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DECISION CASCADES

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Abstract

Empirical legal scholarship has long documented the phenomenon of order effects in legal decisions, often attributed to the cognitive bias known as the contrast effect. While the contrast effect revolves around the biased perception of the subsequent case due to the order in which cases are presented to judges, all existing evidence of order effects in legal decisions comes from settings where cases are *presented* and *decided* sequentially. This paper presents a theory of decision cascades, suggesting that order effects in legal decisions stem from the order in which cases are decided rather than presented. Instead of mapping the numerous attributes of a given case onto a cardinal scale, judges calibrate the sentence in each case relative to the sentence previously determined. The paper presents evidence from a pre-registered incentivized experiment that allows us to separate the impact of the presentation and decision dimensions on sentencing outcomes, as well as to establish the counterfactual fully informed sentences and the optimal wedge between them. We find that when cases are heard sequentially, but decided together, order effects are eliminated. Furthermore, when two cases are heard and decided sequentially, regardless of order, the sentence imposed on the second case equals the sentence in the preceding case with the addition or subtraction of the optimal wedge. Consequently, any error in the evaluation of the preceding case is fully transmitted to the decision that follows. The implications are far-reaching—while cases must be heard in some order, a theory of decision cascades suggests that end-of-sequence decision protocols could offer a promising debiasing mechanism.

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1. INTRODUCTION

Legal cases are regularly heard and decided sequentially. Extensive research has shown that the order of encountering cases can systematically skew judicial decisions in a predictable way. The same case can be judged more severely when it follows a milder case and more leniently when it follows a more egregious one. This negative auto-correlation in judicial decisions, commonly attributed to the contrast effect, was documented in laboratory experiments and observational studies across various legal contexts, including criminal convictions (Bindler & Hjalmarsson, 2019), sentencing (Leibovitch 2016, Pepitone & DiNubile 1976, Rachlinski & Jourden 2003, Rodríguez & Blanco 2016; Rachlinski et al 2015), civil punitive damage awards (Kahneman et al. 1998, Sunstein et al. 1998, Sunstein et al. 2002) and asylum requests (Chen et al. 2016).

Notably, while the cognitive bias known as a contrast effect revolves around the biased perception of the subsequent case due to the order of presentation (Tversky & Griffin 1991), all existing evidence of order effects in legal decisions comes from settings where cases are *presented* and *decided* sequentially. This limitation makes it impossible to know whether the observed pattern stems from the order of presentation (i.e., contrast effect) or the order of decisions. What if the impact on the decision in a subsequent case arises not from exposure to a previous case but rather from the act of deciding it?

This question is material to the study of judicial behavior and to the operation of the courts. If path dependence in judicial decisions hinges on the presentation dimension, little can be done to address it, as cases must be heard in some order. However, if path dependence stems from the decision dimension, debiasing mechanisms can focus on how decisions are made. Yet, despite its undeniable importance, the distinction between the presentation and decision dimensions in legal decision-making has escaped scholarly attention.

The paper develops and experimentally tests a theory of decision cascades through its application to criminal sentencing decisions. According to the theory, decisionmakers evaluate the appropriate sentences in a relative manner, by calibrating the sentence in a particular case to the sentences previously determined. As long as the sentence in the first case is "correct," relative sentencing will lead to sentences in subsequent cases that are both proportional to each other and appropriate on their own.[1] However, if the first sentence was overly harsh or lenient, deriving the following sentences based a relative comparison will lead to a lingering error—the initial sentencing error will continue to echo in subsequent cases. This result constitutes what we term a "decision cascade," where prior sentences propel subsequent ones. As we explain, there are multiple normative and practical reasons why sentences may be derived in such a comparative manner. The paper formalizes how resorting to a relative mapping of sentencing decisions can lead to a decision cascade under sequential decision protocols, but not under end-of-sequence decision protocols.

The paper then experimentally tests the theory of decision cascades and the predictions of the model using a pre-registered online incentive-compatible vignette experiment. The basic setup

[1] As we formally define in section II, the "correct" or "ideal" sentence is a function of the judge's improved estimate of the severity distribution after hearing the second case, representing the "complete information" state.

of the experiment was designed to distinguish between the theory of decision cascades and contrast effects by manipulating both the order in which cases were *presented* and whether decisions were made *sequentially* or *together*. Participants were asked to decide on the appropriate sentence in two cases of high (H) and low (L) severity, under one of three decision protocols. In the *Sequential* condition, participants made their sentencing decisions in sequence. They read and decided on the first case before proceeding to read and decide on the next one. In the *End-of-sequence* condition, both cases were presented and decided on the same screen. In the *Sequential + Back* condition, participants made their decisions in sequence, but were provided with an opportunity to click a "back" button to review and revise the sentence they imposed in the previous case.

This design entails three main advantages over prior literature. First, the *Sequential* and *End-of-sequence* conditions allow us to distinguish whether order effects are driven by the order in which cases are presented (*i.e.*, giving rise to a contrast effect) or by the order in which cases are decided. Second, by evaluating the sentences imposed when cases are decided together, we can establish the counterfactual sentences under full information, thereby interpreting any deviation from these sentences under sequential decision-making as a sentencing error. Last, using the counterfactual sentences under complete information to derive the optimal wedge between sentences, our design allows us to gauge the decision function underlying the observed outcomes. Notably, while a theory of relative mapping predicts that the error in the preceding case is fully transmitted to the subsequent case and the wedge identical across conditions, a theory of a conscious compromise between absolute and relative coherence predicts the error in the subsequent case to be smaller than the error in the preceding case, and the wedge in the sequential condition to be smaller than the wedge in the end-of-sequence condition.

The results indicate that order effects in legal decision-making do not stem from the order in which cases are presented but rather from the order in which decisions are made. While the order of cases has a substantial and significant effect on sentencing outcomes when cases are decided sequentially, this effect is completely eliminated when cases are presented sequentially but decided together. Furthermore, by taking the difference between the fully informed sentences in the *end-of-sequence condition and* their parallel among the sequential conditions, we identify a significant sentencing error when the low-severity case was decided first (sequence LH). Consistent with a theory of relative mapping as a measurement device, we find that the sentencing error in the low-severity case is fully transmitted to the subsequent high-severity case, and the wedge between the two cases is identical across treatments. When the high-severity case was decided first (sequence HL) we do not find a sentencing error in the first case, which is statistically indistinguishable from the fully informed sentence. Although this divergence was unexpected, it allowed us to test two complementary behavioral predictions of the model of decision cascades: when the first decision is erroneous, relative mapping leads to a lingering mistake in the second case, but when the first decision is accurate, relative mapping allows the second decision to remain accurate as well, resulting in no order effects regardless of the decision protocol being used. These findings gain force in further exploratory analysis, showing that participants rarely utilize the option to revise past decisions, and decisions under the *Sequential+Back* protocol were similar to those made under the *Sequential* protocol.

Taken together, the results suggest that order effects stem not from a biased perception of a case against the backdrop of other cases, but rather from the process of calibrating the appropriate sentence relative to sentences previously determined. Furthermore, this calibration is not the byproduct of a deliberate compromise between maintaining absolute and relative coherence across

cases, but rather stems from using relative mapping as a measurement device, leading to decision cascades where prior decisions propel future ones and errors fully linger. While the paper focuses on order effects in the determination of sentences, the novel conceptualization of a decision cascade has potential implications for a wide range of decision settings, legal and extra-legal.

The paper proceeds as follows. Section 2 develops the theory of decision cascades and outlines the conceptual framework that guided the experimental design. Section 3 describes the experimental design. Section 4 presents the results. Section 5 discusses the findings and offers some concluding remarks.

2. THE RELATIVE EVALUATION OF SENTENCES AND DECISION CASCADES

2.1. Deriving Sentences Comparatively

Penal decisions are comparative by nature. Different justifications for punishment call not only for an absolute evaluation of the appropriate sentence in each case, but also for a relative evaluation in order to maintain proportionality or marginal deterrence across crimes of increasing severity. At the same time, decisions on criminal sentences or punitive damage awards involve the consideration of numerous factors across multiple dimensions in order to establish the punishment suitable to address a defendant's conduct, including the gravity of the behavior, the relevant circumstances, the harm caused, and the characteristics of the offender. This is generally a daunting task, which is easier to perform in a comparative manner: it is often much harder to establish that defendant A should be sentenced to 12 years, rather than to 13 or 11 years, than to establish that their case warrants two more years of incarceration than another case of defendant B.

The relative aspect of punishment is also easier to scrutinize and verify. Coherence constitutes one of the most important standards for evaluating the rationality and competence of decision-makers (Hammond, 1990, 1996; Falk & Zimmermann, 2017; Hammond, 1990, 1996), and is considered a necessary condition for expertise (Einhorn, 1974). Given the significant variation in judicial sentencing preferences, estimating the quality of legal decisions based on a single case is hardly indicative: it is hard to know whether a very harsh sentence in a particular case results from an unwarranted bias against a minority defendant, for example, or from a judge's harsher penal preferences for such an offense in general, unless we compare the sentence in the particular case to that in other cases decided by the same judge. Conversely, systematic inconsistencies in the treatment of different cases are much easier to identify. Judges thus may have a practical reason to evaluate cases on a relative scale to ensure that their decisions are both genuinely meritorious and perceived as such.

