

ORIGINAL RESEARCH

When pleas precede evidence: Using Bayesian analyses to establish the importance of a reasonable standard for evidence prior to plea offers

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Abstract

In most U.S. jurisdictions, prosecutors are not required to clearly establish a *reasonable basis* for guilt prior to offering defendants plea deals. We apply Bayesian analyses, which are uniquely suited to illuminate the impact of prior probability of guilt on the informativeness of a particular outcome (i.e., a guilty plea), to demonstrate the risks of plea offers that precede evidence. Our primary prediction was that lower prior probabilities of guilt would coincide with a significantly higher risk for false guilty pleas. We incorporated data from Wilford, Sutherland et al. (2021) into a Bayesian analysis allowing us to model the expected diagnosticity of plea acceptance across the full range of prior probability of guilt. Our analysis indicated that, as predicted, when plea offers are accepted at lower prior probabilities of guilt, the probability that a plea is actually false is significantly higher than when prior probabilities of guilt are higher. In other words, there is a trade-off between prior probability of guilt and information gain. For instance, in our analysis, when prior probability of guilt was 50%, posterior probability of guilt (after a plea) was 77.8%; when prior probability of guilt was 80%, posterior probability of guilt was 93.3%. Our results clearly indicate the importance of ensuring that there is a *reasonable basis* for guilt before a plea deal is extended. In the absence of shared discovery, no such reasonable basis can be established. Further, these results illustrate the additional insights gained from applying a Bayesian approach to plea-decision contexts.

Keywords: false guilty pleas, plea bargains, Bayesian analysis, standard of evidence, discovery

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I. Introduction

In 1963, the United States Supreme Court made a landmark ruling in favor of John L. Brady (*Brady v. Maryland*, 1963). Specifically, the Court found that prosecutors' failure to turn over potentially exculpatory evidence to the defense violated his 14th Amendment right to due process of law. The *Brady* doctrine was later applied to cases in which a prosecutor denied having any knowledge of the exculpatory evidence (e.g., it was not turned over by law enforcement; *Kyles v. Whitley*, 1995). Critically, this established doctrine set a clear deadline for evidence disclosure: trial. Unfortunately, as the Supreme Court acknowledged almost fifty years later, our criminal justice system "...is for the most part a system of *pleas*, not a system of *trials*..." (*Lafler v. Cooper*, 2012). Consequently, a natural question arises: Are prosecutors required to disclose any potentially exculpatory evidence prior to the adjudication of a case (i.e., by trial or guilty plea)? And, in the absence of such a requirement, how can a reasonable standard for evidence be established prior to a guilty plea?

In the current paper, we discuss the dangers of plea offers that precede evidence (or evidentiary discovery). To illustrate these risks, we apply Bayesian analyses, which are uniquely suited to illuminate the impact of the prior probability of guilt (or base rates of guilt) on the informativeness of a particular outcome (i.e., a guilty plea). We conclude by discussing the implications of the results from our Bayesian analyses and offering relevant recommendations for reform.

A. The Purpose of Plea Bargaining

In 1970, the United States Supreme Court made another landmark *Brady* ruling—this time ruling against the petitioner, Robert M. Brady (*Brady v. United States*, 1970). In a unanimous opinion, the Court ruled that the threat of death did not render a guilty plea involuntary. The Court defended plea negotiations by stating that they allow "... scarce judicial and prosecutorial resources [to be] conserved for those cases in which there is a substantial issue of the defendant's guilt or in which there is substantial doubt that the State can sustain its burden of proof." Here, the Court clearly suggests that prosecutors should be taking cases they are *less certain* of to trial and that plea bargaining should be reserved for cases in which there is strong evidence of guilt. In other words, the original purpose of plea bargaining was to accelerate the

pace of cases for which the accused person's guilt was essentially certain. In so doing, the State's resources could be reserved to try those cases for which reasonable doubt might exist.

Accordingly, to deem a plea conviction valid, the Court must theoretically establish a *sufficient* factual basis for the plea. In practice, courts can rely solely on the police report, or even the accused person's own guilty plea, to meet this standard (Bibas, 2014; Dezhnev et al., 2022; Redlich et al., 2022). Further, the U.S. Supreme Court later ruled (unanimously) that the prosecution was permitted to require that accused persons' "...waive their right to impeachment information relating to any informants or other witnesses..." as a condition of accepting a plea offer (*United States v. Ruiz*, 2002). The Court recognized the right (to potentially exculpatory *Brady* material) as cloaked in one's right to a fair trial—when that right is waived (by pleading guilty), all accompanying rights are also waived.

"It could require the Government to devote substantially more resources to trial preparation prior to plea bargaining, thereby depriving the plea-bargaining process of its main resource-saving advantages. Or it could lead the Government instead to abandon its heavy reliance upon plea bargaining in a vast number – 90% or more – of federal criminal cases. We cannot say that the Constitution's due process requirement demands so radical a change in the criminal justice process in order to achieve so comparatively small a constitutional benefit" – Justice Breyer (23, *U.S. v Ruiz*, 2002)

Thus, while failing to sufficiently define the factual-basis-for-guilt requirement of pleas, the Court has also made it clear that the *Brady* doctrine does not apply (at least not fully) to plea negotiations. This conclusion seems to conflict with the Court's earlier justification of plea bargaining as a means of more efficiently processing cases for which guilt is not in question. If guilty pleas are to be reserved for essentially unequivocal cases, why deprive the defense of potentially exculpatory evidence? *Ruiz* seems to represent a significant change in the Court's original views of plea-bargaining such that the increased efficiency it confers outweighs potential threats to due process.

