a relatively obscure legal institution: a labor court on the outskirts of Mexico City. At the same time, we shall be attempting to conduct this specific inquiry in a manner that, we believe, would be of use in approaching judicial decision-making in general. By taking as evidence the corpus of decisions from a homogeneous group of cases, we believe we may reveal both the preferences and biases of judges, and the legal rules they implement. While our court might lack the factual intrigue and legal brilliance of more famous chambers, its very routine and the repetitiveness of its task have combined to create an environment tractable and transparent enough to make feasible an almost literal application of basic decision-theoretic concepts to its analysis, while the nature of the Mexican legal system has made it possible to collect data that would be difficult to obtain elsewhere. By developing our theoretical tools to attack this simple empirical environment we believe we are able to ask questions that have not, till now, been asked and that may be fundamental to understanding the nature of what courts - including those of greater fame and sophistication - do.

The general question of "what courts do" is the subject of Cameron and Kornhauser (2017, henceforth CK) synthesis of modern developments in the formal modeling of courts. They summarize the task of a court, in general, as, firstly, fact-finding: aggregating evidence in the case into a collection of legal facts - and,

*Extremely preliminary and incomplete. Please do not circulate. We would like to thank Diego Jimenez, Alejandro Hernandez Gonzalez, and Misael Ramirez Rangel for research assistance. We would like to thank participants in the FUR 2014 conference in Rotterdam, 2015 NYU Alumni conference, 2016 APET conference, and seminars in HSE in Moscow and ITAM for valuable comments. Financial support from the Associación Mexicana de Cultura and Interamerican Development Bank is gratefully acknowledged.

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secondly, adjudication - applying legal rules to the set of observed facts in order to have the case properly disposed. In the latter task, presumably, the courts are constrained by law and precedent. Disparity in legal outcomes based on the same set of legal facts would strike at the very heart of the notions of due process and equal treatment inherent in any definition of rule of law. In contrast, according to them, fact-finding may be a task opened to a greater degree of discretion, with different *reasonable* decision-makers coming to different conclusions in establishing what really happened from noisy evidence presented in the case. It is, perhaps, understandable that, as acknowledged by CK, the bulk of the literature has concerned itself with the cleaner task of adjudication. Besides, in most environments, though not in ours, a researcher's ability to observe the same evidence as perceived by the judge may be limited.

In this paper we extend the classic *case space* model of judicial decision-making of Kornhauser (1992) to accommodate both the intrinsic uncertainty of the fact finding stage and the possibility of individual judge's preferences/biases from outside the courtroom entering into her decision-making process. However, our main contribution is to use this model to try to recover both the legal rules and judicial biases from actual data that we can obtain from a corpus of judicial decisions.

The legal meaning of what our model requires of a judge can be boiled down to deciding similar cases similarly both in a cross section of cases and across time. This is related to broad legal concepts such as due process and equal protection of law, and to an important debate across different legal systems on the importance of judges correctly and publicly motivating their decisions. Our basic model is fairly standard. Our judge is facing a binary choice (this could be viewed as the overall decision to convict or to acquit; but even more complex decisions can be decomposed into a sequence of binary determinations of legal facts - as proposed already in Cameron and Kornhauser (2009)). This decision has to be taken based on evidence presented to and accepted by the court. Following Posner (1999) and Lester *et. al.* (2012) we model the judge as a Bayesian decision maker. However, we do not assume we have a direct insight into the judge's mind, either in terms of her preferences, prior beliefs, or legal notions of what constitutes proof. Rather, we attempt to derive all of these as much as possible from data that could be conceivably obtained from courts.

Our approach is not merely theoretical. It is, in fact, strongly motivated by the features of an actual institution to which we have access and from which we can extract a novel data set that we are using to illustrate and test our results. As part of a long-term field project on administration of justice in Mexican labor courts conducted by one of us, we have obtained access to complete legal files, containing both admitted evidence and first instance judgments in a large collection of cases involving employer-employee disputes. Crucially, we have access to the entire evidence seen by the decision-maker: the people who prepare these decisions are never present at court and decide based on the same case file that we have. In addition, we have the judicial decisions, which besides an eventual disposition ("the verdict ") contain a determination of legal facts used in reaching the final decision. By concentrating on a homogeneous subset of these cases, we compile a data set that corresponds to the one we propose in this paper. In order to abstract from the "mistakes" inherent in analyzing complicated legal files by the judges (something we intend to address in a sequel to this paper) we also conducted a lab experiment in the field, in which the same judges answered questions about a set of hypothetical cases we formulated.

So far our empirical results focus on simulated data and the lab experiment conducted with the judges, for whom we are completing the collection of data from over 1000 cases adjudicated in 2014 - 2015. From the simulated data we see that with a relatively small number of bits of evidence, a high proportion of random decisions could be rationalized, whereas in real data we often find non-rationalizability and direct conflicts with the same number of bits of evidence. From the lab in the field data, we find that legal rules are stable and mostly consistent across judges, but the mapping from evidence to relevant legal facts contains many contradictions across judges.

The rest of the paper is organized as follows. Section 2 discusses the motivation and related literature, focusing to an important extent on providing a methodology for empirically verifying equal treatment. Section 3 discusses the legal environment and the data extracted from full case files and first-instance decisions. Section 4 explains the model and its main results. Section 5 explains the field experiment and the results found so far. Section 6 discusses the lab in the field experiment and results. Section 7 concludes and mentions unfinished and further work.

2 Motivation and related literature

Our motivation springs from the opportunities that a rare and novel data set provides us to contribute to important strands of literature on the roles of judges and courts, rule of law, and the phenomenon of rational inattention in judges' behavior. A common principle across legal systems is that due process and equal protection of law are part of citizens' basic constitutional rights. Both concepts are related to judicial decisions being appropriately reasoned and explained.

Equal protection of law implies the right to receive the same outcome in any legal dispute that a similarly situated subject of the law receives. This prohibits discrimination and bias, but is broader than those concepts. For example, arbitrary or error-prone decision making (perhaps due to inattention) would also result in similarly situated parties getting different results and would violate the equal protection of law principle.

Clarifying the judicial reasoning behind a decision is necessary in order to uphold both principles. Without knowing the basis on which one is judged, the right to appeal is frustrated, violating due process. By the same token, if an arbitrator were to treat similarly situated parties differently, she could be guilty of bias, and this would violate the due process of all the parties involved in these "disparate" decisions. Therefore, when a judge decides differently in two factually similar cases under the same law, it is the judge's duty to distinguish the two cases in legally relevant ways.

Due process, equal protection, and their relationship to reasoned judicial decision making have been discussed in the literature for many years. In a controversial and much cited lecture, Wechsler (1959) criticized celebrated Supreme Court decisions of his time as he defined the "neutrality principle" to consist of two elements: content generality and equal applicability. Professor Wechsler defined a principled decision as one "resting on reasons quite transcending the immediate result that is achieved, and applying to all parties equally."

Blackstone (1976), supports this view, and states that "logical consistency in decisions is a criterion that is necessary .... for an adequate judicial decision. If there are two cases under consideration by a judge and those cases in all relevant respects are indistinguishable, and if a judge or court decides one case in one way and the other case differently, then something basic to the judicial process is wrong. Such decisions are arbitrary and capricious."

Concerns about inconsistency violating basic legal rights are not limited to legal theory or constitutional law. An important issue in the US legal system in recent years has been the variability in sentences resulting from the same crime. Federal law (18 U.S.C. § 3553(a)(6) (2012)) requires the sentencing judge to consider "the need to avoid unwarranted sentence disparities among defendants with similar records who have been found guilty of similar conduct" when imposing a sentence). Frankel (1991) argues that in "any system of justice purporting to be civilized....people similarly circumstanced are to be treated equally under the law" Sunstein et. al. (2002) state "our society is deeply committed to employing the force of government with reason and consistency. Discrepant punishments for the same act . . . are inconsistent with that commitment."

Variability in the treatment given to similar tort plaintiffs and defendants is another area in which equal protection and due process have been invoked. Bovbjerg (1989) argue that "fundamental fairness requires similarly situated parties to be treated in a similar fashion by the legal system." Studdert, et. al. (2011) take the view that "whatever the explanations, the heterogeneity in noneconomic-damages awards among injuries of similar severity is inefficient, inequitable, and has damaging consequences for the legitimacy of personal-injury compensation systems."

One author (Lahav 2011) has gone as far as to suggest that automated decision making in torts cases would be preferable to the current variability in torts outcomes and awards. She stresses that only "relevant variables" should be taken into account to define a-likeness between cases, and that judges must clarify and articulate what these relevant variables are in their tort decisions.