Empirical research has documented ways in which the outcome of the present case may be shaped by characteristics or outcomes of other cases in the judge's docket [OR decided by the presiding judge] () (Chen et al. 2016, Leibovitch 2016, 2017, Rachlinski & Jourden 2003; Kahneman et al. 1998, Sunstein et al. 1998, Sunstein et al. 2002) . For example, defendants whose cases follow milder cases were found to be more likely to be treated as more severe and sentenced

more harshly, while defendants whose cases follow graver cases are more likely to be treated as less serious and sentenced more leniently, an outcome commonly referred to as "order effects".[2]

Importantly, while existing literature remains vague about whether the comparative evaluation of legal cases by judges reflects rational learning or a cognitive bias,[3] it interpreted order effects as reflecting actual changes in the perceived magnitude of the contrasted stimulus: a case may be viewed as milder when it follows a more serious case, and as graver when compared to relatively milder case. However, to the extent that judges resort to a relative scale in the evaluation process, while the direction of the effect resembles that of a contrast effect, the underlying mechanism is fundamentally different. As we formally illustrate in the following section, decisionmakers' reliance on a relative scale as a measurement device, leads to the counterintuitive result that any sentencing error in the preceding case replicates to the one that follows.

Notably, as long as evaluations early in a sequence of cases are accurate, relative mapping will not only be normatively appropriate and practically more efficient, but also lead to outcomes that are both relatively and absolutely coherent (Brockner, 1992). However, if an early sentence is too harsh or too lenient, then following decisions that use it as a benchmark will continue to echo the same error and be incorrect as well. The result is a decision cascade—where maintaining the appropriate sentencing wedge across cases leads to past errors being fully transmitted to the next cases and to the applied sentencings scale.

2.2. Theoretical Framework

We develop a simple two-period model of criminal sentencing in a dynamic learning framework. Closely following the experimental design, the model formalizes the theory of decision cascades in sequential decision-making. From the model, we derive testable hypotheses for the experiment.

There are two time periods, $t = 1,2$. In each period, the judge, a rational-Bayesian decision-maker, is faced with a case with severity $h_t \in [\underline{h}, \bar{h}]$ which is assumed to be known to the judge. The parameter h is distributed according to the cumulative distribution function $G(.)$, with density $g(.)$, on the support $(-\infty, \infty)$.[4] The judge has a prior about the distribution G_0, which they adjust as they encounter more cases. Let G_t stand for the judge's belief regarding the distribution at the end of period *t*, where G^* denotes the true distribution, where $G_t \to G^*$ when $t \to \infty$.

In $t = 1$, the judge views the first case with severity h_1, and updates their prior belief regarding the severity distribution G_0 following Bayes' rule, *i.e.*, $h_1 \xrightarrow{Bayes} G_1$. Under the theory, in $t = 1$, the judge chooses a sentence s_t according to a decision function $f: h_t \times G_t \to s_t \in [\underline{s}, \bar{s}]$, where $\underline{s}$ *and* $\bar{s}$ denote the mandatory minimum and maximum sentences, respectively, and s_t increases in severity, $\frac{\partial s}{\partial h} > 0$. Importantly, the decision function f, takes the severity level of the given case, h_1, and the information available to the judge regarding the severity distribution of

[2] Evidence of order effects in non-legal contexts includes speed dating (Bhargava and Fisman (2014)), medical decisions (Jin et al. (2020)), and more.

[3] One exception is Leibovitch 2016, which showed that order effects persist even where judicial caseloads are balanced on average, implying that the effect cannot be fully captured by rational learning.

[4] The intuition is that both cases are randomly drawn from the universe of cases, where each case is characterized by its ordinal position on the continuum of the severity scale.

criminal cases, g_1, as inputs, and maps it onto an absolute sentence length: $s_1 = f(h_1, g_1)$. For expositional purposes, we shall refer to mapping through f as "absolute mapping". The judge's reliance on absolute mapping hinges on the fact that at $t = 1$, where decisions in the relevant comparison group have yet to be established, the judge must undertake the task of mapping h_1 onto an absolute cardinal scale of an appropriate sentence.

In $t = 2$, the judge views the second case with severity h_2, and updates his belief about the severity distribution following Bayes' rule, *i.e.*, $h_2 \xrightarrow{Bayes} g_2$. Because the judge uses a comparative evaluation of the case relative to h_1, the mapping function is $\psi: h_t \times h_{t-1} \times G_t \to W_t$,[5] and they decide the second case according to the following decision rule:

$$(1)\ s_2 = s_1 + W^*$$

According to equation (1), the sentence for the second defendant is established by calculating the ideal sentencing wedge, denoted as W^*, between the two defendants, and then adding it to the sentence imposed on the first defendant, s_1. The mapping function ψ translates the attributes of the two cases onto the ideal sentencing wedge W^*, which dictates how many years more or less the defendant should serve, compared to the defendant in the preceding case. We shall refer to mapping through ψ as "relative mapping".

An important definition that we will use to simplify the exposition, which constitutes a slight abuse of terminology in a simplistic two-period setting like ours, is that for every sequence t and $t + 1$, the ideal sentence s_h^* and the ideal wedge W^* denote the values of s and W as a function of the most accurate estimate regarding the severity distribution as of the later period, $t + 1$. In our model, the ideal sentence for the h severity case is thus given by $s_h^* = f(h, g_2)$, which coincides with $s_{h_1} = f(h, g_1)$ if and only if $g_1 = g_2$.[6] Accordingly, the term "complete information" will be used to describe the judge's improved estimate regarding the severity distribution at $t = 2$.

Crucially, while the judge is assumed to be a Bayesian, who rationally adjusts his beliefs regarding the severity distribution, he always assumes that decisions he had made in the past are *unambiguously correct*, in which case he is always better off by relying on relative (rather than absolute) mapping.[7] To understand this statement, note that in an idealized (unrealistic) world where judges' past decisions are always correct and there is no room for learning, i.e., $G_0 = G^*$, the judge's choice to use ψ instead of f, should lead to the same very outcome: perfectly accurate estimates are necessarily perfectly coherent, meaning that $W^* = f(h_2, g_2) - f(h_1, g_2)$. Intuitively, the wedge between two optimal sentences necessarily coincides with the optimal wedge when incorporating the judge's improved estimate regarding the severity distribution, $f(h_2, g_2)$, in which case the inputs in the absolute and relative mapping functions coincide. If $f(h_1, g_2) = s_1$, it is straightforward that a relative mapping would lead to precisely the same

[5] Note that to satisfy the judge's decision rule, embodied in equation (1), W_t is restricted to $[\underline{s} - s_1, \bar{s} - s_1]$.

[6] As such, if the case heared at time $t + 1$ is informative ($g_{t+2} \neq g_{t+1}$), then the "ideal" sentence for defendant h had he was heared by the judge at $t + 1$ does not coincide with its ideal had he was heared at time $t + 2$, as $f(h, g_{t+1}) \neq f(h, g_{t+2})$.

[7] The assumption that the judge always assumes that decisions he had made in the past are unambiguously correct is the only feature of our model that deviates from Bayesian-rational behavior, thus warrants its classification as a quasi-Bayesian model. Nontheless, note that to the extent that the cost of absolute mapping is sufficiently high, then our model is equally consistent with the behavior of a perfectly rational Bayesian decision.

outcome achieved through absolute mapping: $s_2 = s_1 + W^* = f(h_1, g_2) + W^* = f(h_1, g_2) + f(h_2, g_2) - f(h_1, g_2) = f(h_2, g_2)$.

The most important implication of the preceding analysis is that to the extent that judges are imperfectly informed about the distribution and features of criminal behaviors, by turning to a relative (rather than absolute) mapping, a sentencing error made in the previous case feeds back into the sentencing decision in the subsequent case. To illustrate how applying the decision rule presented in equation (1) leads to order effects under a theory of decision cascades, we further assume that the judge could reasonably order each pair of h_1 and h_2 by severity, to a high severity case (H) and a low severity case (L), such that $h_t \in \{H, L\}$ and t denotes the order in which case are heard: $h_1 = L \rightarrow h_2 = H$ and $h_1 = H \rightarrow h_2 = L$. Further, without loss of generality, assume that the adjustment of beliefs induced by observing h_2 implies that the sentence imposed on the first defendant was too moderate for the given type of case: $s_{L_1} > s_L^*$ and $s_{H_1} < s_H^*$,[8] where s_{h_t} denotes the sentence imposed on the h severity case observed at time t. In other words, upon viewing H (L), and adjusting their belief regarding the severity distribution, re-evaluating the ideal sentence for the first defendant through the mapping function f (rather than the shortcut of ψ), would have led the judge to conclude that their previously imposed sentence on L (H) was too harsh (lenient). Following the literature, let us define order effects as any observed difference in the sentences imposed on a case with severity h, when viewed first or second:

$$\Delta s_h = |s_{h_2} - s_{h_1}| \qquad (2)$$

Order effects occur where the same case is sentenced more harshly when it is preceded by a milder case ($s_{H_2} > s_{H_1}$), and more leniently when it is preceded by a more severe case ($s_{L_2} < s_{L_1}$). Under the theory of decision cascades, the order in which sentencing *decisions* are made dictates the way in which the *sentence* is derived, and the type of sentencing error that follows. Namely, a previous sentence that is excessively harsh (lenient) leads to an overly harsh (lenient) sentence in the subsequent case. To show this, consider the following two decision protocols.