Unsurprisingly, criminal attorneys now readily acknowledge the occurrence of guilty pleas in weak cases (Alschuler, 2016). In fact, many have noted that the "system of pleas" is designed to encourage prosecutors to take stronger cases to trial (to preserve high conviction rates) while pleading weaker cases away (Rakoff, 2014)—completely antithetical to the Supreme Court's original justification for guilty pleas (in *Brady*). When prosecutors' confidence in

securing convictions would generally be lowest (or at least the most unclear), they can still negotiate convictions. The faster the guilty plea, the faster the case resolution (maximizing judicial efficiency; Wilford & Khairalla, 2019). Judges also rarely question guilty pleas (Rakoff, 2014). Presumably, legal actors defend these quick pleas (that precede evidence) via the assumption that guilty pleas are themselves sufficient evidence for conviction. Yet, a guilty plea (as the prevalence of demonstrably false guilty pleas illustrates; Wilford & Bornstein, 2023) is a far cry from an assurance of true guilt.

B. In the Shadow-of-the-Trial

Many legal scholars have further defended the practice of plea-bargaining with the supposition that it operates in the shadow of the trial (Landes, 1971). Specifically, accused persons can choose to accept a plea offer by evaluating the sentence it confers against the potential sentence after trial (Mnookin & Kornhauser, 1979). The shadow-of-the-trial (or shadow) model is essentially utility theory, applied to the context of plea decision-making. When offered a plea, accused persons compare the known utility associated with pleading guilty (i.e., the plea sentence) with the expected utility associated with going to trial (i.e., the estimated risk of conviction and the expected trial sentence). In this way, plea outcomes (and discounts) are theoretically still influenced by the trial process (Yan, 2020; 2022). Research testing the predictive validity of the shadow model has been mixed, with some finding support for it at an aggregate but not individual level (e.g., Bushway & Redlich, 2012; Bushway et al., 2014). Others have highlighted more systematic weaknesses of the model (e.g., Bartlett & Zottoli, 2021; Petersen et al., 2020; Wilford, Sutherland et al., 2021), or the significant impact of other decision-making biases or strategies unaccounted for in the shadow model (e.g., anchoring: Cardenas, 2023; discounting: Clatch & Borgida, 2021; framing: Garnier-Dykstra & Wilson, 2021; Helm & Reyna, 2017; fuzzy-trace: Helm et al., 2018; Zottoli et al., 2023).

Of course, even if we assume that most accused persons are rational decision-makers (tenuous given growing critiques of utility theory, Kahneman, 2011; Thaler, 2016), rational decision-making relies on comprehensive information (Ahituv et al., 1998; Grünig & Kühn, 2017). Without access to evidentiary discovery, how can we expect accused persons to accurately estimate their probability of conviction? Put another way, how can plea bargaining occur in the shadow of the trial when trial evidence is kept in the dark? Further, the shadow

model provides a clear prescription for prosecutors with weak cases: offer larger plea discounts (Landes, 1971).

C. Quick Pleas

Depriving accused persons of evidentiary discovery during the plea process eliminates their ability to evaluate plea offers rationally, whether they are innocent or guilty. Even when states require openness (Turner & Redlich, 2016), individuals can still be offered a plea prior to seeing their case evidence. Arizona, for instance, is an open-file state. Prosecutors are required to share discovery as soon as charges are formally filed (i.e., at a preliminary or probable cause hearing; Turner & Redlich, 2016). But Maricopa County (including Phoenix) now has Early Disposition Courts (EDCs), which are designed to “fast-track” cases by consolidating or skipping steps in the legal process. The original purpose of these courts was to allegedly provide persons accused of low-level, non-violent offenses incentives to plead quickly and receive treatment (e.g., drug rehabilitation) earlier. Yet, data from the Maricopa County Attorney’s Office indicates that in a 4-year period (from January 2017 to January 2021), only 6.7% of all EDC cases diverted convicted persons to treatment programs (ACLU v. Maricopa County Attorney’s Office, 2021). Many criminal cases are routed into this system as soon as an accused person has been arrested (Biscobing, 2021). Typically, the only “evidence” defense attorneys are provided by the EDC is a police report, their client’s criminal record (which can be inaccurate when, for instance, the client is confused with someone else of the same name), and a plea offer from the prosecutor’s office (Hessick, 2021). Thus, there is no evidence to support that cases being routed to EDCs involve stronger evidence or a higher probability of conviction. In fact, even if prosecutors are in possession of additional evidence when initial pleas are offered, they often refuse to turn it over until the preliminary hearing.

Attorneys and their clients then have until the preliminary hearing to accept, reject, or renegotiate the offer. Once the case has advanced to a preliminary hearing or an indictment, Maricopa County has clearly established that the EDC plea offer expires and will not be matched; any subsequent offer (which is not guaranteed) will be significantly worse. In fact, written plea offers for EDC cases are often accompanied by the following text:

“The offer is withdrawn if the witness preliminary hearing is set or waived. The offer may be changed or revoked at any time before the court accepts the plea. *Note:

County attorney policy dictates that if the defendant rejects this offer, any subsequent offer tendered will be *substantially* harsher.”

Thus, in jurisdictions like Maricopa County, accused persons are essentially being asked to take a plea offer while completely blind as to the strength of the prosecution’s case. The preliminary hearing is when prosecutors are required to share discovery: to demonstrate that they have sufficient evidence to show that a crime occurred, and that the accused person is guilty of that crime (Biscobing, 2021). Encouraging individuals to plead guilty before even this preliminary bar has been met is unquestionably increasing the risk of false guilty pleas. It is allowing prosecutors to move forward with convictions even when there is no way they could (yet) meet a significant burden of proof. Accordingly, the ACLU is pursuing a class action lawsuit against Maricopa County alleging that EDCs are punishing and threatening accused persons for exercising their constitutional rights.

Quick pleas have allowed prosecutors and judges to use guilty pleas, in lieu of evidence, to establish guilt. Presumably, these legal actors believe that accused person’s decision to plead guilty is fully diagnostic of actual guilt, regardless of when pleas occur. In an opinion, the former Supreme Court Justice Antonin Scalia estimated a wrongful conviction rate of 0.027%, clearly signaling his faith in the veracity of guilty pleas (*Kansas v. Marsh*, 2006). Former Judge Paul G. Cassell (2018) later used a “components parts approach” to calculate a wrongful conviction range of 0.016 to 0.062%; notably, this analysis was informed by untested assumptions like, “... the risk of a wrongful conviction is, unexpectedly, greater for rape-homicides than for less serious crimes” (p. 829). These presumptions ignore the pressure prosecutors can exert on accused persons to plead guilty. Prosecutors possess a substantial toolbox and significant discretion during the plea process. Accused persons can be incarcerated pretrial (Wilford, Zimmerman et al., 2021), face dramatic sentencing discrepancies (Wilford & Bornstein, 2023), even including qualitatively different punishments (e.g., probation versus incarceration; Helm, 2018).