Equality before the law and due process are also main building blocks of civil law systems. Articles 14 and 16 of the Mexican Constitution provide the basic elements of due process, and both mention that all judicial determinations and acts must be "reasoned and founded in previous law", implying that judges must explain and motivate their decisions, and that these should be consistent. One obstacle to seeing how judges' behavior is crucial to equal protection of law in civil law systems is the notion that there is no "discretion" or "law making capacity" for civil law judges. This is generally wrong because legal rules are often imprecise, and the decision of how to aggregate evidence into legally relevant facts, to which legal rules can be be applied, is often left up to the judge.

In the legal environment we consider, this general conception is particularly erroneous: on the dichotomous legal facts that need to be determined in a standard firing case, Mexican labor law provides only guidelines as to who bears the burden of proof under each controversy ("litis"). But the determination of whether this burden of proof has been fulfilled or not has virtually no precise guidelines, and is exactly the type of "mixed question of fact and law" which US-style juries and judges routinely have to decide in cases like contracts, employment, and torts. In other words, in our context in particular, there is about the same type of decision being made in both legal systems, and with about the same type of discretion.

An additional complication in the impact of judicial discretion on guaranteeing equal protection of law is the possibility that judges makes mistakes or do not pay attention to all the relevant evidence in a case. Danziger, et. al. (2011) find that judges' in criminal parole-board decisions exhibit large variation in the percentage of favorable decisions over the course of a day, with high rates of parole approval coinciding with the judge just having eaten. In experimental work in the same Mexican labor court, before the current set of experiments, we found a high incidence of errors, including two types that speak of judges' inattention. In over 10% of cases, the judge did not mention an item of evidence in her decision, even though listing all evidence in the first-instance decision is an explicit requirement under Mexican labor law, and often the omitted evidence would have provided stronger basis for the judge's decision. We also found that in cases the plaintiff won, the judge made a non-trivial mistake over 20% of the time in the quantification of compensation to be paid to the worker.

We follow the case-space framework for analyzing judges' decisions, as summarized by CK. However, to measure whether like cases are indeed decided alike, and deal with possible inattention of judges, we extend this approach to deal explicitly with the fact-finding stage. Our model posits two "mappings", the first from fact to legal facts, which are jury-type determinations such as "did the plaintiff and the defendant have a labor relationship?". The second is adjudication, mapping legal facts to the verdict, that is, the "legal rule".

3 Legal environment and data

As part of a set of experiments aimed at testing policies to improve the administration of justice, we obtained access to a large data set of decisions coming from administrative labor courts in Mexico. These are administrative tribunals that belong to the executive branch of government at the state or federal levels. Labor law is federal in Mexico, so the legal environment is the same across the country. Most labor lawsuits are firing related. The law classifies firing in only two ways: fair or unfair. Fair firing does not lead to any severance pay. A finding of unfair firing means substantial severance pay, and the specific amount of money award is determined in the court's decision. Each decision establishes a number of legal facts, such as whether there was, in fact, an employee/employer relationship between the plaintiff and the defendant, whether the firing occurred, and if it did whether it was fair or unfair; it also declares whether the decision is in favor of the firm, in favor of the worker, or "mixed", and gives a specific number for the total award (while detailing how the amount is arrived at) in cases of unfair firing. In order to simplify our empirical task, to begin with we concentrate on the first of these legal facts: existence of employer-employee relationship - and code the aspects of the case files that are commonly used to determine it.

It is important to note that the draft decisions are not produced by a judge who participates in the hearings process. Rather, each "court location" has a number of draft decision writers (we will call them clerks) who have the same formal rank as judges' assistants, but are administratively independent from each individual labor court. Once the judge's assistant declares a case file "closed", the case file is sent to the "draft decisions area" where one of the clerks reads the case file and produces a draft decision. According to the law, judges must review all draft decisions; in practice we believe very few are reviewed, and we know that in only around 5% of all cases does a judge ask for any change or correction in the draft decision. Finally an important institutional feature of these courts is the built-in random assignment. To begin with when case files enter the "court location" they are assigned in a round-robin (quasi-random) fashion to the individual courts. Secondly, when case files arrive at the decision writing area, they are also assigned to clerks randomly.

The clerks assigned to produce written decisions effectively act in the capacity of a standard first-instance court (jury/judge) in that they decide issues of fact, based on the evaluation of evidence, and issues of law, as they apply legal statutes and jurisprudence (accepted body of interpretations of labor law made by the Mexican Supreme Court). Due process principles imply that the clerks should consider all evidence (and only the evidence) which is offered by one of the parties and legally admitted by court. In practice, we commonly observe a number of violations of due process. For the purposes of our study it is important that written decisions frequently ignore existence or admission of evidence. Supervision of the clerks by the judges, however imperfect, provides incentives for clerks writing the decisions to avoid mistakes. More importantly, mistakes may lead to successful appeals by the parties to the case. A granted appeal generally results in the a new judgment having to be written, and is assigned to the same clerk who wrote the first decision.

For each clerk, we have multiple observations of decisions. In addition to issuing a verdict (essentially, a series of binary determinations of legally established facts, followed by binary conclusion on whether there was an illegal firing, which is then followed by a separate determination of damages), the clerk must provide a written summary of the evidence contained in the file as part of the legal motivation (they may be assumed to be incentivized to do this properly, as failure to do so may result in an appeal, responding to which would increase their own workload). It should be noted that case files vary substantially in their volume, the number of issues considered, clarity, etc.

The recorded and observed events are coded by encoding the binary answers (or lack thereof) to a series of 75 questions, reflecting the most common evidence types presented in such cases. Given the availability of the full case file, we can do this both for the evidence admitted by the court and for the decision written by the lawyer. For the purposes of this paper we concentrate on a collection of legal cases in which the main legal issue is a factual determination of existence of a contractual labor relationship between the parties. This allows us to concentrate on a homogeneous collection of around a dozen evidence bits that are common in making such a determination. In general, however, our data set contains many more binary evidence and outcome variables that could be used for similar analysis.

Note that each column, under perfect information, would contain a 0 or 1, indicating that the answer is NO or YES, to the question posed by the column. In reality, however, there may be no mention of certain evidence, or no question of a particular type put to a party or witness, so that the column would contain an "x". The database, then, contains long strings of "0"s, "1"s, and "x"s, while the true state of the world is a string of only "0"s and "1"s.

4 The Model

The court has to decide on the merits of the case, issung the verdict $v \in \{1, -1\}$, where 1 stands for *guilty* and -1 for $innocent$. We shall, in fact, propose that a judge, charged with making this decision, uses a two-stage procedure for coming up with the verdict. First, she establishes a number of *legal facts*, based on evidence presented to and accepted by the court. In our environment a typical legal fact could be whether there existed an actual labor relationship between the alleged employer and the employee or whether the employee was actually fired. Once this is done, she utilizes a legal rule to come up with a verdict either in favor of the plaintif or the defendant.

In that second stage, when deciding on the verdict, she faces a universe of possible cases F, which, following Kornhauser () we shall call the case space. Each state $f \in F$ may be thought of (as in Kornhauser...) as a length $n \in \mathbb{N}$ string of zeros and ones: $f = (f_1, f_2, ..., f_n)\,, f_i \in \{-1, 1\}$. Each element f_i of the string, shall be called a *legal fact*, the case space is $F = \{-1,1\}^n$ (its cardinality is $N = 2^n < \infty$). The case space F is partitioned into two disjoint payoff-relevant events: guilty and innocent, $G \cup I = F, G \cap I = \varnothing$. This parititioning of the state space may be interpreted as a *legal rule* (see, for instance, Cameron and Kornhauser 2009). We shall assume throughout that the legal rule is fixed. Once the set of legal facts and hence the true case $f^* \in F$ is determined (that is, the judge establishes the value of f_i for each $i = 1, 2, ...n$) she will apply the legal rule, to issue the verdict $v = 1$ if $f^* \in G$ and $v = -1$ otherwise.