The first decision protocol is *End-of-sequence decision-making*. Under the end-of-sequence protocol, decision-makers hear multiple cases sequentially during a session, and sentencing decisions are finalized only after all cases have been heard.[9] Accordingly, under end-of-sequence decision-making, where all sentencing decisions are rendered after the judge adjusts from g_1 to g_2, the sentence imposed on the first defendant through absolute mapping incorporates the improved estimate g_2, yielding the ideal sentence for that defendant $s_{h_1}^* = f(h_1, g_2)$. Under these conditions, applying the judge's decision rule in (2), and using the alternative representation of $W^* = f(h_1, g_2) - f(h_2, g_2)$, would result in the ideal sentence for the second defendant as well $s_{h_2}^* = s_{h_1}^* + W^* = f(h_1, g_2) + W^* = f(h_1, g_2) + f(h_2, g_2) - f(h_1, g_2) = f(h_2, g_2)$. It is easy to see that the order in which decisions are rendered has no bearing on sentencing outcomes: if the judge chooses to establish the sentence in the low-severity case L first, thereby setting s_{L_1} at $f(L_1, g_2) = s_{L_1}^*$, resorting to relative mapping ψ to establish the ideal wedge and adding it to the sentence imposed on L would result in the ideal sentence $s_{H_2}^*$: $s_{H_2} = s_{L_1}^* + W^* = f(L, g_2) +$

[8] The underlying intuition is that by observing H at $t = 2$, the judge learns that H-type cases are more common than they thought, i.e., $g_1(H) < g_2(H)$, hence $G_1(H) > G_2(H)$. Likewise, by observing L at $t = 2$, the judge learns that L-type cases are more common than they thought, i.e., $g_1(L) < g_2(L)$, hence $G_1(L) < G_2(H)$.

[9] This protocol is employed in some jurisdictions for various types of decisions, including sentencing (Cohen & Yang, 2018), employment discrimination, and Bankruptcy (Desrieux et al. 2023).

$f(H, g_2) - f(L, g_2) = f(H, g_2) = s^*_{H_2}$. Alternatively, if the judge chooses first to establish the sentence in the high-severity case *H*, thus setting s_{H_1} at $f(H, g_2) = s^*_H$, resorting to ψ to compute the ideal wedge and adding it to the sentence imposed on *H* would result in the ideal sentence in the subsequent low-severity case L: $s_{L_2} = s^*_H + W^* = f(H, g_2) + f(L, g_2) - f(H, g_2) = f(L, g_2) = s^*_L$. Using equation (3), it then follows that $\Delta s_L = |s_{L_2} - s_{L_1}| = 0$ (as $s_{L_1} = s_{L_2} = s^*_L$); and that $\Delta s_H = |s_{H_2} - s_{H_1}| = 0$ (as $s_{H_1} = s_{H_2} = s^*_H$).

The second decision protocol is of *Sequential decision-making,* where cases are heard sequentially and decisions are rendered one at a time.[10] Under sequential decision-making, the sentence imposed on the first defendant is inevitably too high or too low relative to the ideal sentence s^*_h. That is, as long as $g_1 \neq g_2$, hence $f(h_1, g_1) \neq f(h_1, g_2)$, it follows that $s_{L_1} > s^*_{L_1}$ and $s_{H_1} < s^*_H$. Let e_1 and e_2 denote the sentencing errors in the first and second cases, respectively, where $e_1 \equiv s_{h_1} - s^*_{h_1}$ and $e_2 \equiv s_{h_2} - s^*_{h_2}$. It is easy to see that by applying the judge's decision rule in (2), the sentence imposed on the second defendant will inevitably be too high or too low relative to its ideal, s^*_h. Concretely, the sentencing error in the first case will essentially reproduce in the following case: where $h_1 = L$ and $h_2 = H$, sentencing defendant L to two years in excess of its ideal ($s_{L_1} - s^*_{L_1} = 2$), would result in sentencing defendant H to two years in excess of its ideal: $s_{H_2} = s^*_{H_2} + 2$. Although g_2 constitutes a better approximation of the true density g than g_1, in turning to a relative rather than absolute mapping, the improvement in the judge's estimate regarding the severity distribution results in the very same mistake: $s_{h_2} = s_{h_1} + W^* = e_1 + s^*_{h_1} + f(h_2, g_2) - f(h_1, g_2) = e_1 + f(h_1, g_2) + f(h_2, g_2) - f(h_1, g_2) = e_1 + s^*_{h_2} \rightarrow s_{h_2} - s^*_{h_2} = e_1 = e_2$. Accordingly, under a sequential decision protocol, the order in which decisions are made has significant implications on sentencing outcomes: $\Delta s_L = |s_{L_2} - s_{L_1}| > 0$ (as $s_{L_1} > s_{L_2}$); and that $\Delta s_H = |s_{H_2} - s_{H_1}| > 0$ (as $s_{H_1} < s_{H_2}$).[11]

Taken together, our conceptual framework yields two complementary hypotheses:

H_1: *There will be larger order effects under a sequential decision protocol than under an end-of-sequence decision protocol. That is,*

$$\Delta s^{seq}_L > \Delta s^{EOS}_L = 0$$
$$\Delta s^{seq}_H > \Delta s^{EOS}_H = 0$$

H_2: *Judges calibrate the sentence in the following case according to the optimal wedge W^*, such that a sentencing error in the first case will be reproduced in the second case. That is,*

$$s_{L_2} = s_{H_1} + W^* = s^*_L + e_1$$
$$s_{H_2} = s_{L_1} + W^* = s^*_H + e_1$$

[10] This protocol is typically employed in less complex decisions that must be rendered in short time frames like pre-trial detention (Dobbie et al. 2018) or refugee asylum decisions (Chen et al. 2016).

[11] Note that by setting $s_1 = f(h_1, g_1)$, we assume a myopic non-forward-looking behavior, in the sense that the judge ignores the potential effect of his first period decision on future levels of loss. However, note that this assumption is not restrictive at all, seeing as choosing according to their belief at $t = 1$ is optimal not only from a standard utility perspective, but also for an agent with taste for internal consistency.

3. EXPERIMENTAL DESIGN

Participants were presented with two vignettes, which were based on two actual armed robbery cases decided by the Eastern District Court of Wisconsin.[12] To enhance their engagement, participants were instructed to envision themselves as judges in the Eastern District Court of Wisconsin, tasked with sentencing two defendants, and it was emphasized that both cases were fictitious but closely resembled two real cases. Participants were incentivized to provide their true belief regarding the appropriate sentences by using the Bayesian Truth Serum (BTS) algorithm (Prelec, 2004).

The two cases were deliberately adjusted to create a clear ranking of severity. In order to maximize learning across ordinal positions, each vignette introduced a new dimension relevant for sentencing, which the other vignette lacked.[13] The "*L*" case depicted an offender who stole an exceptionally large sum of money but had no prior convictions and used an unloaded gun. The "*H*" case involved an offender who made threats of violence while having a lengthy prior criminal record. Participants were informed that both defendants had already been found guilty and were asked to decide on the appropriate sentences, bounded by the mandatory maximum of 40 years.

We implemented a 2X3 factorial design, which randomly varied both the order in which the cases were presented (L-H or H-L) and the decision-making protocol. Participants were randomly assigned to one of three decision protocols. In the *Sequential condition*, participants made their decisions in sequence. The second case was evaluated only after a final decision in the preceding case was reached and submitted. This protocol replicates the classic design used in previous experimental legal studies and mirrors the common practice of sequentially viewing and deciding cases in courts. In the *End-of-sequence condition*, participants were presented with both cases on the same screen and could make both decisions together. In the *Sequential + Back condition,* participants made their decisions in sequence, but were provided with an opportunity to click a "back" button to review and revise the sentence they imposed in the previous case. To effectively communicate the option to go back without inadvertently influencing participants to utilize it, we integrated a "back" button at the bottom of the screen, and included a generic statement in the instructions that they may navigate back and forth as much as they want. All decisions, including initial first-round decisions and any final decisions if altered, were recorded and analyzed.

The experiment was designed to explore the theory developed in this article, that decision cascades underlie order effects, in three ways. First, the design allows to distinguish between the presentation and decision dimensions as the source of order effects. Our first hypothesis, formally articulated in section 2.2, posits that order effects arise not from the order of the presentation of cases but from the order of decision-making in cases. This is captured by the comparison between the *Sequential* and the *End-of-sequence* conditions. If order effects stem from the order in which cases are presented, leading to a change in the perceived magnitude of the contrasted stimulus, one

[12] The original factual setting of the low-severity case (L) is based on US .v Sweeney, 325 F.Supp.3d 926 (E.D. Wisconsin, 2018); the original factual setting of the low-severity case (H) is based on Lewis .v king (S.D. Mississippi, 2016).