Yet, the perceived diagnosticity of guilty pleas makes plea convictions even harder to overturn (in many ways) than trial convictions (Wilford & Khairalla, 2019). While accused persons do not automatically waive their right to appeal by pleading guilty, the Supreme Court has noted that avenues for appeal *can* be waived as a condition of pleading guilty (*Class v. United States*, 2018). Further, without a trial, records to support an appeal (e.g.,

prosecutorial misconduct) are extremely limited (Johnson, 2023). In the forthcoming analyses and discussion, we further challenge the assumption that a guilty plea is diagnostic of guilt. By illustrating the relationships among prior probability of guilt, diagnosticity, and wrongful convictions (using a Bayesian approach), we hope to give all legal actors involved in the plea process an opportunity to reevaluate the value of quick pleas against their potential costs.

Notably, we intentionally conflate a lower probability of *proving* guilt with a lower probability of *being* guilty. Our system of justice is predicated on a presumption of innocence—accused persons are presumed innocent until proven guilty. Thus, if there is less evidence of guilt, there is an inherently higher probability the State will fail to prove guilt (resulting in dismissals and acquittals, regardless of whether the individual is innocent or guilty). In the absence of evidence, the presumption is that the accused person is innocent, not that they are guilty (i.e., people are innocent unless the State can prove otherwise). The withholding of potentially exculpatory evidence (i.e., discovery) is a due process concern for which factual guilt is essentially irrelevant. The concern is whether the State is being held to a reasonable burden of proof prior to convicting accused persons of crimes. As such, our analysis focuses on the prior probability of the State's ability to *prove* factual guilt beyond a reasonable doubt at trial.

II. Plea Decision-Making As a Bayesian Problem

Given these assumptions and parameters, a Bayesian approach is uniquely well-suited to demonstrate both the diagnostic utility of a guilty plea and the increased risk of false guilty pleas when pleas are entered quickly (and blindly). Wells et al. (2015) used the same approach to model the diagnosticity of eyewitness identifications in multiple contexts noting, "... that the conditional probabilities of interest to the legal system naturally map into Bayesian formulations" (p. 100). In their treatise, Wells et al. (2015) argued that the base rate of guilt (i.e., the prior probability that a suspected person is actually guilty) is a system variable; a system variable represents something that is under the control of the legal system (e.g., lineup instructions; Wells, 1978; Wilford & Wells, 2013). The justice system can control the prior probability (or base rate) of guilt for any legal procedure by pre-determining some acceptable criterion for that procedure (e.g., an *evidence-based suspicion* prior to

putting suspected persons in lineups or interrogating them, Wells et al., 2020; Moody et al., 2023; a *reasonable basis* for guilt prior to offering an individual a plea).

While the majority of plea decision-making experiments in which guilt status is manipulated employ a 50-50 ratio (i.e., there is a 50% prior probability that any given participant-defendant is guilty), the real-world base rate is unknown. However, Bayesian analyses allow us to calculate the posterior probability of guilt, given a guilty plea, across the full spectrum of base rates simultaneously (Smith et al., 2016). In other words, we can observe the impact a guilty plea has on the posterior probability of guilt for each possible base rate. Importantly, in the absence of evidence, attorneys (both defense and prosecution) cannot accurately assess the probability that an accused person is *actually* guilty. Consequently, it is important to examine the impact prior probability could have on posterior probability to underscore the importance of a *reasonable* standard for evidence.

For the purposes of the current analyses, we relied on data from Wilford, Sutherland et al. (2021) to inform plea acceptance rates for innocent and guilty participants. We chose this study because of the design utilized (i.e., 2 [guilt status: innocent or guilty] x 3 [plea sentence: 6 months, 12 months, or 18 months] x 3 [conviction probability: 20%, 50%, or 80%] repeated-measures design), as well as the large and diverse sample recruited (i.e., 525 Prolific Academic participants and 596 student participants).¹ Wilford, Sutherland et al.'s

¹ Wilford, Sutherland et al., (2021) tested the predictive power of an expanded shadow-of-the-trial model that incorporated guilt status. Participants were undergraduate students (half completed the study in-person and half completed the study online) and community participants recruited through Prolific Academic. Participants had to be U.S. residents who were 18 years of age or older. Community members had an average age of 30.9 years and were 51.8% male, 45.1% female, and 1.9% transgender or gender nonconforming. They were 65.5% White, 12.4% Asian, 7.6% Black, 5.9% Hispanic or Latinx, 5.9% bi- or multiracial, and 0.8% American Indian or Alaska Native. Student participants had an average age of 19.9 years and were 51.2% male, 45.8% female, and 1.5% transgender or gender nonconforming. They were 60.6% White, 14.6% Asian, 9.6% Black, 8.2% Hispanic or Latinx, 4.2% bi- or multiracial, and 0.2% American Indian or Alaska Native. The study employed two counterbalanced crime scenarios: a hit-and-run and a theft. Participants saw both scenarios (via an interactive computer simulation) and were randomly assigned one of the eighteen experimental conditions for each scenario. Participants started the study by giving consent and completing a demographics questionnaire. They then saw a simulated legal scenario of either the hit-and-run or theft: they were accused of the crime, summoned to court, where the prosecutor laid out the charges and the evidence, then remanded to a holding cell. A flashback then revealed to the participant whether they were innocent or guilty. After, they met with their defense attorney who told them their conviction probability and the terms of the plea deal: plead guilty for 6/12/18

(2021) pattern of findings were also largely consistent with the extant plea literature (e.g., guilty participant-defendants were much more likely to accept the plea offer than innocent participant-defendants). Using this data allowed us to ground our estimation of plea behavior in empirical research for which guilt status was known.