Prior to this, of course, the judge has to make a binary determination for each of the legal facts. We shall assume that she employs a similar procedure, by aggregating a number of evidentiary *bits* into a legal factual determination. Specifically, we shall assume that for each legal fact i the judge considers a space of possible true states of the world Ω^i, in which each state $\omega^i \in \Omega^i$ is described by a string (of length n_i) of possible answers to a series of true/false questions, such as "has a formal contract been presented to the court?" or "did the employer allege the employee resigned voluntarily?" Therefore, $\omega^i = \left(\omega_1^i, \omega_2^i, ..., \omega_{n_i}^i\right), f_i \in \{-1,1\}$. Each element ω_j^i of the string, shall be called an *evidentiary bit* and the corresponding case space is the case space is $\Omega^i = \{-1,1\}^{n_i}$. As before, we shall assume that the judge has in her mind a partition $G^i \cup I^i = \Omega^i, G^i \cap I^i = \varnothing$, constituting a legal rule.

However, unlike in the second stage, by which all legal facts have been established and no uncertainty exists as to where the case lies with respect to the partition, in the first stage the judge might be forced to make her decisions based on incomplete evidence, without observing the true state $\omega^{i*} \in \Omega^i$. Correspondingly, we may define the *evidence record* to be a string, $e^i = \left\{e_1^i, e_2^i ... e_n^i\right\}$, $e_j^i \in \{0, 1, x\}$, where $e_i = x$ denotes a failure of the record to reflect potential evidence. We shall assume that every $e_i \in \{\omega_i^*, x\}$ - that is, that the record always allows for the truth.. Any such string e^i corresponds to an event $E^i \in 2^{\Omega^i}$. The true state is denoted $\omega^{i*} \in \Omega^i$ and may belong either to G^i or I^i.

The two stages we define are, of course, quite similar. We could have, in fact, merged them into a single act of judicial decision-making. Our decision to separate the two is based on the nature of our data: we actually observe both the admiited evidence and the legal fact determinations that, by law *(cite the legal provision)* the judges must make in their written decisions. We thus have an opportunity to establish both the legal rules, implicit in the observed mapping between established legal facts and verdicts, and the rules the judges use to establish the legal facts themselves based on their observation of the empirical facts of the case as described by the evidence admitted by the court. The structure of the two problems, however, is similar enough that it will be convenient to treat the two together. We shall return to treating them as distinct when analyzing the data. For the rest of this section we shall concentrate on a single problem: that of a Bayesian judge agregating observed data into a single binary verdict.

4.1 The judge

We shall now consider a simple model of a single-stage decision by the judge, who has to issue a single binary verdict based on evidence.. It shall be convenient, for the moment, to abstract from the structure of the evidence she faces. It is sufficient for our first result that she knows that the true state ω^* is an element of some finite measurable set $\left(\Omega, 2^\Omega\right)$ We shall assume that she has a prior belief β, which is a probability measure over the finite measurable space $\left(\Omega^i, 2^{\Omega^i}\right)$. The set of all possible beliefs shall be denoted as

$-(\Omega) = \Delta^{2^n}$ As the evidence is presented, she is observing an event $\omega^* \in E \subset \Omega$ and updates (in a Bayesian way) the probability of guilt.

As before, our judge, can take one of two actions $v \in \{-1, 1\}$ the former standing for innocence and the latter for guilt. We shall assume her *ex post* utility of each action depends only on whether the true state ω^* belonging either to the event G or the event I into which the state space is partitioned by the legal rule. Let $U_T(v)$ denote the utility of action v if the truth lies in $T \in \{G, I\}$. In everything that follows we shall assume that $U_G(1) = U_I(-1) = 0, U_I(1) = -q$ and $U_G(-1) = -(1-q)$ for some $q \in (0,1)$, which may be naturally interpreted as aversion to convicting the innocent (see for instance, Coughlan 2000). Clearly, with this functional form, the judge would want to convict whenever the $\tau(G) > q$ and acquit whenever $\tau(G) < q$ (for simplicity we shall ignore the possibility of indifference). We may interpret q as the judge's *conviction bias.*

The true state of the world, $\omega^* \in \Omega$ may or may not be fully observable by the court. Indeed, at a trial only partial evidence may be presented and or allowed, producing a recorded event $\omega^* \in E \subset \Omega$. Typically, only the evidence admitted by the court may be considered in issuing the verdict.Hence, assuming the judicial decision is based on the evidence record (ignoring the possibility of indifference), $\tau(G|E) = \frac{\beta(E \cap G)}{\beta(E)} > q$ implies a verdict of g and a verdict of i follows from $\frac{\beta(E \cap G)}{\beta(E)} < q$.

Hence, the *case record* can be denoted as a pair $r = (E, v)$, consisting of the evidence admitted by court E and and the verdict v The set $\mathcal{C}$ of all observed case records r produced by a given judge we shall call his *legal output.* Notably, legal output $\mathcal{C} = \{r_1, r_2, ..., r_M\}$ is observable and can be used as data in analyzing the behavior of the judge. In particular, it can be used to reveal the parameters determining individual choice, such as G, β and q, which may be subjective and not directly observed by the researcher.

4.2 Rationalizing the legal output

The first question that we shall ask is whether the *legal output* of a judge is consistent with her basing decisions only on evidence formally admitted by the court. It turns out that even this very stylized model, which remains agnostic on the causes of incompleteness in the court record, imposes a testable restriction on what $\mathcal{C}$ may contain, even if we do not know the judge's prior β, her conviction bias q or her guilty set G. In fact, assuming the data satisfy this restriction, we may use it to "reveal" the unobserved parameters of the model.

We shall say that a triple (β, q, G) *rationalizes the legal output* if for any $r = (E, v) \in \mathcal{C}$ such that $f = g$ we have $\tau(G|E) = \frac{\beta(E \cap G)}{\beta(E)} > q$ and for any $r' = (E', v') \in \mathcal{C}$ such that $v' = i$ we have $q > \tau\frac{\beta(E' \cap G)}{\beta(E')} = (G|E')$.

We shall denote the set of all recorded events corresponding to the legal output of a judge that result in conviction as $A(\mathcal{C})$ and the set of all recorded events resulting in acquittal as $B(\mathcal{C})$. It is straightforward to see that the two sets $A(\mathcal{C}), B(\mathcal{C}) \in 2^\Omega$ are disjoint. Furthermore, it is easy to show that a union of any two disjoint events from $A(\mathcal{C})$ (or, respectively,$B(\rfloor)$), if the corresponding verdict is ever observed, must be in the same set. Indeed, for any $E_1, E_2 \in A(\mathcal{C})$ such that $E_1 \cap E_2 = \varnothing$, $\tau(G|E_1 \cup E_2) = \frac{\beta((E_1 \cup E_2) \cap G)}{\beta(E_1 \cup E_2)} = \frac{\beta(E_1 \cap G) + \beta(E_2 \cap G)}{\beta(E_1) + \beta(E_2)} = \frac{\frac{\beta(E_1 \cap G)}{\beta(E_1)}\beta(E_1) + \frac{\beta(E_2 \cap G)}{\beta(E_2)}\beta(E_2)}{\beta(E_1) + \beta(E_2)} > q\frac{\beta(E_1) + \beta(E_2)}{\beta(E_1) + \beta(E_2)} = q$ (and, correspondingly, for any $E_1, E_2 \in B(\mathcal{C})$ such that $E_1 \cap E_2 = \varnothing, \tau(G|E_1 \cup E_2) < q$). This, as can be easily seen from the examples below, implies a clear testable restriction on $\mathcal{C}$.

A1 (additivity) For any $E_1, E_2 \in A(\mathcal{C})$ such that $E_1 \cap E_2 = \varnothing$, it follows that $E_1 \cup E_2 \notin B(\mathcal{C})$ and for any $E_1, E_2 \in B(\mathcal{C})$ such that $E_1 \cap E_2 = \varnothing$, it follows that $E_1 \cup E_2 \notin A(\mathcal{C})$

Notably, as long as additivity is satisfied we have the following natural corollary: if, whatever the realization of a certain bit of evidence, given the other bits observed the verdict is unchanged, then not observing the same bit shall not affect the verdict either (this, in fact, could be considered as a consequence of the standard Blackwell (1953) information ranking). This can be easily illustrated in the following pair of simple examples.