[13] To see how introducing a new relevant for sentencing dimension in each case can induce learning, consider the example of using an unloaded gun. In our design, participants who first observed the high-severity case, which remained silent about the gun chamber status, might disregarded this factor when sentencing the first defendant. Upon reading the second, low-severity case, which explicitly referred to an unloaded gun, a rational Bayesian decision maker might realize that the gun in the first, already rendered, sentence, must have been loaded, which should justify a harsher sentence in retrospect.

expects to observe a similar effect in both conditions—that is, a low- (high-) severity case would be viewed as milder when it follows a more (less) serious case, regardless of whether a decision was already rendered or not. However, if order effects result from the order in which cases are decided, we expect larger order effects in the sequential condition than in the end-of-sequence condition.

Second, the design allows us to estimate the precise magnitude of the sentencing error. If order effects stem from a revised (biased) perception of the subsequent case, then to the extent that the first case is informative, both sentences are biased. Accordingly, studies of order effects focus on estimating the differences in case outcomes based on their ordinal position in the queue, but could not suggest which of the estimates, if any, is correct. Conversely, according to a theory of decision cascades, order effects result from the different information available to a judge at the time of making each decision, and the decision function used. When complete information on both cases is available, decision-makers can reach decisions that are both absolutely and relatively appropriate. The *End-of-sequence* condition thus allows us to estimate the counterfactual sentencing decisions under complete information and to compare it to the decisions in the *Sequential* condition, thereby to establish the sentencing errors as any deviation thereof.

Last, using the counterfactual sentences under complete information to derive the optimal wedge, the design also allows us to gauge at the extent to which the outcomes observed can be explained by the employment of a relative mapping function as a measurement device, as opposed to a deliberate tradeoff between absolute and relative coherence. Notably, a theory of a conscious tradeoff predicts that under a sequential decision protocol, decision-makers will sacrifice *some* (but not all) of the accuracy of the second sentence to maintain the appropriate wedge between the two cases, resulting in a sentencing wedge that is smaller than the optimal one. In contrast, a theory of relative mapping predicts that the error in the preceding case fully replicate to the subsequent case, and that the wedge between cases remains equal the optimal wedge. Furthermore, a theory of a conscious tradeoff between absolute and relative coherence predicts that decision-makers will desire to revise their previously mistaken decisions, if allowed to do so at no meaningful cost. To test this theory, the *Sequential+Back* protocol replicates the sequential condition, but allows participants to revise their previous sentencing decision and by that avoid this tradeoff.

Following the completion of the vignettes, a post-experimental survey was conducted. Participants were asked to provide a short explanation of what affected their decisions in each of the two cases. Participants' written feedback and a comprehension test administered indicate a high level of understanding of the instructions and the legal materials.[14]

The experiment was conducted online using the Prolific platform. Participants were jury-eligible U.S. citizens. They received a $2.5 participation fee and had the potential to earn an additional $2 bonus payment based on their BTS score. A total of 1,190 participants participated

[14] 90% of the participants answered all three post-survey comprehension questions correctly. Participants' answers to the open-ended question revealed thoughtful, often reasonable, and well-detailed explanations, focused on the "unique" salient dimensions of each of the cases, indicating the effectiveness of our manipulation to maximize learning (for example: "*Bens' case showed no malice, and an unloaded weapon is a sign that there wasn't an intent to inflict damage. In the second case, the perpetrator acted with extreme malice, force, and intent to hurt if not given what was demanded*."; "*The lack of a loaded gun and the lack of threats to kill or hurt anyone in the first case affected my decision. In the second case the threats to shoot a baby and the extensive criminal history affected my sentence determination*").

in the study.[15] Table 1 provides information on the allocation of participants into each of the six combinations of presentation orders and decision protocols, indicating the randomization into experimental conditions was effective. Screenshots of the experiment are presented in the Appendix.

Table 1. Assignment to experimental conditions

	Sequential	***Sequential + Back***	***End-of-sequence***	Total
L-H	16.6% (197/1,190)	16.6% (197/1,190)	16.7% (199/1,190)	49.9% (593/1,190)
H-L	16.6% (198/1,190)	16.7% (199/1,190)	16.8% (200/1,190)	50.1% (597/1,190)
Total	33.2% (395/1,190)	33.3% (396/1,190)	33.5% (399/1,190)	

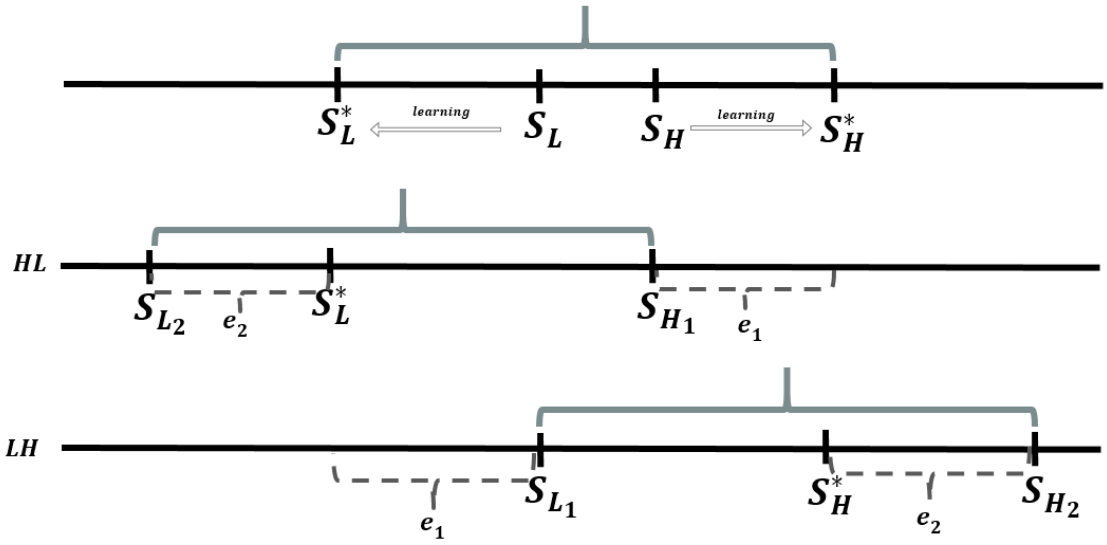

Figure 1. Identification Strategy

[15] Our exclusion criteria were to exclude participants who satisfy at least one of the following: (1) Labeled by Qualtrics' algorithm as "likely an algorithm" with either a RecaptchaScore of 0.5 or less or a RelevantIDFraudScore of 30 or more; (2) Labeled by Qualtrics as likely a duplicate (with either "true" in the RelevantIDDuplicate variable or a score of greater than 75 in the RelevantIDDuplicateScore variable), or registered with the same prolific ID more than once; (3) Failed to answer at least one of three post-experimental comprehension questions; (4) Their imposed sentence in at least one of the cases exceeded the specified mandatory maximum of 40 years, in violation of the experimental instructions; (5) Their entry in at least one of the cases in the "months" entry box exceeded 12 months.

4. RESULTS

4.1 End-of-Sequence Decision-Making

The theory of a decision cascade relies on the conjecture that order effects in legal decisions are caused by the order in which cases are *decided* rather than *presented*, and thus cannot be explained by the contrast effect. Accordingly, our first hypothesis posits that there will be larger order effects under a sequential decision protocol than under an end-of-sequence decision protocol. Figure 2 presents the average sentence imposed on the low and high-severity cases across case ordering in the end-of-sequence decision protocol.[16]

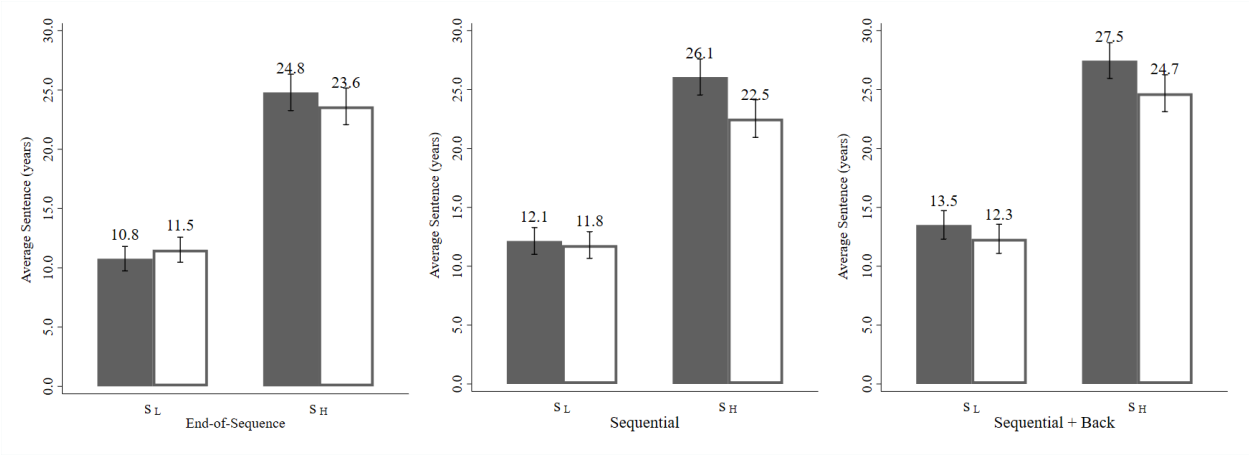

Figure 2. Sentencing outcomes across experimental conditions

As predicted, we find no order effects both for the high- and low-severity case, with sentencing outcomes being essentially the same regardless of the order in which cases were presented. The defendant in the high-severity case was sentenced to of 23.6 years on average when heard first, and 24.8 years on average when it followed a low severity case, a difference that is statistically indistinguishable from zero (two-sided Mann-Whitney U-test [MWU], $p = 0.3219$; two-sided t-test, $p = 0.287$). Likewise, the defendant in the low-severity case was sentenced to 10.8 years on average when heard first, and 11.5 years on average when it followed a high severity case, a difference which is statistically indistinguishable from zero, and operates in the opposite direction than that predicted by a theory of contrast effect (MWU, $p = 0.312$; two-sided t-test, $p = 0.2231$).