There are two noteworthy limitations of this approach. First, the exact plea acceptance rates from Wilford, Sutherland et al. (and plea research broadly; 2021) emanate from study-specific parameters (e.g., evidence was constant across conditions in this study) that may not generalize consistently across all aspects of criminal trials. This limitation would be better addressed if, like Wells et al. (2015), we used a meta-analysis to inform our behavioral estimates. However, to-date there is no meta-analysis of the plea research literature. Second, existing empirical research has not sufficiently captured the potential dynamism of plea decision-making: plea decisions are not assessed before and after changes to the case parameters (e.g., participant-defendants are typically not asked to accept or reject a plea offer before and after evidentiary discovery is shared). Regarding both limitations, changes in associated plea rates would necessarily produce differences in our empirical analysis. However, these experimental data combined with Bayesian analysis provide an important, initial demonstration of the diagnostic value of plea offers and the risk of false conviction via plea as a function of guilt status and prior probability of guilt. Thus, we strongly encourage future researchers to continue adopting a Bayesian approach with experimental data to further test the generalizability of these trends in plea contexts, as well as other legal contexts (e.g., interrogations, see Moody et al., 2023).

We used General Linear Mixed Modeling (GLMM) to estimate the log odds of plea acceptance (vs. rejection; e.g., Wilford, Sutherland et al., 2021). The model evaluated the overall probability of plea acceptance as a function of guilt (vs. innocence; *G*) status (see

months in jail or risk a maximum of 24 months if convicted at trial. After making their plea decision, participants answered manipulation check questions, as well as subjective questions (e.g., how guilty they thought they were, their perceived probability of conviction). All data are available at <https://osf.io/k9amw/files/>

Equation 1) while controlling for order effects (O), crime type (C), subpopulation (S), and within-subject effects (β_{0i}).²

$$\log_e \left(\frac{P(PA_{it})}{1-P(PA_{it})} \right) = \beta_{0i} + \beta_1 * O + \beta_2 * C + \beta_3 * S + \beta_4 * G \quad (1)$$

These models were used to estimate the expected, condition-specific log odds of plea acceptance, which were then converted to condition-specific plea acceptance probabilities (see Equation 2) for experimentally manipulated guilt and innocence status (47.9% and 13.7% plea acceptance rates, respectively).

$$P(PA_{it}) = \frac{e^{\log_e \left(\frac{P(PA_{it})}{1-P(PA_{it})} \right)}}{1 + e^{\log_e \left(\frac{P(PA_{it})}{1-P(PA_{it})} \right)}} \quad (2)$$

We were then able to use experimentally observed conditional response rates to calculate the posterior probability of participant guilt (G). Specifically, we calculated the probability of participant guilt given their acceptance of a plea offer (PA), $P(G|PA)$ (see Equation 3) using the experimentally derived, condition-specific probabilities of plea acceptance when participant-defendants were guilty, $P(PA|G)$, or innocent (NG), $P(PA|NG)$. As previously discussed, we do not know what the base rates of guilt, $P(G)$, and innocence,

$$P(G|PA) = \frac{P(PA|G)*P(G)}{P(PA|G)*P(G) + P(PA|NG)*P(NG)} \quad (3)$$

$P(NG)$, are in the population, but using this formula we estimated the posterior probability of guilt across the entire range of possible guilt base rates (0-100%). Once we estimated the posterior probability of guilt, we then calculated information gain about guilt probability as a function of plea acceptance by subtracting corresponding baseline probabilities of guilt from our posterior probabilities of guilt (see Equation 4).

$$\text{Information Gain} = P(G|PA) - P(G) \quad (4)$$

A. Comparing Two Plea Decision Points

Consequently, we were able to compare diagnosticity of plea acceptance (i.e., the posterior probability of guilt) across varying base rates (i.e., prior probabilities) of guilt. When considering plea diagnosticity, it is important to note that the base rate for (provable)

² We did not run models in which the overall probability of plea acceptance was examined as a function of guilt, plea discount, and conviction probability. Instead, for the purpose of simplicity, the effect of the plea discount and conviction probability manipulations were collapsed across conditions.

guilt varies by both jurisdiction and timepoint in the legal process (e.g., from arrest to adjudication or dismissal). In these analyses we assume that case duration and evidence strength are related. While we acknowledge that the relationship between case duration and evidence strength is not entirely monotonic, we argue that generally, the longer a case survives the process, the more likely the accused person is to be *proven* guilty (and consequently, *plead* guilty). When a case is opened, only the prosecution has had the opportunity to acquire evidence; the defense typically begins building its case only after charges are filed. Thus, as time passes, the chances that the defense can raise motions to limit or suppress evidence, or even dismiss charges entirely, increase as they conduct their own investigations and/or eventually receive evidentiary discovery. As a result, the odds that weak or tenuous cases will drop out naturally increase. Further, because convictions can never outnumber charges, and because cases referred will never outnumber cases filed, we can assume that the cases being dropped as the system progresses are those less likely to conclude with a conviction. In other words, the number of cases that make it to pre-trial motions (for instance) will necessarily be smaller than the number of cases that make it to a preliminary hearing. Thus, cases that persist through the legal procedure will most likely have a relatively higher prior probability of *demonstrable* guilt (again, we do not distinguish demonstrable prior probability of guilt from actual guilt); these are the cases that prosecutors have not dropped, and judges have not dismissed.