Example 1 *Let $N = 4$ and suppose we observe that $A(\mathcal{C}) = \{\{\omega_1, \omega_2\}, \{\omega_3, \omega_4\}\}$, $B(\mathcal{C}) = \{\{\omega_1, \omega_3\}, \{\omega_2, \omega_4\}\}$. Clearly this is impossible, as it would necessitate that, no matter what G, q and β, the verdict corresponding to the uninformative $E = \Omega$, if it ever were to be observed, would have to simultaneously be in $A(\mathcal{C})$ and $B(\mathcal{C})$.*

Example 2 *Let $N = 4$, $A(\mathcal{C}) = \{\{\omega_1, \omega_2\}, \{\omega_1, \omega_3\}, \{\omega_4\}\}$ and $B(\mathcal{C}) = \{\Omega, \{\omega_1\}\}$ are inconsistent following repeated application of the same "Blackwellian" argument. Indeed, if ω_2 were to result in the verdict of innocent, since $\omega_1 \in B(\mathcal{C})$ it would imply, by the argument of the previous example, that, contrary to the record $\{\omega_1, \omega_2\} \in B(\mathcal{C})$. Hence, we know that ω_2 can only correspond only to the verdict of guilt. Analogously, ω_3 may only be consistent with guilt. However, that, together with the fact that $\{\omega_4\} \in A(\mathcal{C})$ implies that $\{\omega_2, \omega_4\}$ and $\{\omega_3, \omega_4\}$ can only correspond to the verdict of guilt, which, noting that $\{\omega_1, \omega_3\} \in A(\mathcal{C})$, would require a verdict of guilt based on the uninformative event Ω - contradiction.*

Unfortunately, additivity is insufficient for rationalizability of a legal output, as can be seen from the following example

Example 3 *Let $N = 3$, $A(\mathcal{C}) = \{\{\omega_1, \omega_2\}, \{\omega_2, \omega_3\}, \{\omega_1, \omega_3\}\}$ and $B(\mathcal{C}) = \{\Omega\}$ As there are no two observed cases with empty intersection, additivity has not bite here. However, whatever the prior β the judge may have and whatever the legal rule (G, I) and evidence standard q she may use these decisions may not be rationalized. Indeed, for each state ω_i we may define $\alpha_i = \beta(\omega_i)$ if $\omega_i \in G$ and $\alpha_i = 0$ otherwise. Clearly, the three observed guilty verdicts imply that $\alpha_1 + \alpha_2 > q(\beta(\omega_1) + \beta(\omega_2))$, $\alpha_2 + \alpha_3 > q(\beta(\omega_2) + \beta(\omega_3))$, $\alpha_1 + \alpha_3 > q(\beta(\omega_1) + \beta(\omega_3))$ so that, summing them up we obtain $2(\alpha_1 + \alpha_2 + \alpha_3) > 2q(\beta(\omega_1) + \beta(\omega_2) + \beta(\omega_3)) = 2q$. But the innocent verdict imples that $\alpha_1 + \alpha_2 + \alpha_3 < q$ - contradiction.*

The exact strengthening of additivity that is necessary if our attention model is to be consistent with the observed data turns out to be well-known. Originally introduced in Kraft *et al.* (1959), this condition may, following Fishburn (1970), be presented as follows. Consider two collections of recorded events $\mathbf{A} = (A_1, A_2, ..., A_{m_1})$ and $\mathbf{B} = (B_1, B_2, ..., B_{m_2})$ (repetitions of events in a collection allowed). Denote as $n_\omega(\mathbf{E})$ the number of events in the collection $\mathbf{E}$ that state ω is included in. We say that the two collections are equivalent $\mathbf{A} \approxeq \mathbf{B}$ if for each event $\omega \in \Omega$ $n_\omega(\mathbf{A}) = n_\omega(\mathbf{B})$.

A2 *(strong additivity)*: For any $\mathcal{C}$ there does not exist equivalent collections $\mathbf{A}$ consisting of elements of $A(\mathcal{C})$ (possibly repeated) and $\mathbf{B}$ of elements of $B(\mathcal{C})$ (also possibly repeated).

The assumption A2 cannot be violated with a single observation of a decision by a judge, and becomes increasingly harder to satisfy, as the number of observations grows. As the following theorem shows, the

Proposition 4 *There exist the partition of the state space into G and I, the prior β and the conviction threshold q rationalizing the legal output $\mathcal{C}$ if and only if A2 holds. Furthermore, without loss of generality, the conviction bias may be normalized to $q = \frac{1}{2}$.*
Proof. *See appendix* ■

Notably, as part of the proof of proposition 1 we recover the parameters of the model. In fact, the partition of the state space Ω into G and I would be unique if the judge's legal output were sufficiently complete: this is trivial, assuming the evidence were fully recorded (i.e., $E = \{\omega^*\}$ in each case) and a decision corresponding to every possible $\omega \in \Omega$ were on record. In contrast, the prior distribution β will, in general, be non-unique (we cannot hope to get uniqueness in general, unless we get the infinite divisibility of the state space). These parameters, in fact, correspond to a solution of a sytem of linear inequalities

$$Ax > 0$$

with the matrix A given by the legal output $\mathcal{C}$. Each row $j = 1, 2, ..., M$ of the matrix would correspond to a case record $r_j = (E_j, v_j)$, while each column $i = 1, 2, ...N$, would correspond to a state ω_i. The corresponding element of the matrix is $a_{ji} = v_j 1_{E_j}(\omega_1)$. For each solution $x = (x_1, x_2, ...x_N)$ to such a system such that $\sum_{i=1}^{N} |x_i| = 1$ we may interpret the absolute value of the coordinate as the prior probability $\beta(\omega_i) = |x_i"|$, while the sign of the x_i would indicate whether ω_i is in G (if it is positive) or I (if it is negative).

Example 5 *Let $N = 4$, $A(\mathcal{C}) = \{\{\omega_1, \omega_2\}, \{\omega_1, \omega_3\}\}$ and $B(\mathcal{C}) = \{\{\omega_2, \omega_4\}, \{\omega_3, \omega_4\}\}$. The parameters of the model can be discovered from the solution to the following system of inequalities:*

$$\begin{aligned} x_1 + x_2 &> 0 \\ x_1 + x_3 &> 0 \\ -x_3 - x_4 &> 0 \\ -x_2 - x_4 &> 0 \end{aligned}$$

One (normalized) solution to the system could be $x = \left(\frac{1}{3}, \frac{1}{6}, \frac{1}{6}, -\frac{1}{3}\right)$ corresponding to $G = \{\omega_1, \omega_2, \omega_3\}$,$I = \{\omega_4\}$ and the prior distribution $\beta = \left(\frac{1}{3}, \frac{1}{6}, \frac{1}{6}, \frac{1}{3}\right)$.

4.2.1 Minimal rationalizing facts: attention

A natural question to ask here is, what proportion of possible legal records of this sort could be rationalized. Indeed, if legal records of a certain dimension are nearly always rationalizable, our ability to use actual data to test the theory using real data should be considered suspect, as failure to reject would likely reflect the lack of "power " in the test we propose. Indeed, if we consider state spaces that are large enough, we should be always able to rationalized whatever data we consider, since pretty much any pair of cases is likely to be substantially different in many minor aspects of the case. Consequently, the question is not whether the data can be rationalized if we consider a large number of possible case distinctions: it, probably, can. Rather, the question is what is the minimal collection of such distinctions that would make the legal output of a judge rationalizable. We could, in fact, interpret such "coarsest" state space as what the judge had to, at a minimum, pay attention to in order for the data to be consistent with our theory. Posing this question in this way is somewhat complicated, however since it is not, in fact, obvious that rationalizability is monotonic in how detailed is the judge's observation of the case. Indeed, in general, as the following example shows, it is not true.

Example 6 *Consider an example with 4 states,*$\Omega = \{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega 6\}$*, and 4 cases* $E_1 = \Omega$, $E_2 = \{\omega_2, \omega_5\}$, $E_3 = \{\omega_1, \omega_4\}$ *and* $E_4 = \{\omega_1, \omega_6\}$. *Suppose when nothing is known,* $E_1 = \Omega$ *we observe the verdict verdict* g*, while otherwise is* i. *Clearly*

$$x_1 + x_2 + x_3 + x_4 + x_5 + x_6 > 0$$

$$x_2 + x_5 < 0$$

$$x_1 + x_4 < 0$$

$$x_3 + x_6 < 0$$

Which cannot be rationalized. However, suppose the judge cannot distinguish between states ω_1 *and* ω_2 *so that whenever one of the two obtains, she says that either is possible. Effectively, this results in a merger of the two states into a single state which we will call* ω_{12}. *We know get* $\Omega = \{\omega_{12}, \omega_3, \omega_4, \omega_5, \omega_6\}$, $E_1 = \Omega$, $E_2 = \{\omega_{12}, \omega_5\}$, $E_3 = \{\omega_{12}, \omega_4\}$ *and* $E_4 = \{\omega_3, \omega_6\}$ *implying the system*

$$x_{12} + x_3 + x_4 + x_5 + x_6 > 0$$

$$x_{12} + x_5 < 0$$

$$x_{12} + x_4 < 0$$

$$x_3 + x_6 < 0$$

which is solved, for instance, by $x = \left(-\frac{1}{3}, -\frac{1}{8}, \frac{1}{4}, \frac{1}{4}, \frac{1}{24}\right)$

It turns out however, that our original view of evidence, as a sequence of answers to binary questions, the monotonicity we conjectured is restored. Fortunately, this evidence structure is indeed exactly what we obtain from actual legal data.