The fact that we were unable to produce order effects under an end-of-sequence decision protocol (but succeeded under the sequential decision protocols), provides strong evidence in support of the theory that order effects are caused by the order in which cases are *decided* rather

[16] Appendix Figure B1 reports the results for an alternative measure of log (years of sentence), which is more robust to outliers. Using a log transformation of the outcome variable is the standard practice in settings where subjects tend to exhibit the phenomenon of preferred numbers, which follow a logarithmic pattern. Our data revealed this general pattern, consistently with prior research showing this practice in the context of criminal sentencing (Dhami et al. 2020).

than *presented.* A theory of contrast effect that hinges on the presentation dimension posits that order effects are generated by changes in the *perceived* magnitude of the contrasted stimulus: a high (low) severity case will be perceived as more (less) severe when it follows a low (high) severity case. With the exposure to the previous case being the theorized trigger, therefore, order effects are expected to hold whether or not the decision in the contrasted stimulus was already rendered.

Notably, the finding that the average sentences in both the high- and low-severity cases are statistically identical under the end-of-sequence decision protocol regardless of a case's ordinal position, allows us to interpret the end-of-sequence first-period sentencing decisions as reflecting the ideal sentences under complete information ($s_{L_1}^{EOS} = s_L^*, s_{H_1}^{EOS} = s_H^*$). In the next section we use this benchmark to evaluate the magnitude of the sentencing error under the sequential decision protocols by decomposing the sentences according to the model so that $s_2 = s_2^* + e_1$, or equivalently $s_2 = s_1 \pm W^*$.

4.2 Sequential Decision-making

Under the sequential decision protocols, we observe significant sentencing errors in the LH sequence, in comparison to the sentences rendered under the end-of-sequence decision protocol. Notably, participants rarely utilized the option to revise past decisions under the Sequential + Back protocol,[17] and we observe similar decision patterns and errors under both the sequential and sequential + back protocols.[18] As evident from Figure 3, when heard first, in the sequential condition the low-severity case received a sentence of 12.1 years, reflecting a sentencing error of 1.4 years in comparison to the sentence of 10.8 years under the end-of-sequence condition ($e_1^L = 1.4$, MWU $p = 0.07$; two-sided t-test $p = 0.077$).[19] In the sequential + Back condition, when heard first, the low-severity case received a sentence of 13.5 years, amounting to a sentencing error of 2.7 years ($e_1^L = 2.7$, MWU $p< 0.001$; two-sided t-test $p < 0.001$) in comparison to the parallel end-of-sequence sentence.

[17] Only 11 (3%) participants clicked the back button, which is statistically indistinguishable from the frequency of using this option in all other screens [add the p-values for each screen].

[18] We fail to reject the null of equivalence across the two sequential conditions for both ordinal positions (sequence HL: $p = 0.096$; sequence LH: $p = 0.1176$), allowing us to reasonably treat the two samples as capturing two equivalent purely sequential decision protocol.

[19] The few participants (3%) who use the option to go back upon viewing the second case were excluded from all analyses [explain why within-participants design like ours]. Figure 3B in appendix B, we re-estimate of our baseline results for the entire pool of participants, finding similar results.

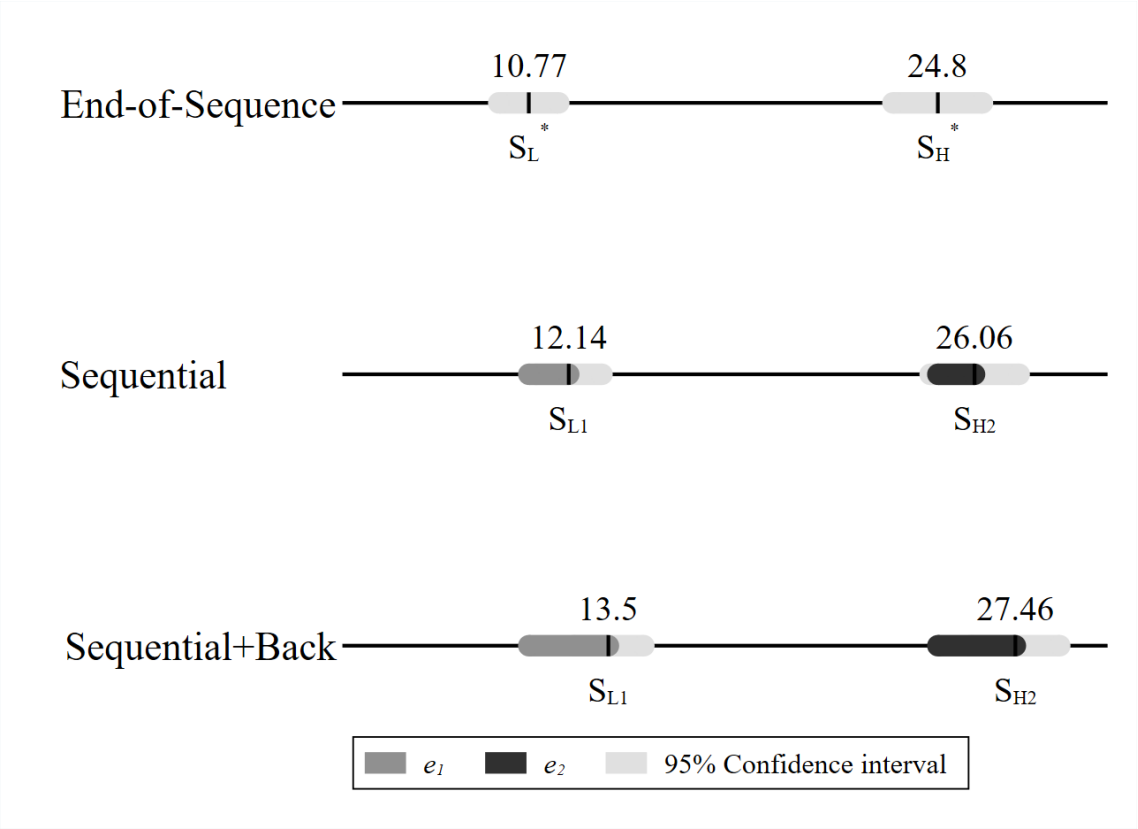

Figure 3. Sentencing outcomes in the LH sequence

The difference in the first case's sentencing outcomes across decision protocols captures the extent of rational learning. Participants who made their decisions sequentially had less information than participants who made decisions at the end of the sequence, as they were not yet exposed to the facts of the more serious case. Note, that if order effects are merely driven by rational learning, sentencing errors are expected in the first case but not in the second case, as full information on both cases was available to decisionmakers at that time under all decision protocols. Nevertheless, we find a sentencing error in the high-severity case as well, and remarkably in the exact same magnitude as the sentencing error in the first case. When heard second, in the sequential condition the defendant in the high severity case was sentenced to 26.1 years, reflecting a sentencing error of 1.3 years in comparison to the sentence of 24.8 years under the end-of sequence condition. In the sequential + Back condition, when heard second, the defendant in the high severity case was sentenced to 27.5 years, reflecting a sentencing error of 2.7 years in comparison to the parallel end-of-sequence sentence.

Strikingly, as shown in figure 4 below, even though the sentences for each case vary by decision protocol, the sentencing wedge between the two cases was consistently maintained at 14 years. When participants observed case L first and case H second, the error in the evaluation of the first case fully translated into the evaluation of the second case—with both cases sentenced on average for the same number of years more than in the *End-of-sequence* condition. A 1.3 too high a sentence in the low-severity case in the sequential condition had led these participants to impose 1.4 years too high a sentence in the high-severity case, which is statistically and economically

indistinguishable (two-sided t-test, $p = 0.894$). Likewise, a 2.7 too high a sentence in the low-severity case in the sequential + Back condition had led these participants to impose exactly 2.7 years too high a sentence in the high-severity case (two-sided t-test, $p = 0.903$). Put formally, we find that $s_2 = s_1 \pm W^*$, which is equivalent to $s_2 = s_2^* + e_1$, where $W^* = 14$, $e_1 = 1.4$ in the sequential condition, and $e_1 = 2.7$ in the sequential+back condition.