Consider a jurisdiction like Maricopa County, the base rate of guilt for accused persons being offered an initial plea could be relatively low due to their Early Disposition Courts. But, individuals who reject those initial pleas can still be offered subsequent plea deals, and the base rate of guilt for those persons could be significantly different from the base rate for those who accepted initial pleas; weaker cases are more likely to be dismissed or dropped with additional time for investigation. In other words, the base rate of guilt for first-round pleas versus second-round pleas, in the same jurisdiction, could be significantly lower due to changes in the pool of cases prosecutors choose to continue pursuing (versus dismissing). But, there will also be jurisdictional differences. In San Francisco County, for instance, case rejection rates (i.e., cases in which prosecutors choose not to file charges after an initial assessment or screening process) are relatively high (i.e., between 40-60% from 2017 to 2021; Prosecutorial Performance Indicators, 2022). Thus, one would expect that the base rate of guilt among those offered an

initial plea in San Francisco County would be relatively higher than those offered an initial plea in Maricopa County (given the seemingly higher criterion, or higher confidence in conviction, for prosecutors to file charges).

A recent analysis of five years of cases from 15 United States prosecutor's offices found that approximately 28% of cases are rejected after initial screening, and another 28% are eventually dismissed (Prosecutorial Performance Indicators, 2022).³ Thus, about 51.8% of cases referred to prosecutor's offices (typically by law enforcement) are fully prosecuted (resolved at trial or by plea). In Maricopa County specifically, between 2019 and 2021, an average of only 36.7% of referred cases were fully prosecuted (excluding those still pending; Maricopa County Attorney's Office, AZ). That said, it is unclear whether cases routed to Early Disposition Courts go through the same initial screening as cases routed to other court systems. Thus, we believe a conservative estimate regarding the base rate among those offered early initial pleas, in jurisdictions like Maricopa County, is around 50%. Note again that in this context, 50% does not necessarily represent the base rate of *actual* guilt, but rather the base rate for those who could be *proven* guilty at trial (which we use as a proxy for *actual* guilt). Thus, we can use 50% to calculate the posterior probability of guilt given plea offer acceptance (see Equation 5) and the information gained from a plea decision (see Equation 6).

$$P(G|PA) = \frac{.479 * .50}{.479 * .50 + .137 * .50} = \frac{.2395}{.3080} = .778 \quad (5)$$

$$Information\ Gain = .778 - .50 = .278 \quad (6)$$

When an accused person accepts a plea offer with a 50% prior probability (or base rate) of guilt, there is a corresponding increase of 27.8% of their likelihood of being guilty (to 77.8% total probability).

In contrast, the base rate for plea offers in more conservative jurisdictions (e.g., San Francisco County) or those extended later in the process (e.g., shortly before trial), might be closer to 80% (in FY 2019, ~20% of bench and jury trials resulted in non-convictions; *Federal Justice Statistics*, 2019).

$$P(G|PA) = \frac{.479 * .80}{.479 * .80 + .137 * .20} = \frac{.3832}{.4106} = .933 \quad (7)$$

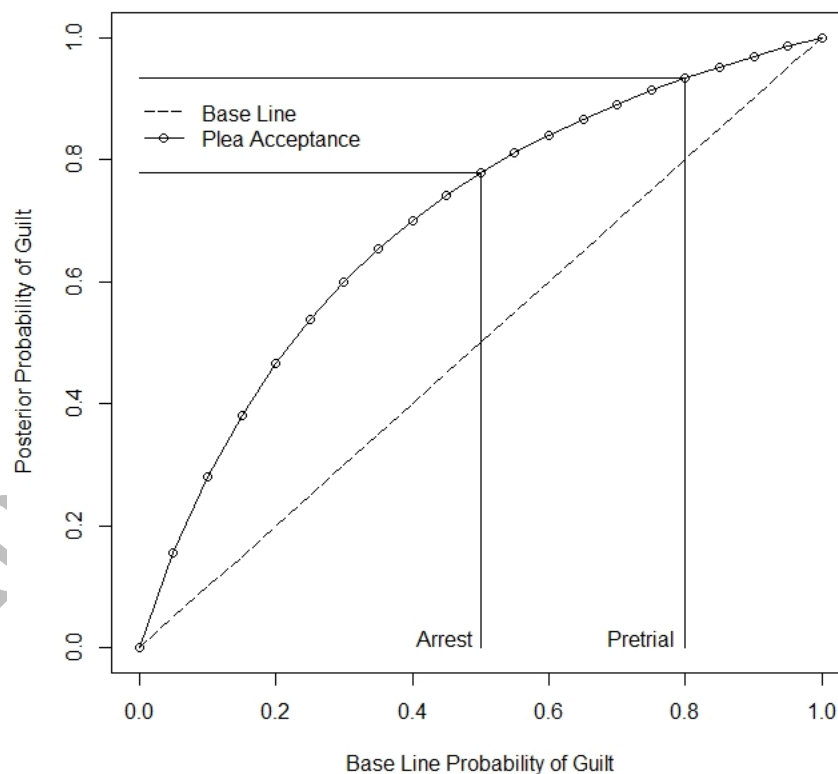
$$Information\ Gain = .933 - .80 = .133 \quad (8)$$

³ Please note that these Prosecutorial Performance Indicators are only available from jurisdictions in which the District Attorney's office voluntarily opts into reporting the relevant measures. Thus, there could be self-selection biases that impact the results and trends observed.

In this example, the overall probability of guilt, if accepting a plea offer, is high (93.3%; see Equation 7), but information gain drops to 13.3% (see Equation 8). To further illustrate the impact that these base rates can have on the posterior probability of guilt, Figure 1 displays the prior-by-posterior guilt probability. The diagonal, dashed line indicates the posterior probability of guilt if no information was gained from plea acceptance, when the posterior probability of guilt would be equivalent to baseline probability of guilt. The solid curved line with circles indicates the posterior probability of guilt for any given baseline probability of guilt given an accepted plea offer. Finally, the intersecting vertical and horizontal solid lines indicate the posterior probability of guilt when baseline probability of guilt is 50% (e.g., at arrest) and 80% (e.g., shortly before trial); resulting in a 77.8% and 93.3% posterior probability of guilt, respectively.

Figure 1

Posterior probability of guilt as a function of plea acceptance.



Note. The dashed line indicates the posterior probability of guilty if no information was gained from plea acceptance. The solid line with circles indicates the posterior probability of guilty for any given baseline probability of guilt given a person accepted a plea offer. Vertical and

horizontal solid lines indicate the posterior probability of guilt when baseline probability of guilt is 50% (at arrest) and 80% (shortly before trial); 77.8% and 93.3% posterior probability of guilt, respectively.