Indeed, we shall now recall that we have originally defined $\omega \in \Omega$ as a length-$n, n \in \mathbb{N}$ string of zeros and ones: $\omega = (\omega_1, \omega_2, ..., \omega_n), \omega_i \in \{0, 1\}$. Each element ω_i of the string, shall be called a *bit*, the state space is $\Omega = \{0, 1\}^n$ (its cardinality is $2^n < \infty$). As before the state space is partitioned into two disjoint payoff-relevant events: guilty and innocent, $G \cup I = \Omega, G \cap I = \varnothing$. The true state is denoted $\omega^* = (\omega_1^*, \omega_2^*, ..., \omega_n^*) \in \Omega$. Each bit in our string may be interpreted as referring to a binary determination of the truth of a relevant statement (whether the defendant ate in a McDonald's an hour before the murder or not; whether he was due a certain payment or not, *etc.*). The even G corresponds to the collection of states, which unambiguously (in the eyes of a decision-maker) correspond to defendant's guilt.

Correspondingly, we may define the *evidence record* to be a string, $e = \{e_1, e_2 ... e_n\}$, $e_i \in \{0, 1, x\}$, where $e_i = x$ denotes a failure of the record to reflect potential evidence. We shall assume that every $e_i \in \{\omega_i^*, x\}$ - that is, that the record always allows for the truth. We shall denote as $k(e) = \{i : e_i \neq x\}$ the total number of elements in e that are different from x (i.e., the number of bits contained in the record). For every observed case record we may define the corresponding *recorded event*

$$E_e = \{\omega \in \Omega : e_i \neq x \text{ implies } e_i = \omega_i \text{ for all } i = 1, 2, ..., n\}$$

Likewise , we may define the recorded motivation to be $\varpi = (\varpi_1, \varpi_2, ..., \varpi_n)$, $\varpi_i \in \{0, 1, x\}$, where $\varpi_i = x$ denotes failure to mention a bit of evidence, either because it is unavailable in the original record, or for any other reason. If the judge is completely uninformed, we shall denote her observation as $\varpi = \varpi^0$. Similarly to the *recorded event*, we may define the corresponding *described event*

$$E_\varpi = \{\omega \in \Omega : \varpi_i \neq x \text{ implies } \varpi_i = \omega_i \text{ for all } i = 1, 2, ..., n\}$$

In what follows we shall assume that $\varpi_i \in \{e_i, x\}$, that is that the only "mistake" that the judge may make is not to consider available evidence. We shall denote as $k(\varpi) = \{i : \varpi_i \neq x\}$ the number of observed bits

In a legal record with m different cases we shall denote the case number with a superscript, so that $\left(e^j, f^j\right) \in \{0, 1, x\}^n \times \{0, 1\}$ and a decision is $\left(\varpi^j, f^j\right) \in \{0, 1, x\}^n \times \{0, 1\}$. Thus, the legal record is $\mathcal{C} = \left\{\left(e^j, f^j\right)\right\}_{j=1,2,...m}$ and the collection of decisions is $\mathcal{D} = \left\{\left(\varpi^j, f^j\right)\right\}_{j=1,2,...m}$.

We can easily translate the examples of the previous section into this language, as we illustrate below.

Example 7 *Let $n = 2$ and suppose we observe that $A(\mathcal{C}) = \{1x, 0x\}$, $B(\mathcal{C}) = \{x1, x0\}$. Clearly this is impossible, as it would necessitate that, no matter what G, q and β, the verdict corresponding to a string xx, if it ever were to be observed, would have to simultaneously be in $A(\mathcal{C})$ and $B(\mathcal{C})$.*

Example 8 *Let $n = 2$, $A(\mathcal{C}) = \{1x, x1, 00\}$ and $B(\mathcal{C}) = \{xx, 11\}$ are inconsistent following repeated application of the same "Blackwellian" argument. Indeed, if 10 were to result in the verdict of innocent, since $11 \in B(\mathcal{C})$ it would imply, by the argument of the previous example, that $1x \in B(\mathcal{C})$. Hence, we know that 10 can only correspond only to the verdict of guilt. Analogously, 01 may only be consistent with guilt. However, that, together with the fact that $00 \in A(\mathcal{C})$ implies that $0x$ and $x0$ can only correspond to the verdict of guilt, which, noting that $1x \in A(\mathcal{C})$, would require a verdict of guilt based on xx - contradiction.*

Clearly, the characterization of the previous section apply here as well. Of course, the number of states here is large: $\#\Omega = 2^n$. Hence, even for a relatively small number of observable bits n we may expect a large probability of data being spuriously rationalizable (due to irrelevant but observable distinctions between cases). Fortunately, however, a judge consistently observing an extra bit of information effectively splits each in two not one, but every state $\omega \in \Omega$. Consequently, it actually turns out that observing finer distinctions can never hurt rationalizability, which allows us to meaningfully ask the question: what is the smallest (by inclusion) collection of evidence such that if we assume the judge is basing her decisions on the bits in this collection, her legal output is rationalizable. Formally, if $K = \{1, 2, ...K\}$ is the set of observable bits, we shall define a non-empty subset $\varnothing \neq S \subset N$ as the *attention set* of the judge, with corresponding $\Omega(S)$ being the judge's *subjective state space*. Clearly, we can use the proposition 1 above to check the rationalizability given $\Omega(S)$. We then obtain the following proposition

Proposition 9 *Consider two possible attention sets such that $\varnothing \neq S \subset T \subset N$ If the data can be rationalized with $\Omega(S)$ then it can be rationalized with $\Omega(T)$*
Proof. *See Appendix* ■

5 Field Experiment and Results

The field experiment was initially aimed at providing case summaries to the clerks in order to reduce error incidence which had been detected in a previous quality control experiment carried out in 2012 - 2013. In the quality control experiment, all evidence from the case file was coded, as well as all evidence mentioned in the draft decision. Discrepancies between the two were written down on an "observations sheet", and for 50% of the casefiles, the observations sheet was given to the clerk responsible for decision, and she was given an opportunity to correct or rewrite her decision.

A fairly high incidence of clear procedural errors was found, including not mentioning items of evidence that had been viewed by the trial court and quantifying the amount owed to the plaintiff based on erroneous facts. However, we found that only about one-third of the time clerks made changed to their draft decision after receiving an observation sheet with discrepancies. When we interviewed clerks after the experiment had ended, they stated that on many occasions although the observations sheet pointed out real discrepancies, they could not rewrite decisions since this was too time consuming. They suggested instead a mechanism for error prevention, and this gave rise to the idea of providing case summaries that the clerks could read before working on a casefile, and that would provide them with information about what items of evidence had been admitted and viewed at trial, including where to locate these items in the file.

The case summaries experiment was carried out between August 2013 and September 2015. During the first stage, which ended in October 2014, casefiles entering the draft decisions division of the court as part of the regular process (non-appeals) were randomized at 50% between receiving a case summary and not receiving a case summary. In the second stage, covering October 2014 to September 2015, we focused on creating greater variation in the information provided to the clerks, in order to later test hypotheses based on models of inattention. As such, we provided all casefiles with summaries, but varied the number of items of evidence included in the summary, as well as whether page numbers were provided or not. Clerks were notified clearly of which type of summary they were being provided for in each casefile, so that they knew that only up to a certain number of items of evidence were included, and therefore knew to look for additional items not coded in the summary sheet.

Table 1 shows the population of casefiles that entered the draft decisions division of the court, from administrative records kept by the manager of the division. These records register each case file that arrives at the division, and classifies the entry as "regular process", a granted appeal that requires a new draft decision but may or may not require new hearings, other appeals, and cases with no employee answer, which were supposed to be decided by the judges themselves, but of which some proportion were sent to the clerks during 2014 and 2015 due to heavy case loads of the judges.