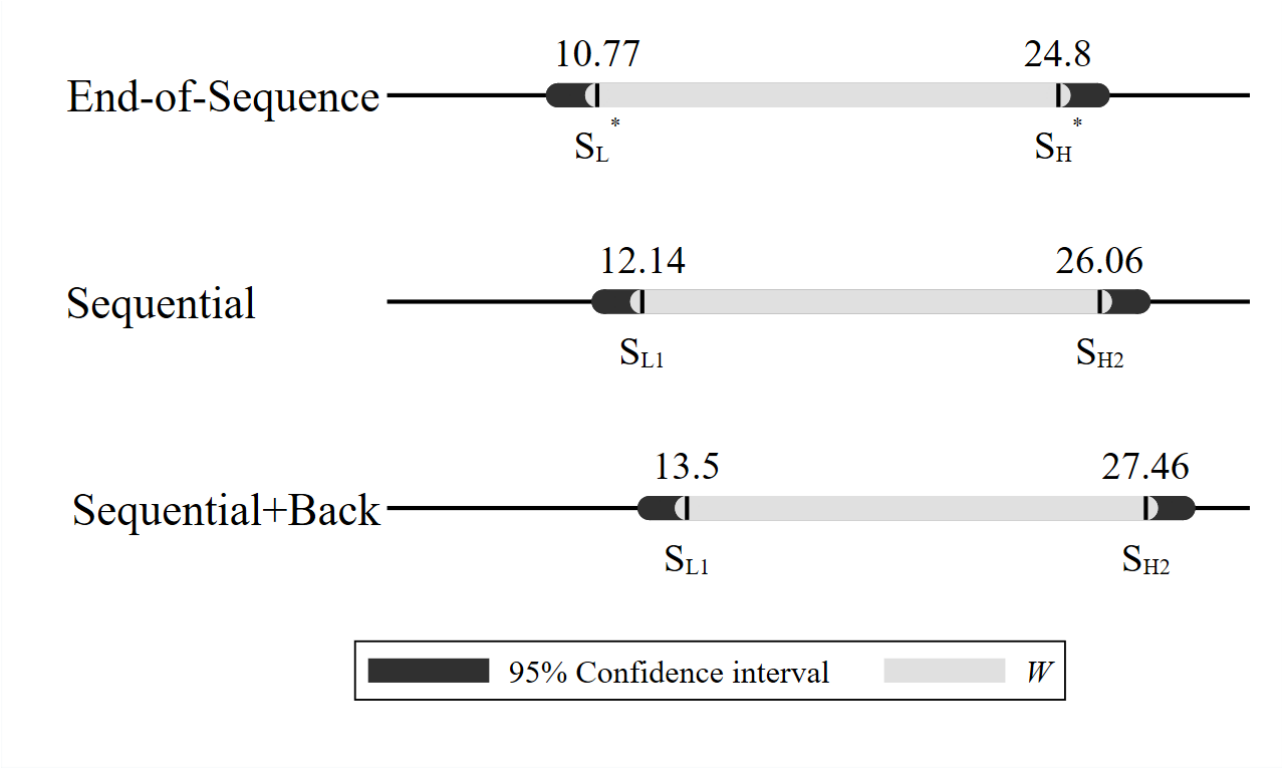

Figure 4. The sentencing wedge in the LH sequence

In the HL sequence, when focusing on the first case sentencing outcomes, we do not observe significant sentencing errors in comparison to the sentences rendered under the end-of-sequence decision protocol. Rather, decisions are statistically and economically identical to the counterfactual benchmark sentence in the end-of-sequence protocol, implying that we were unable to induce learning. As evident from Figure 5, when heard first, the high-severity case received a sentence of 22.5 years in the sequential condition, and 24.4 year in the sequential + back condition, both are statistically indistinguishable from the sentence of 23.6 years under the end-of-sequence condition (sequential: $e_1^H = -1.1$, MWU, $p = 0.214$; two-sided t-test, $p = 0.339$; sequential + Back: $e_1^H = 1.1$, MWU, $p = 0.339$; two-sided t-test, $p = 0.3375$;).

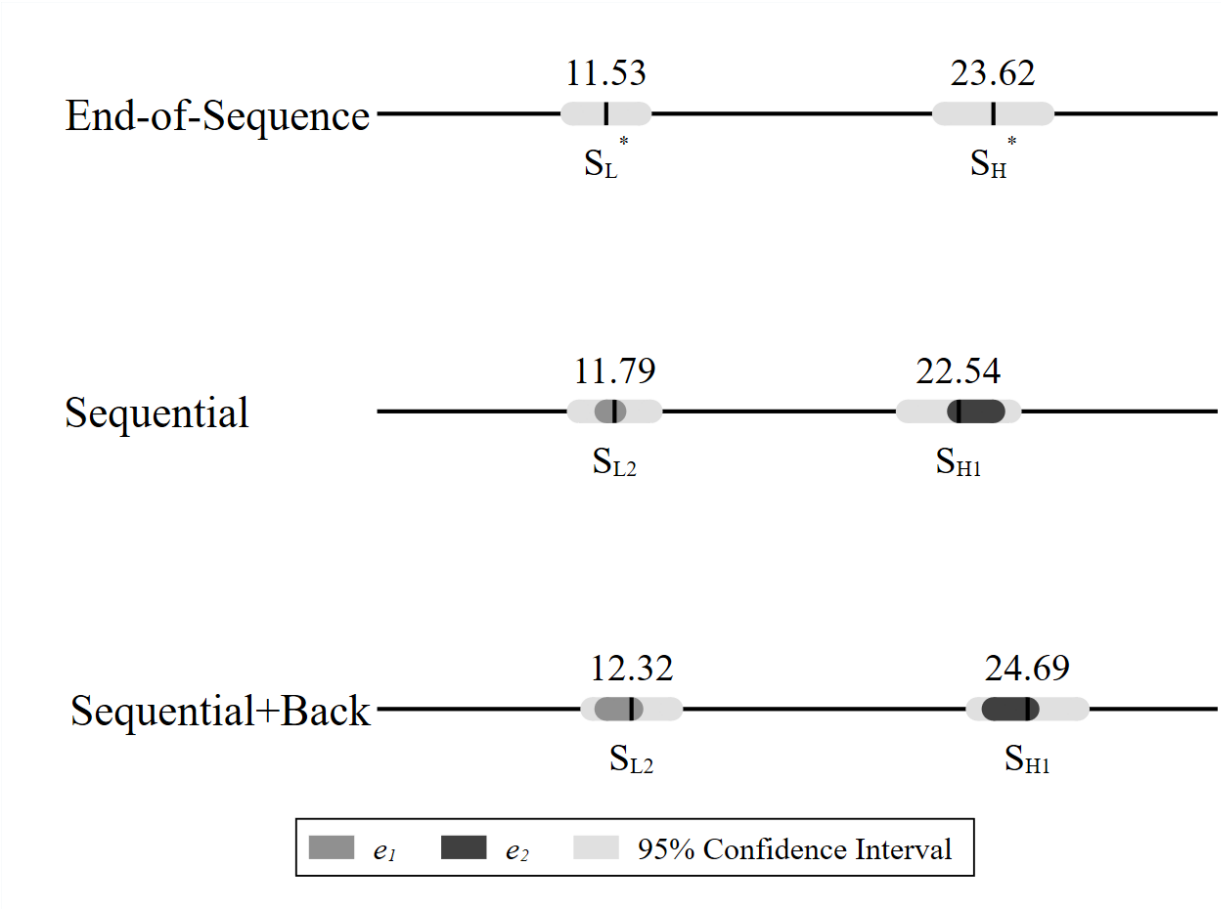

Figure 5. Sentencing outcomes in the HL sequence

Although this divergence was unexpected, it allowed us to test an important complementary behavioral prediction of our model of decision cascades. Where there is no room for learning such that no error is made in the first sentencing decision, relative mapping should lead to the very same accurate outcome, regardless of the decision protocol being used. Indeed, when there is no error in the first decision, we also observe no error in the second decision—when heard second the low-severity case received a sentence of 11.8 years in the sequential condition ($e_2^L = -0.27$, MWU, $p = 0.957$; two-sided t-test, $p = 0.733$), and 12.2 years in the sequential + back condition ($e_2^L = -0.8$, MWU, $p = 0.648$; two-sided t-test, $p = 0.333$). Both are statistically indistinguishable from the sentence of 11.5 years under the end-of-sequence condition. Strikingly, even under the "placebo" condition the sentencing wedge between the two cases consistently remained around 12 years in all decision protocols. While exploratory in nature, this finding lends further support for a theory of decision cascades over contrast effect. When early decisions in the sequence are accurate, deriving sentences in a relative manner will lead to outcomes that are both relatively and absolutely coherent.