B. Everyone is Blind Without Evidence

The practice of coercing accused persons to accept pleas immediately (e.g., after arrest) is worrying for several reasons. The first being that an arrest can then serve as sufficient evidence to threaten an accused person with an immediate criminal conviction. Notably, the standard of proof for arrest (and most initial phases of prosecution) is “probable” cause, and the determination of probable cause is typically one-sided. Although a judge is required to agree that probable cause exists for an arrest, they have no resources by which to investigate the State’s claims at these early phases. Thus, they are likely to defer to the opinion of law enforcement.

A system that can entice individuals to plead guilty as soon as they are accused of a crime, when the only burden the State has met is probable cause, looks like a system presuming *guilt*, not *innocence*. In such jurisdictions, it appears that the presumption of innocence is yet another Constitutional right cloaked in one’s right to a trial; a presumption that our more efficient *system of pleas* cannot tolerate. Once accused, the State need only convince an individual to accept a plea offer and its burden of proof has been met.

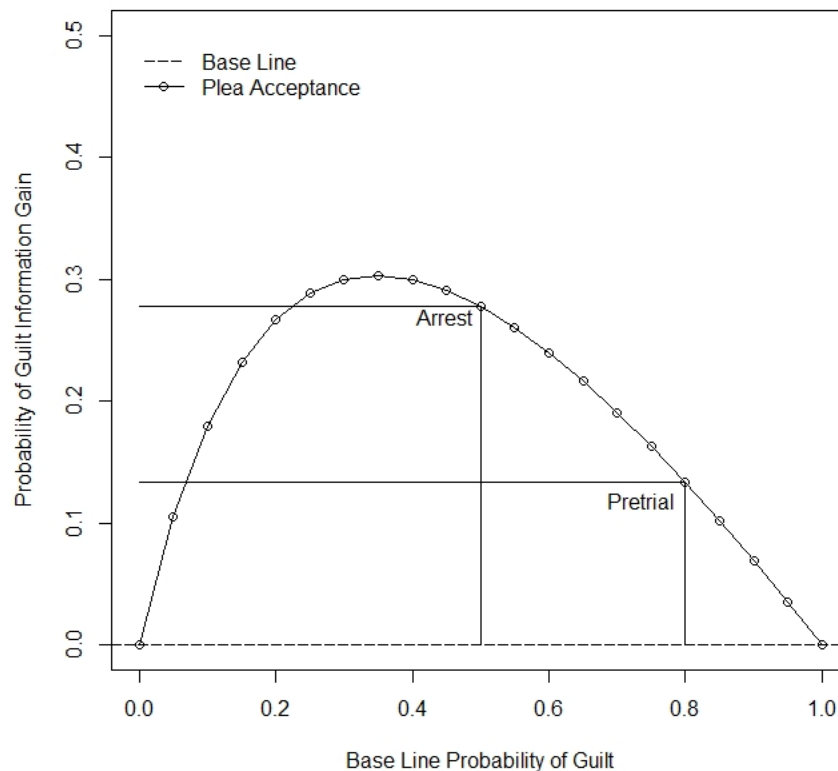
We can clearly observe the impact of policies such as these: as the base rate of guilt increases (from 50%), information gain decreases (see Figure 1). In other words, there is a trade-off between prior probability of guilt and information gain when treating guilty pleas as diagnostic of guilt. When we rely more on plea outcomes (rather than evidence) to conclude an individual is guilty, we increase the information gained from a guilty plea at the increased risk of false guilty pleas. But, guilty pleas are not evidence, they are convictions (*Boykin v. Alabama*, 1969; Wilford & Wells, 2018). Thus, ideally (as originally envisioned in *Brady v. United States*, 1970), the system would already be confident in one’s guilt prior to offering a guilty plea.

Consequently, it is important to examine the information gained from a guilty plea at various potential points in the legal process across different jurisdictions—not to maximize information gain, but to question whether the plea outcome is replacing the role of evidence in adjudications. To further examine the impact of prior guilt probability on the information gained from the outcome of a plea offer, we constructed an information-gain curve (see Figure 2). The dashed horizontal line indicates information gained (none) if plea acceptance does not provide

additional information concerning the probability of guilt, while the solid line with circles indicates the relative information gained about guilt status as a function of plea acceptance and baseline probability of guilt. Similar to Figure 1, the intersecting solid vertical and horizontal lines indicate the information gained when baseline probability of guilt is 50% (e.g., at arrest) and 80% (e.g., shortly before trial).

Figure 2

Probability of guilt information gained as a function of plea acceptance



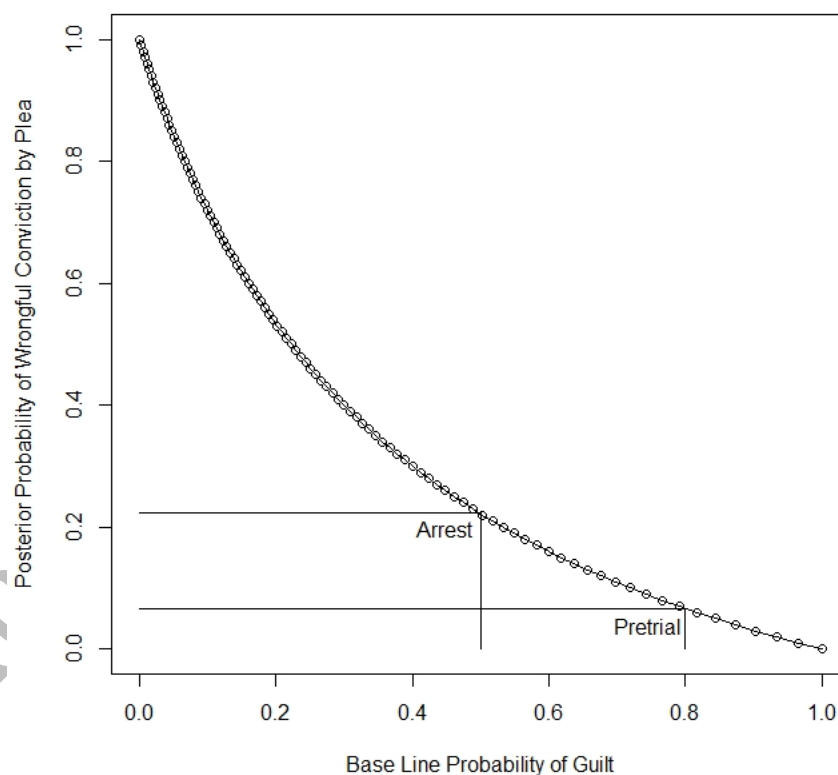
Note. The dashed line indicates the information gained about guilt probability if no information was gained from plea acceptance. The solid line with circles indicates the information gained about guilt probability for any given baseline probability of guilt given plea offer acceptance. Vertical and horizontal solid lines indicate the information gained about guilt probability when baseline probability of guilt is 50% (at arrest) and 80% (shortly before trial); 27.8% and 13.3% increased probability of guilt, respectively.