Table 1

Year	Type of entry to judgments division of the court				
	Regular process	Granted appeal requiring a new judgment	Granted appeal requiring new procedure and judgment	Other appeal	Cases with no employer answer
2013	1225	85	14	5	
2014	974	112	61	58	162
2015	988	172	78	153	125
2016	731	69	56	108	3

The experiment worked as follows: only casefiles that entered as part of the regular process (non-appeals) were allowed into the experiment. These were randomized at 50% in the 1st stage and at 25% in the second stage into the control and treatment groups. All casefiles, of control or any treatment group, were detained for a few days while the casefile was coded, and the summary sheets produced, so that when the clerk received the casefile, the summary sheet was stapled to the front. From then on, the clerk had control of the casefile and produced the draft decision, later returning the file with its draft decision to the division manager, who would return the file to the judge of the individual labor court. Table 2 shows the population of the experiment in each of the two stages. The first row in each panel shows the number of casefiles whose first entry to the division was a non-appeal, and then for these same case files, the second row shows the numbers that entered as non-appeals for the first time but subsequently entered as an appeal.

Table 2: Experiment population

(a) Field experiment 1st stage

		Did not receive summary sheet	Received summary sheet
Casefiles with first entry as regular process	905	464	441
After first entry as regular process, subsequent entry as non-regular	215	109	106

(b) Field experiment 2nd stage

		Treatment			
		0	1	2	3
Casefiles with first entry as regular process	819	190	211	202	216
After first entry as regular process, subsequent entry as non-regular	143	29	40	40	34

Notes: Second stage treatment groups correspond to the following:
0=up to 1 of each type of evidence, without page numbers
1=up to 1 of each type of evidence, with page numbers
2=up to 5 of each type of evidence, without page numbers
3=up to 5 of each type of evidence, with page numbers

Tables 3 and 4 show descriptive statistics of treatment effects, and regressions of treatment effects. Since not enough data has yet been collected from subsequent entries of casefile in the second stage of the experiment, we only conduct treatment effects regressions for the first stage. We find statistically significant effects in the following sense: of those files that entered as non-appeals for the first time, those that received a case summary were strictly less likely to enter on a subsequent date as an appeal.

Table 3: Descriptive statistics of treatment effects

(a) Field experiment 1st stage

	Did not receive summary sheet	Received summary sheet
Second or later entry as regular process	65	79
Second or later entry not as regular process	66	38

(b) Field experiment 2nd stage

	Treatment			
	0	1	2	3
Second or later entry as regular process	25	35	34	32
Second or later entry not as regular process	5	9	11	8

Table 4: Treatment effects regression

	Subsequent entry is an appeal	
	(1)	(2)
Summary provided	-0.047**	-0.051**
	(0.023)	(0.023)
Constant	0.128***	0.525***
	(0.016)	(0.217)
Observations	732	732
Controls	NO	YES
Log-likelihood	-172.63	-165.845
Akaike Inf. Crit.	349.26	367.689

Notes: Controls are month/year of first entry.

These treatment effects mean that the quality of the draft decisions, measured by subsequent appeals, increased when the responsible clerk received a case summary before working on the file. What could explain this results? The most natural explanation is that clerks do not pay full attention to every part of the casefile, because attention is costly. In a model of costly attention, information that helps focus the attention of the decision maker on relevant bits of information is likely to raise the quality of her decision.

In order to better isolate the issue of inattention empirically, and also to test whether judges are using the same legal rules but may be valuing evidence differently, we ran a lab in the field experiment consisting of a questionnaire with 47 simplified case scenarios, which 6 judges from the draft decisions division answered separately (without comparing notes). The following section discusses results from these questionnaires, as well as rationalizability in random data as compared to real data.

6 Results from Lab in Field and Random Data

By analyzing the data resulting from the questionnaires, if we limit the analysis to the case where the worker sues for indemnity and the employer answers the suit by denying the existence of a labor relationship, we find that all judges are consistent in the mapping between the only relevant legal fact ("did the labor relationship exist?") and the verdict in favor of or against the worker. However, we find significant conflicts across judges in the mapping between the simplified evidence provided in the hypothetical scenarios, and the legal fact finding the existence or not of the labor relationship. Table 5 shows from examples of these discrepancies. Clearly there is significant variation in what evidence the judges consider sufficient to establish a labor relationship, even in stripped down hypothetical cases. Since casefiles are randomly assigned to these judges when they enter the draft decisions division, parties would randomly be subject to these variations in valuation of evidence.

Table 5: Inconsistencies in evidence to legal facts mapping, lab in the field data

	Litis: Indemnity / Denial of labor relationship		
	Scenario	Judge	Relationship exists?
question 7, day 2	Worker offers inspection	1	YES
	of labor contract,	2	YES
	to be produced by firm;	3	YES
	firm does not show up to inspection;	4	YES
	firm provides no evidence	5	NO
	of labor contract,	6	NO
question 10, day 2	Worker offers inspection	1	NO
	of labor contract,	2	NO
	to be produced by firm;	3	YES
	firm shows up ut does not produce contract,	4	NO
	claiming it does not exist;	5	NO
	firm provides no evidence	6	NO

Tables 6 and 7 are generated with random data. Table 6 shows, for random data sets, the proportion of the time that we can rationalize a certain number of observations, with a certain number of columns in the data base (recall each column doubles the possible states of the world). It is useful to note that random and real data are very different. We find non-rationalizability quite easily with real and lab in the field data, in cases where random data would be rationalizable with a very high probability.

Table 7 shows an example, also generated with random data, of non-rationalizability that does not arise from a direct conflict, but rather from a cycle. To show a conflict, all rows of the table must be used; removing any one of the rows eliminated the conflict, leaving a set of three rationalizable data points.

Table 6: Proportion of Sets Consistent with Rationality: Randomly Generated Data.

	Bits								
Obs.	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
20	21.1%	63.5%	86.8%	96.8%	98.6%	99.6%	99.8%	100%	100%
40	0%	10.4%	55.8%	81.1%	94.2%	98.6%	99.6%	99.5%	100%
60	0%	0.4%	22%	66.6%	88.3%	96.1%	98%	99.9%	99.7%
80	0%	0%	6.5%	42.4%	79.4%	91.5%	97.2%	99.2%	99.9%
100	0%	0%	0.6%	29.7%	69.2%	87.1%	96%	99%	99.6%
120	0%	0%	0.1%	16.3%	55.1%	83.6%	94.4%	98.6%	99.2%
140	0%	0%	0%	6.5%	43.3%	78.6%	91.3%	98%	99.2%

Table 7: Example: Non-rationalizable set with indirect conflict.

Bit 1	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**			**Verdict**
1	X	X	X	1			1
1	0	X	X	0			1
1	X	X	X	X			-1
1	1	X	X	0			1

Finally, Figures 1 and 2 show all the conflicts in the finding of two facts, whether or not an employment relationship existed and whether or not the employee resigned voluntarily. Each group of conflicts creates a 3-dimensional figure. We find 4 conflicts out of only 13 questions on existence of the labor relationship, and 5 conflicts out of only 10 questions on voluntary resignation. Given the hypothetical questions posed to the judges were both simplified and typical combinations of opposing claims and evidence, it is telling (if not damning) that the incidence of conflict is so high. Meanwhile, in the mapping from the legal facts found by the judge to the verdict, we find no contradictions within or between judges, supporting the conjecture that discretion really operates, and does damage, at the fact-finding stage.