4.3 Telling relative mapping apart from deliberate tradeoff

The above analysis raises the question: to what extent does the sentencing error lingering in the decision cascades reflect relative mapping, as in our model, or a deliberate sacrifice of absolute coherence in favor of relative coherence from the perspective of decision-makers. In the *Sequential* decision protocol, even if participants recognize in retrospect that their initial decision was erroneous, they are locked in to that decision. If that is the case, taking the decision at $t = 1$ as given, the choice of punishment at $t = 2$ entails a tradeoff between the two types of errors: any adjustment of s_{H_2} towards the ideal sentence s_H^* will increase its deviation from the optimal wedge W^*, while any adjustment towards maintaining the optimal wedge will increase its deviation from the ideal sentence. Conversely, if participants derive the sentence through relative mapping they will not even encounter a conflict.

The fact that participants maintain the sentencing wedge in full across treatments is an indication that they do not confront such an absolute-relative accuracy tradeoff. Otherwise, we should expect a compromise: transmitting part, but not all, of the error-in-hindsight, while maintaining some, but not all, of the optimal sentencing wedge. Strikingly, we find that even though the sentences for each case vary by decision order, the sentencing wedge across cases was consistently maintained.

In order to explicitly test for the implementation of relative mapping versus deliberate tradeoff among participants, the *Sequential+Back* protocol provided participants with the option to revise their first decision. If after encountering the second case participants view their previous decision as overly harsh or overly lenient in hindsight, the availability of an option to revise the previous decision allows them to correct the past decision based on the full information available in the second period, and to render decisions that are both accurate and relatively appropriate similar to the decisions made under the *End-of-sequence* decision protocol. Strikingly, we find that only 3% of participants in the *Sequential+Back* condition utilized the option to change their previous decision. Notably, this rate is statistically indistinguishable from the frequency of using the "back" option in other screens of the experiment (e.g., going back to read the instructions, or in the exit questionnaire).

IMPLICATIONS AND DISCUSSION

Order effects in judicial decision-making have long been recognized to have normative and practical implications for the fairness of the justice system and the institutional design of the courts (Chen et al. 2016, Kahneman et al. 1998, Leibovitch 2016, 2017, Rachlinski & Jourden 2003, Sunstein et al. 1998, Sunstein et al. 2002). While existing scholarship has mostly attributed order effects to the cognitive bias of contrast effect, this paper identifies a different mechanism at the root of the problem: decision-makers commitment to their past decisions.

The findings of this study suggests that contrary to common wisdom, the sequential order of presenting cases has little impact on decision outcomes, and accordingly they cast doubt on the widely held belief that order effects in legal decisions are generated by changes in the perceived magnitude of the contrasted stimulus. Instead, the results indicate that it is the order in which decisions are made that leads to order effects. Furthermore, the experimental design allows us not only to detect the differences in the sentencing of cases based on the order in which decisions are

made, but also to estimate the optimal sentences under complete information and derive the magnitude of the sentencing errors caused by the case's ordinal position. We find that sentencing errors that occur earlier in the sequence play a pivotal (almost deterministic) role in future errors. In the experiment, a preceding sentence that was 1.4 years too harsh led to a harsher sentence by 1.4 years in the subsequent case; a preceding sentence that was 2.7 years too harsh led to a harsher by 2.7 years in the subsequent case. A direct implication of the theorized cascade is that the larger the error made earlier in the sequence, the greater the resulting bias in subsequent decisions.

While the conceptualization of order effects as a cascade, whereby previous errors propel subsequent ones is troubling, the most important implication of the theory is the possibility of addressing order effects through end-of-sequence decision protocols. Some jurisdictions, for some types of legal decisions, already employ decision-making procedures that closely resemble the experimental conditions tested in this paper. For instance, in relatively complex cases, courts often hear arguments throughout the day and decide all cases later in tandem at the end of the sequence. These protocols were documented in some jurisdictions for employment discrimination and bankruptcy claims (Desrieux et al. 2023) and for sentencing serious offenses (Cohen & Yang 2018) The theory and findings of this paper shed new light on such practices. Most importantly, it means that decisions about such procedural protocols are not merely administrative but can affect substantive case outcomes.

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APPENDIX A

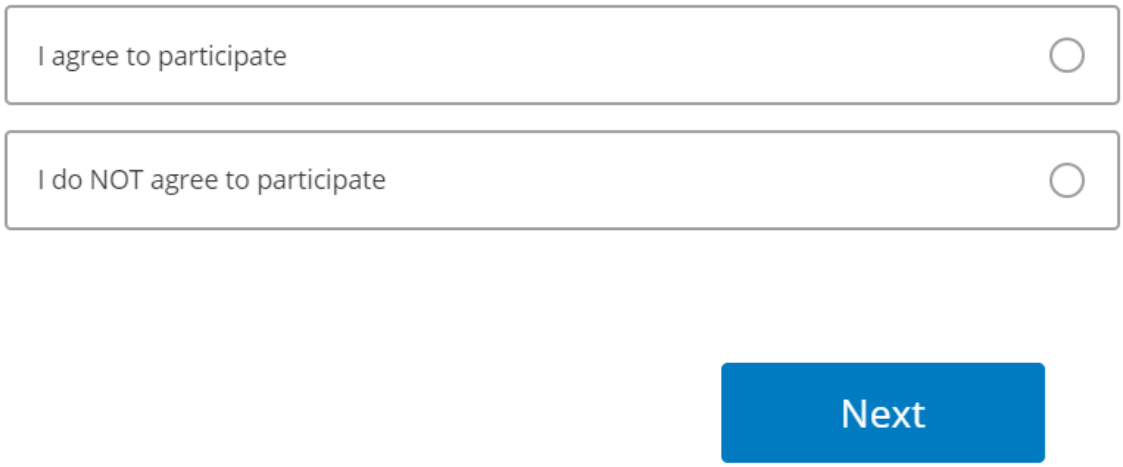
Consent form

You are invited to participate in a study on legal decisions. You must be at least 18 years old to participate. Your participation will take about 15 minutes. There are no risks associated with this study, and your identity will be kept confidential.

Participation: If you decide to participate in this study, please note that your participation is voluntary and that you may withdraw your consent or discontinue your participation at any time without any penalty. You have the right to refuse to answer particular questions. Your privacy will be maintained in all published and written data resulting from the study.

Payment: You will be awarded a $2.8 show-up fee for your participation until the end, in addition to anything you may earn during the study.

Contact Information: If you have any questions, concerns, or complaints about this study, its procedures, risks and benefits, contact zurlab975@gmail.com. By clicking "Agree" below, you confirm that you have read the consent form, you are at least 18 years old, and you agree to participate in this study.



What is your Prolific ID? Please note that this response should auto-fill with the correct ID

Next

General Procedure

In this study, we would like you to imagine that you are a judge in the Eastern district court of Wisconsin. This morning, your court calendar includes the sentencing of two defendants. Each of these cases arises from separate incidents, but in both, the trial jury has already found the defendant guilty. Both cases are fictitious, but closely resemble two actual cases decided by the Eastern district court of Wisconsin.

[Sequential treatment]
For each of these two cases, you will read a short summary of the facts, after which you will be asked to decide on the appropriate sentence, given the information you have.

[Sequential + Back treatment]
For each of these two cases, you will read a short summary of the facts, after which you will be asked to decide on the appropriate sentence, given the information you have. You may re-read these instructions and cases and go back and forth as much as you want.

[End-of-sequence treatment]
For each of these two cases, you will read a short summary of the facts and asked to decide on the appropriate sentences, given the information you have.

Pursuant to 18 U.S.C. § 3553, in determining the particular sentence to be imposed, the sentencing court shall consider the nature and circumstances of the offense, along with the history and characteristics of the Defendant. When sentencing, a judge must impose the least severe sentence that achieves three main goals: *retributing* the criminal with just punishment for having acted criminally; *deterring* the convict and other potential criminals from committing

crime; and *rehabilitating* those who commit crime, to support their successful reintegration into society.

To proceed to the second part of the instructions, please click the "Next" button below.

Next

How your answers regarding the appropriate sentence will affect your bonus payment?

The success of this study depends on you making an honest effort to carefully read the materials and decide on the sentences. To encourage truthful answers, we apply a mathematical formula called the "Bayesian Truth Serum". The formula was invented by an MIT professor and published in the academic journal *Science*. For each question, your answer will receive a "truth score". A **$2 bonus payment** will be awarded to **one-third** (1/3) of the participants with the highest truth score.

Because only the top one-third will receive the $2 bonus, you are most likely to earn the bonus if you answer your true beliefs regarding the appropriate sentences. By "true beliefs" we mean not only that you are honest, but also that you consider each question thoroughly before deciding your answer, and that you take care to avoid mistakes. While it is not necessary that you understand the technical formula of the Bayesian Truth Serum, if you are interested in reading about it the paper from *Science* with a short abstract is available here.

To make sure that you understand how your answers regarding the appropriate sentence will affect your bonus payment, please answer the following question:

Giving truthful answers will _____ your payment.

We invite you to carefully read these instructions again. Once you have finished, click the "Next" button below to start.

Back Next

L-first

[Sequential treatment]

Case #1

Ben is a 24-year-old male convicted of armed robbery of a bar in his neighborhood. Testimony and a surveillance video indicate that on December 14, 2020, Ben entered the bar through the back door. He encountered the General Manager as she was climbing up the stairs from her basement office. Ben opened his coat and showed the manager that he was carrying a handgun. In response, the manager returned to the office, picked up a bag containing the bar's weekly revenue in the amount of $50,000 in cash, tossed it to Ben, and triggered a silent alarm. The Assistant Manager of the bar also testified that upon entering the bar, Ben took approximately eleven hundred dollars ($1,100) in cash from the cash register. The police apprehended Ben while he was running away. Ben's gun was not loaded.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Ben within this range.