We observed that information gain from plea acceptance is greatest (30.3%) when the prior probability of guilt is 35%, and that information gain is approximately 20% or higher for prior probability of guilt ranging from approximately 12 to 68%. Overall, Figure 2 indicates that plea acceptance is informative of guilt status for a wide range of prior probability of guilt.

However, returning to Figure 1, we inverted the posterior probability of guilt trajectory to become a posterior probability of wrongful conviction (see Figure 3). Figure 3 shows that across that same range of prior probability of guilt (12-68%), the percent of plea acceptance by the innocent ranges from approximately 68 to 12%. Taken together, Figures 1-3 illustrate that when the State extends plea offers too early in the process (i.e., when the probability of case dismissal is greatest and the likelihood of acquittal would be highest), innocent people will necessarily be caught; sometimes at a rate greater than guilty persons (i.e., when prior probability of guilt is 22% or less). When guilty pleas are the primary (or only) piece of evidence against the accused persons, their veracity should be questioned. While these results rely on one study of plea decision-making and should be replicated via additional plea experiments manipulating guilt status, they nonetheless highlight grave concerns about our current *system of pleas*.

Figure 3

Probability of wrongful conviction as a function of plea acceptance



Note. The solid line with circles indicates the posterior probability of wrongful conviction by plea for any given baseline probability of guilt given a person accepted a plea offer. Vertical and horizontal solid lines indicate the posterior probability of wrongful conviction by plea when the baseline probability of guilt is 50% (at arrest) and 80% (shortly before trial); 22.2% and 6.7% probability of wrongful conviction, respectively.

Some may argue that the diagnostic value of plea decisions presented in this paper is justification for their use, particularly in cases where prosecutorial confidence is low. As has been regularly emphasized, the legal system is overburdened—we should, therefore, preserve limited resources as much as possible. Further, the more cases that must be tried, the longer accused persons will wait before their case is tried (thus, threatening their Constitutional right to a speedy trial). So, why not let them identify themselves as guilty as early in the process as possible, particularly given evidence that in those circumstances, plea acceptance provides greater confidence in *actual* guilt status?

Unfortunately, as is indicated by the extant body of experimental plea research (Helm & Reyna, 2017; Redlich & Shteynberg, 2016; Wilford, Sutherland et al., 2021), and this Bayesian analysis, the diagnostic value of pleas is inexorably intertwined with an unacceptable wrongful conviction rate, except at the highest prior probabilities of accused persons' guilt. While previous studies have shown that innocent people accept plea offers, none have shown how relatively weak their correspondence to actual guilt can be (in relation to prior probability of guilt). These results clearly undermine the assumption many legal actors must be making with regard to the diagnostic value of guilty pleas (e.g., Cassell, 2018). When significant incentives are offered to accused persons for a guilty plea, they will plead guilty (whether actually guilty or not). Using guilty pleas to inform the system of accused persons' guilt (rather than evidence) will increase the information gained from guilty pleas; but, this increase in information gain is necessarily linked to an increased risk for false guilty pleas.

More importantly, there is an inherent problem with using plea acceptance as a diagnostic test of guilt; acceptance of a plea offer cannot be used as evidence given that it serves as conviction (not as evidence). Given the problematic nature of posthoc justifications for conviction and sentencing and the increasingly high rate of wrongful convictions, solicitation of early plea offers (e.g., prior to discovery) is legally unjustifiable. Further, as the [Supreme] Court has clearly acknowledged, weak cases should not conclude with a conviction (even if that conviction carries a minimum sentence), they should conclude with a dismissal.

III. Policy Recommendations

In light of the analyses presented in this manuscript and our review of today's *system of pleas* (Edkins & Redlich, 2019), we conclude by offering a few recommendations that would unquestionably reduce the rate of false guilty pleas. First, plea offers should not be extended to

accused persons until the State can meet a *reasonable* standard for guilt. Although we will not attempt to articulate what this standard should be specifically, we will refer back to Figure 3, which illustrates the posterior probability of wrongful conviction across base rates of guilt. In a jurisdiction in which accused persons are offered pleas immediately after arrest (when prior probability of guilt is lower; e.g., 50%), approximately 22.2% of those accepting pleas are innocent; in contrast, a jurisdiction that pushes pleas closer to trial (when probability of guilt is presumed to be greater; e.g., 80%) will result in approximately 6.7% of those accepting pleas being innocent. Although these exact percentages are based on estimates of baseline guilt probability, they clearly demonstrate that the higher the prior probability that an accused person is guilty, the more diagnostic of guilt the guilty plea will be (and consequently, the fewer innocent people who will be swept up in the process). This recommendation is very similar to one articulated in the American Psychology-Law Society's most recent scientific review paper outlining ideal "Policy and Procedure Recommendations for the Collection and Preservation of Eyewitness Identification Evidence" (Wells et al., 2020). Specifically, the paper includes a recommendation that law enforcement have an "evidence-based suspicion" prior to putting a suspect in a lineup. If some probability of guilt is important to protect a suspected person from possible wrongful *identification*, we believe a higher probability of guilt is critical to protect a suspected person from possible wrongful *conviction*.