Figure 1: Conflicts on existence of labor relationship

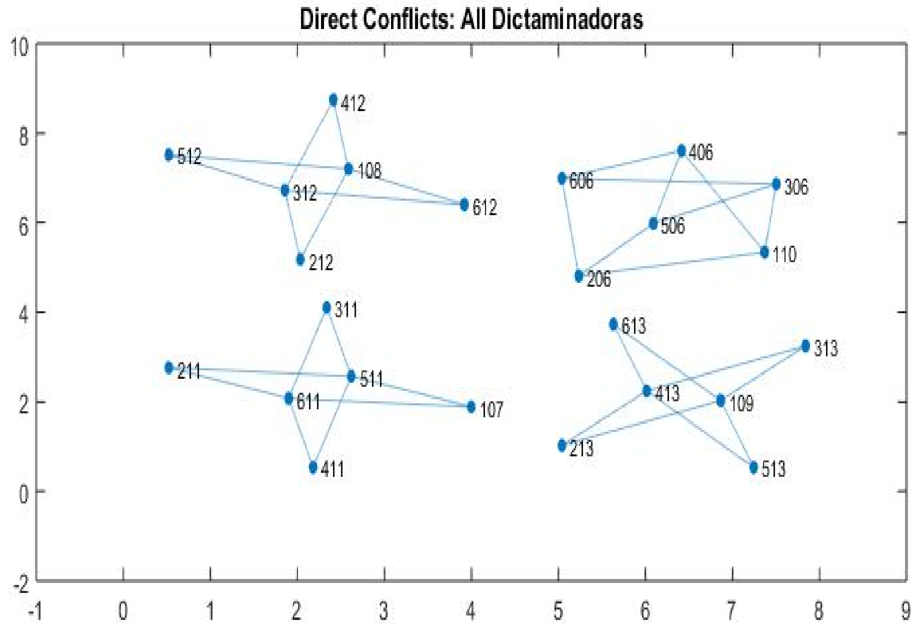
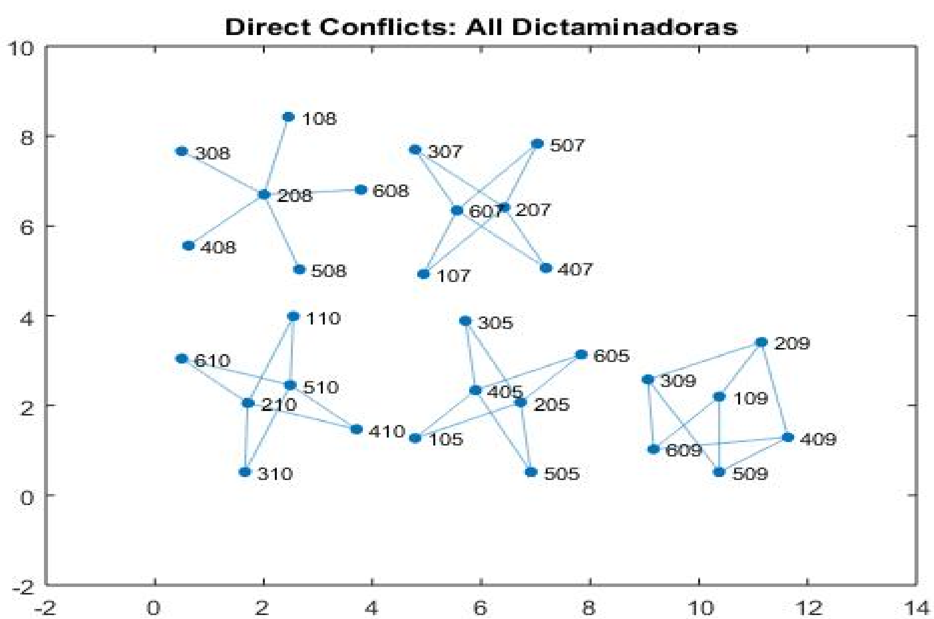


Figure 2: Conflicts on resignation



7 Conclusions and further research

This paper explores implications of treating the motivations contained in legal decisions as evidence for (in)attention on the part of the decisions' author. We derive the testable implications of a simple inattention model on such data and show how to recover the underlying parameters of the model. We than apply this model to real data from a labor court deciding a dichotomous issue in a relatively simple setting, but in which high caseloads and high levels of appeals may imply rational inattention by the clerks who draft first-instance decisions. Data work continues: we have still to code some of the data from full casefiles, and have still to determine rationalizability or conflicts with and across judges for the full data set.

Our aim is to find whether judges are using the same legal rule or not across each of the possible controversies, and whether they aggregate evidence to legal facts in the same way. When this is not the case, we would like to determine whether the conflicts within and across judges are the result of rational inattention, and would like to verify the impact of the field experiment using case summaries, as an intervention that randomly changes the cost of acquiring information from the case file, for the decision maker responsible for the draft ruling.

8 Appendix A: Proofs of propositions

Proposition 10 *There exist the partition of the state space into G and I, the prior β and the conviction threshold q rationalizing the legal output $\mathcal{C}$ if and only if A2 holds. Furthermore, without loss of generality, the conviction bias may be normalized to $q = \frac{1}{2}$.*
Proof. *See appendix* ■

The necessity of this condition follows from the observation that for any two equivalent collections $\mathbf{A} \approxeq \mathbf{B}$ it must be that, if we define $1_E(\omega) = \begin{cases} 1, \text{if } \omega \in E \\ 0, \text{if } \omega \notin E \end{cases}$ to be the indicator function for $\omega \in E$, then, whatever the G

$$\sum_{i=1}^{m_1} \beta(A_i \cap G) = \sum_{\omega \in \Omega} n_\omega(\mathbf{A}) \beta(\omega) 1_G(\omega) = \sum_{\omega \in \Omega} n_\omega(\mathbf{B}) \beta(\omega) 1_G(\omega) = \sum_{i=1}^{m_2} \beta(A_i \cap G)$$

and

$$\sum_{i=1}^{m_1} \beta(A_i) = \sum_{\omega \in \Omega} n_\omega(\mathbf{A}) \beta(\omega) = \sum_{\omega \in \Omega} n_\omega(\mathbf{B}) \beta(\omega) = \sum_{i=1}^{m_2} \beta(B_i)$$

However, $\sum_{i=1}^{m_1} \beta(A_i \cap G) = \sum_{i=1}^{m_1} \frac{\beta(A_i \cap G)}{\beta(A_i)} \beta(A_i) > q \sum_{i=1}^{m_1} \beta(A_i) = q \sum_{i=1}^{m_2} \beta(B_i) > \sum_{i=1}^{m_2} \frac{\beta(B_i \cap G)}{\beta(B_i)} \beta(B_i) = \sum_{i=1}^{m_2} \beta(B_i \cap G)$, implying a contradiction.

In order to show sufficiency, first note that for an arbitrary recorded events $A \in A(\mathcal{C})$. Note that for

$$\beta(A \cap G) - q\beta(A) > 0$$

while for any $B \in \mathbf{B}(\mathcal{C})$

$$\beta(B \cap G) - q\beta(B) > 0$$

Define $a(\omega) = 1_A(\omega)$ for any $A \in \mathbf{A}(\mathcal{C})$ and $a(\omega) = -1_B(\omega)$ for any $B \in B(\mathcal{C})$. The above inequalities can now be rewritten as

$$\sum_{\omega \in \Omega} (1_G(\omega) - q)\, \beta(\omega)\, a(\omega) > 0$$

Notably, the $a(\omega)$ are observed. Our task is to use the data to identify G, q and β.

Denote cardinality of the legal output $\#\mathcal{C} = M$ and $\#\Omega = N$. Indexing the elements of $\mathcal{C}$ by i and those of Ω by j we can rewrite the conditions the unobserved parameters of the model must satisfy as a system of M inequalities in N variables

$$\sum_{i=1}^{N} x_i a_i^j > 0$$

where $a_i^j = 1_{E_j}(\omega_i)$ if $E^j \in A(\mathcal{C})$ or $-1_{B_j}(\omega_i)$ if $E^j \in B(\mathcal{C})$, while $x_i = (1_G(\omega_i) - q)\,\beta(\omega_i)$.

By the theorem of the alternative (see Theorem 4.2 in Fishburn 1970), and since all the coefficients a_i^j are all rational, it can be shown that this system has a solution $x \in \mathbb{R}^N$ if and only if A2 holds. In fact, suppose no solution exists. Then, there must exist a collection of non-negative numbers $r_{k,}$ $k = 1, 2, ..., M$, not all of them zero, so that for every $j = 1, 2, ..., N$

$$\sum_{k=1}^{M} r_k a_j^k = 0$$

Which can be rewritten as

$$\sum_{E^k \in \mathbf{A}(\mathcal{C})} r_k 1_{E^k}(\omega_j) - \sum_{E^k \in \mathbf{B}(\mathcal{C})} r_k 1_{B^k}(\omega_j) = 0$$

In fact, since all a_j^k are rational by construction, all r_k may be chosen to be integers. Consider now two event collections $\mathbf{A}$ and $\mathbf{B}$ such that each event $E^k \in \mathbf{A}(\mathcal{C})$ is repeated r_k times in $\mathbf{A}$ and each event $E^j \in \mathbf{B}(\mathcal{C})$ is repeated r_j times in $\mathbf{B}$. From the preceding equation it follows that the number of times each ω_j is included in events in each collection is

Hence

$$n_j(\mathbf{A}) = \sum_{E^k \in \mathbf{A}(\mathcal{C})} r_k 1_{E^k}(\omega_j) = \sum_{E^k \in \mathbf{B}(\mathcal{C})} r_k 1_{B^k}(\omega_j) = n_j(\mathbf{B})$$

and, hence $\mathbf{A} \approxeq \mathbf{B}$. But by construction we have $A^k \in \mathbf{A}(\mathcal{C})$ and $B^k \in \mathbf{B}(\mathcal{C})$ for all $k = 1, 2, ...M$. Hence, A2 is violated.

We now know that the A2 is the necessary and sufficient condition for the linear system above to have a solution. Furthermore, obviously zero cannot be such a solution and every positive scalar multiple of a solution will also be a solution.

Since $(1_G(\omega_i) - q)$ is positive for any $\omega_i \in G$ and negative otherwise each solution to the system corresponds nearly uniquely to a putative $G \subset \Omega$ (the only ambiguity is where to assign those ω_i for which the corresponding $x_i = 0$; of course, this would imply that the prior probability $\beta(\omega_i) = 0$; for convenience, for such zero prior probability ω_i we shall always assume $\omega_i \in I$). It remains to reconstruct the q and the β and show that these would generate the observed behavior. To do this, we will sum up the x_i over i to obtain

$$\sum_{i=1}^{N} x_i = \sum_{i=1}^{N} \left(1_G\left(\omega_i\right) - q\right) \beta\left(\omega_i\right) = \sum_{x_i > 0} \beta\left(\omega_i\right) - q = \beta\left(G\right) - q$$

Furthermore, since for every $\omega_i \in G$ we have $\beta\left(\omega_i\right) = \frac{x_i}{1-q}$ it follows that

$$\beta\left(G\right) = \frac{1}{1-q} \sum_{x_i > 0} x_i$$

Hence, if a q is to be the conviction threshold of the model, it must solve the following quadratic equation, with coefficients determined by a solution of the linear system x:

$$q^2 - \left(1 - \sum_{i=1}^{N} x_i\right) q - \sum_{x_i \leq 0} x_i = 0$$

As $\sum_{x_i \leq 0} x_i \leq 0$ the equation may, in general, not have real roots. However, note that multiplying an arbitrary solution $x \in \mathbb{R}^n \backslash \{\varnothing\}$ by a positive scalar $\alpha > 0$ we obtain another solution to the linear system $x' = \alpha x$. In fact, by setting $\alpha = \frac{1}{2\sum_{i=1}^{N} |x_i|}$ we may guarantee that one of the roots $q = \frac{1}{2}$! Hence, we may always normalize $q = \frac{1}{2}$. In other words, whatever bias the judge might feel in favor or against conviction can always be ascribed to his or her prior probabilities of the states of the world, which in this case are $\beta\left(\omega_i\right) = \frac{1}{2} x_i > 0$ for $x_i > 0$ and $\beta\left(\omega_i\right) = -\frac{1}{2} x_i > 0$ for $x_i \leq 0$.

It remains to show that there will exist a solution of the linear system x such that, in fact, $\sum_{i=1}^{N} \beta\left(\omega_i\right) = 1$. By construction, that implies that

$$\frac{1}{2} \sum_{x_i > 0} x_i - \frac{1}{2} \sum_{x_i \leq 0} x_i = \sum_{i=1}^{N} |x_i| = 1$$

which, of course, is implied by the normalization $\alpha = \frac{1}{2\sum_{i=1}^{N} |x_i|}$ above.

We have, thus, used the data recover the set G, and a collection of the prior distributions β consistent with the normalized $q = \frac{1}{2}$. It remains to show, that at least one of those will, in fact, generate the original choice pattern. This, however, is straightforward, since by construction for every event $E \in \mathbf{A}\left(\mathcal{C}\right)$

$$\sum_{\omega \in \Omega} \left(1_G\left(\omega\right) - q\right) \beta\left(\omega\right) 1_E\left(\omega\right) > 0$$

and for every $E \in \mathbf{B}\left(\mathcal{C}\right)$

$$\sum_{\omega \in \Omega} \left(1_G\left(\omega\right) - q\right) \beta\left(\omega\right) 1_E\left(\omega\right) < 0$$

Q.E.D.

Proposition 11 *Consider two possible attention sets such that $\varnothing \neq S \subset T \subset N$ If the data can be rationalized with*

$\Omega(S)$ then it can be rationalized with $\Omega(T)$

Proof. *We shall prove the equivalent statement that if the data cannot be rationalized with $\Omega(T)$ it cannot be rationalized with $\Omega(S)$. Consider the evidence record $\mathcal{C}$ of $M \in \mathbb{N}$ cases which may not be rationalized by observation of a particular collection T of bits It is sufficient to prove that droppipng any one bit from T may not restore rationalizability. Therefore, WLOG we shall assume that $T = \{1, 2...T\}$ and $S = \{1, 2...T-1\}$. From the proof of proposition 1 we know that for the $M \times 2^T$-dimensional matrix $A(T)$ defined by the observed legal output $\mathcal{C}$ for the state space $\Omega(T)$ there does not exist a solution to the system of inequalities $A(T)x > 0$. Hence, by the theorem of the atlernative, there exists a vector $r_T \in \mathbb{R}^M_+ \setminus \{0\}$ which solves $r'_T A(T) = 0$. We shall prove that there likewise exists a vector $r_S \in \mathbb{R}^M_+ \setminus \{0\}$ which solves the equation $r'_S A(S) = 0$ for the $M \times 2^{T-1}$-dimensional matrix $A(S)$ defined by the same evidence for $\Omega(S)$ Consider all pairs of 2 states that are indistinguishable on S but distinguishable on T: that is, they are described by the bit strings that are identical except in the Tth bit. Without loss of generality, if the first element of such a pair is the ith state ω_{2i-1} let the second element be ω_{2i}; we have 2^{T-1} such pairs Since $r'_T A(T) = 0$ we know that $\sum_{j=1}^{M} r_{Tj} 1_{E_j}(\omega_{2i-1}) v_j = \sum_{j=1}^{M} r_{Tj} 1_{E_j}(\omega_{2i}) v_j = 0$. In the reduced state space $\Omega(S)$ both of these sates will correspond to the single state $\omega'_i \in \Omega(S)$. Clearly, $1_{E_j}(\omega'_i) = \max\left\{1_{E_j}(\omega_{2i-1}), 1_{E_j}(\omega_{2i})\right\}$ and the verdict v_j is unaffected by the reduction of the state space. Note further that for a given case j the realization of the Tth bit we are eliminating is either the same for ω_{2i-1} and ω_{2i-1} or it is different. In the former case $1_{E_j}(\omega_{2i-1}) = 1_{E_j}(\omega_{2i})$ and their sum is equal to either 2 or 0 and in the latter case $1_{E_j}(\omega_{2i-1}) \neq 1_{E_j}(\omega_{2i})$ and their sum is equal to 1. Consequently if we take the columns of the matrix $A(T)$ corresponding to ω_{2i-1} and ω_{2i} and add them up, we will obtain a matrix B in which for each row j the corresponding matrix element can take only one of 2 values, $b_{jk} \in \{0, 1\}, \{0, -1\}$ (cases 1 and 2) or $b_{jk} \in \{0, 2\}$, $\{0, -2\}$ (cases 3 and 4). Furthermore, the corresponding element of $A(S)$, $a_{jk}(S) = b_{jk}$ for the first 2 of these cases and $a_{jk}(S) = \frac{1}{2} b_{jk}$ for the last 2 cases. By construction $r'_T B = 0$. But this implies that by setting $r_{Sj} = r_{Tj}$ for cases 1 and 2 and $r_{Sj} = \frac{1}{2} r_{Tj}$ we shall construct the vector $r_S \in \mathbb{R}^M_+ \setminus \{0\}$ which solves the equation $r'_S A(S) = 0$. Q.E.D.* ■

9 Appendix C: Sample Hypothetical Case for Lab Treatment

Valentina Ramirez, aged 45, claimes 9 years of tenure at a daily wage of 350.00 pesos at a manufacturing firm Manufacturera Oliver S.A.de C.V. She alleges unfair dismissal and claims severance pay consisting of 90 days standard legal severance, as well as overtime of 10 hours per week over her entire tenure. Employer answers lawsuit alleging that it never hired the worker. Evidence submitted is the following:

Worker:

1. Provides photocopy of labor contract. No expert testimony (cotejo) to verify that the copy was made from a true original takes place.

2. Offers inspection of the firm's bank records to prove regular salary deposits made to the worker's bank account.

Firm:

1. Provides original of its employment lists, to show worker was never included in these lists during the alleged period of employment.

2. Does not attend the inspection hearing in which it was summoned to provide its official bank records.

3. Provides testimony by two current workers with tenure covering the alleged employment period of the worker, who attend the testimony hearing and answer the question: “Did the firm Manufacturera Oliver S.A.de C.V. ever hire Valentina Ramirez?” in the negative.

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