Second, as soon as prosecutors are confident enough in their case to offer a plea deal, they should also be sufficiently confident to share their case file. In other words, all jurisdictions should be open-file as soon as a plea offer is on the table. Allowing closed-file policies makes it too easy for prosecutors to avoid disclosing potentially exculpatory information to accused persons when attempting to get a guilty plea (Luna & Redlich, 2020). Consequently, cases survive longer than the evidence supports (artificially inflating case duration). We cannot assume a reasonable standard of guilt has been met unless case evidence is made transparent. Similarly, we would call for additional efforts to collect real-world data to open the "black box" of the plea process (such as the Plea Tracker Project housed at the Wilson Center for Science and Justice at Duke Law School). For instance, we know relatively little regarding how many offers accused persons typically receive and what evidence they are provided prior to each offer (Redlich et al., 2017).

And finally, if these recommendations burden the system (as has been previously alleged), then: 1) put more money into courtrooms, and/or 2) stop criminalizing so many behaviors that the courts are flooded with so-called criminals. Each year federal and state governments increase spending on law enforcement (Department of Justice, 2021). However, most of that money goes toward hiring more police officers, building new jails, and funding prosecutors' offices (Hessick, 2021). While more money is going toward arresting and incarcerating people, judicial staffing has only increased 11%, and public defense staffing has only increased by 4%. Further, several courts are being under-utilized (NACDL, 2018), with some courts recording guilty plea rates of 100% (Redlich et al., 2022). As plea deals are increasing, judges are going long periods of time without trying a case in a courtroom; clerks are leaving clerkships without any trial experience. Instead of spending large portions of the day in a courtroom, judges are saying they now spend all their time in their chambers (Weiser, 2016). Thus, courtrooms are not currently overburdened, at least not universally.⁴

Our recommendations dovetail with those published recently in the American Bar Association's *Plea Bargain Task Force Report* (Johnson, 2023). Notably, this task force included representatives from both adversarial sides of the system. The *Report* includes fourteen principles designed to guide future plea policies—two of which are particularly relevant to the current work. Principle Four emphasizes the importance of prosecutorial charging decisions and

⁴ Regarding increasing decriminalization, a study conducted by the Department of Justice found that states that decriminalized marijuana had substantially fewer marijuana-related arrests and court cases (Farley & Orchowsky, 2019). For example, there was a 90% reduction in Massachusetts and an 86% reduction in California (Neil & Martin, 2015). There have been concerns that legalizing marijuana would result in increased collateral financial costs, such as fatalities as a result of DUIs (Ahrens, 2020). These concerns have not been realized in states that have legalized marijuana; alcohol remains the primary concern for DUIs. In 2015, marijuana arrests accounted for 1-6% of all arrests in Oregon, Colorado, and Washington—three states that have since legalized marijuana. Those 1-6% of arrests required 3 to 4.5 million dollars of each states' budget for policing, correctional, and judicial funding (Miron, 2018). At the federal level, legalizing marijuana is seen as another step toward remedying the negative effects of the War on Drugs, which disproportionately affected Black people. A Black person is more than 3x more likely to be arrested for marijuana possession compared to a White person despite comparable usage rates (American Civil Liberties Association, 2020). In fact, this was one of the reasons President Biden cited for pardoning all individuals charged with simple marijuana possession under federal law in October 2022 (Kanno-Youngs, 2022). Perhaps America should take a page from the Netherlands' approach to criminal behaviors: Dutch culture includes a conception of tolerance that promotes more leniency and selectivity in the prosecution of crimes (Buruma, 2007).

specifically recommends that, “The prosecutorial mindset should not focus on what the prosecutor can charge, but rather what the prosecutor should charge in light of the **evidence** and interests of justice... Prosecutors should dismiss weak cases rather than seek to resolve them through plea bargaining” (p. 18). Principle Eight focuses on issues relating to discovery recommending that, “Defendants should receive all available discovery, including exculpatory materials, prior to entry of a guilty plea, and should have sufficient time to review such discovery before being required to accept or reject a plea offer” (p. 24). Overall, this Task Force’s recommendations also overlapped in many ways with those from the National Association of Criminal Defense Lawyers (2018). Clearly, more and more legal actors are becoming wary of quick pleas and their role in adjudicating cases.

A. Conclusion

Our current *system of pleas* allows prosecutors to acquire convictions with very little proof of guilt. For decades, U.S. courts have protected plea-bargaining practices by arguing that accused persons are free to make the choice that best serves their own interest. Many legal actors have further justified the practice by presuming that guilty pleas are highly indicative of guilt.

Several amicus briefs were filed to the Supreme Court concerning *Mansfield v. Williamson County, Texas*. The issue in the case pertained directly to discovery policies during pretrial plea negotiations. Specifically, the petitioner (Troy Mansfield) alleged that Williamson County’s closed-file policy violated his Fourteenth Amendment right to due process. Prosecutors in his case arguably possessed evidence of *factual innocence* (i.e., even stronger than exculpatory-level evidence) at the time of plea negotiations and did not disclose it while pressuring Mansfield to accept a plea offer. Consequently, Mansfield accepted a sentence of 120 days (rather than risk a potential life sentence). Unfortunately, the Supreme Court refused to hear oral arguments in the case (denying the petition for certiorari); thus, the question as to what evidence (if any) must be disclosed prior to a plea agreement remains unanswered by the highest American court. In other words, the Court has refused to address how accused persons can be expected to make decisions that serve their interests in the absence of evidence. The current analysis has further demonstrated the dangers of a system that replaces substantive evidence with guilty pleas; it also directly undermines assumptions regarding the diagnosticity of a guilty plea. Without a reasonable demonstration of guilt, the system should not be permitted to use its wealth of resources to pressure (plea) convictions directly from accused persons.

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