What is, in your opinion, the punishment that Ben should serve? Please type your decision in the blank box below.

Years Months

Once you are happy with your decision, click the "Next" button below.

Next

Case #2

Mary, a thirty-year-old female, is the owner and operator of a Seven-Eleven Store in Hayward, Wisconsin. On December 19, 2020, between 4:00 p.m. and 5:00 p.m., Michael, a masked 41-year-old male, entered the store with a handgun while Mary was stocking the beverage cooler. Michael pushed her towards the cash registers and demanded that she give him the money. Mary then emptied the first register while Michael continued shouting, aimed his gun and threatened to shoot her baby, who was sleeping in a car seat behind the counter. After Mary emptied the second register, Michael fled from the store.

Based on these facts, on May 2021, Michael was convicted of armed robbery by the Eastern district court of Wisconsin. According to the pre-sentencing report, Michael has a long criminal history, including a juvenile armed robbery conviction in 1998, adult convictions for robbery and witness intimidation in 2002, burglary in 2009, aggravated assault in 2013, and possession of T.H.C. and drug paraphernalia in 2020.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Michael within this range.

What is, in your opinion, the punishment that Michael should serve? Please type your decision in the blank box below.

Years Months

Once you are happy with your decision, click the "Next" button below.

Next

[Sequential + Back treatment]

Case #1

Ben is a 24-year-old male convicted of armed robbery of a bar in his neighborhood. Testimony and a surveillance video indicate that on December 14, 2020, Ben entered the bar through the back door. He encountered the General Manager as she was climbing up the stairs from her basement office. Ben opened his coat and showed the manager that he was carrying a handgun. In response, the manager returned to the office, picked up a bag containing the bar's weekly revenue in the amount of $50,000 in cash, tossed it to Ben, and triggered a silent alarm. The Assistant Manager of the bar also testified that upon entering the bar, Ben took approximately eleven hundred dollars ($1,100) in cash from the cash register. The police apprehended Ben while he was running away. Ben's gun was not loaded.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Ben within this range.

What is, in your opinion, the punishment that Ben should serve? Please type your decision in the blank box below.

Years Months

Once you are happy with your decision, click the "Next" button below.

Back Next

Case #2

Mary, a thirty-year-old female, is the owner and operator of a Seven-Eleven Store in Hayward, Wisconsin. On December 19, 2020, between 4:00 p.m. and 5:00 p.m., Michael, a masked 41-year-old male, entered the store with a handgun while Mary was stocking the beverage cooler. Michael pushed her towards the cash registers and demanded that she give him the money. Mary then emptied the first register while Michael continued shouting, aimed his gun and threatened to shoot her baby, who was sleeping in a car seat behind the counter. After Mary emptied the second register, Michael fled from the store.

Based on these facts, on May 2021, Michael was convicted of armed robbery by the Eastern district court of Wisconsin. According to the pre-sentencing report, Michael has a long criminal history, including a juvenile armed robbery conviction in 1998, adult convictions for robbery and witness intimidation in 2002, burglary in 2009, aggravated assault in 2013, and possession of T.H.C. and drug paraphernalia in 2020.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Michael within this range.

What is, in your opinion, the punishment that Michael should serve? Please type your decision in the blank box below.

[ ] Years [ ] Months

Once you are happy with your decision, click the "Next" button below.

Back Next

[End-of-sequence treatment]

Case #1

Ben is a 24-year-old male convicted of armed robbery of a bar in his neighborhood. Testimony and a surveillance video indicate that on December 14, 2020, Ben entered the bar through the back door. He encountered the General Manager as she was climbing up the stairs from her basement office. Ben opened his coat and showed the manager that he was carrying a handgun. In response, the manager returned to the office, picked up a bag containing the bar's weekly revenue in the amount of $50,000 in cash, tossed it to Ben, and triggered a silent alarm. The Assistant Manager of the bar also testified that upon entering the bar, Ben took approximately eleven hundred dollars ($1,100) in cash from the cash register. The police apprehended Ben while he was running away. Ben's gun was not loaded.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Ben within this range.

What is, in your opinion, the punishment that Ben should serve? Please type your decision in the blank box below.

[ ] Years [ ] Months

Case #2

Mary, a thirty-year-old female, is the owner and operator of a Seven-Eleven Store in Hayward, Wisconsin. On December 19, 2020, between 4:00 p.m. and 5:00 p.m., Michael, a masked 41-year-old male, entered the store with a handgun while Mary was stocking the beverage cooler. Michael pushed her towards the cash registers and demanded that she give him the money. Mary then emptied the first register while Michael continued shouting, aimed his gun and threatened to

shoot her baby, who was sleeping in a car seat behind the counter. After Mary emptied the second register, Michael fled from the store.

Based on these facts, on May 2021, Michael was convicted of armed robbery by the Eastern district court of Wisconsin. According to the pre-sentencing report, Michael has a long criminal history, including a juvenile armed robbery conviction in 1998, adult convictions for robbery and witness intimidation in 2002, burglary in 2009, aggravated assault in 2013, and possession of T.H.C. and drug paraphernalia in 2020.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Michael within this range.

What is, in your opinion, the punishment that Michael should serve? Please type your decision in the blank box below.

Years Months

Once you are happy with your decision, click the "Next" button below.

Next

H-first

[Sequential treatment]

Case #1

Mary, a thirty-year-old female, is the owner and operator of a Seven-Eleven Store in Hayward, Wisconsin. On December 19, 2020, between 4:00 p.m. and 5:00 p.m., Michael, a masked 41-year-old male, entered the store with a handgun while Mary was stocking the beverage cooler. Michael pushed her towards the cash registers and demanded that she give him the money. Mary then emptied the first register while Michael continued shouting, aimed his gun and threatened to shoot her baby, who was sleeping in a car seat behind the counter. After Mary emptied the second register, Michael fled from the store.

Based on these facts, on May 2021, Michael was convicted of armed robbery by the Eastern district court of Wisconsin. According to the pre-sentencing report, Michael has a long criminal history, including a juvenile armed robbery conviction in 1998, adult convictions for robbery and witness intimidation in 2002, burglary in 2009, aggravated assault in 2013, and possession of T.H.C. and drug paraphernalia in 2020.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Michael within this range.

What is, in your opinion, the punishment that Michael should serve? Please type your decision in the blank box below.

Years Months

Once you are happy with your decision, click the "Next" button below.

Next

Case #2

Ben is a 24-year-old male convicted of armed robbery of a bar in his neighborhood. Testimony and a surveillance video indicate that on December 14, 2020, Ben entered the bar through the back door. He encountered the General Manager as she was climbing up the stairs from her basement office. Ben opened his coat and showed the manager that he was carrying a handgun. In response, the manager returned to the office, picked up a bag containing the bar's weekly revenue in the amount of $50,000 in cash, tossed it to Ben, and triggered a silent alarm. The Assistant Manager of the bar also testified that upon entering the bar, Ben took approximately eleven hundred dollars ($1,100) in cash from the cash register. The police apprehended Ben while he was running away. Ben's gun was not loaded.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Ben within this range.

What is, in your opinion, the punishment that Ben should serve? Please type your decision in the blank box below.

Years Months

Once you are
happy with your decision, click the "Next" button below.

Next

[Sequential + Back treatment]

Case #1

Mary, a thirty-year-old female, is the owner and operator of a Seven-Eleven Store in Hayward, Wisconsin. On December 19, 2020, between 4:00 p.m. and 5:00 p.m., Michael, a masked 41-year-old male, entered the store with a handgun while Mary was stocking the beverage cooler. Michael pushed her towards the cash registers and demanded that she give him the money. Mary then emptied the first register while Michael continued shouting, aimed his gun and threatened to shoot her baby, who was sleeping in a car seat behind the counter. After Mary emptied the second register, Michael fled from the store.

Based on these facts, on May 2021, Michael was convicted of armed robbery by the Eastern district court of Wisconsin. According to the pre-sentencing report, Michael has a long criminal history, including a juvenile armed robbery conviction in 1998, adult convictions for robbery and witness intimidation in 2002, burglary in 2009, aggravated assault in 2013, and possession of T.H.C. and drug paraphernalia in 2020.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Michael within this range.

What is, in your opinion, the punishment that Michael should serve? Please type your decision in the blank box below.

Years Months

Once you are happy with your decision, click the "Next" button below.

Back Next

Case #2

Ben is a 24-year-old male convicted of armed robbery of a bar in his neighborhood. Testimony and a surveillance video indicate that on December 14, 2020, Ben entered the bar through the back door. He encountered the General Manager as she was climbing up the stairs from her basement office. Ben opened his coat and showed the manager that he was carrying a handgun. In response, the manager returned to the office, picked up a bag containing the bar's weekly revenue in the amount of $50,000 in cash, tossed it to Ben, and triggered a silent alarm. The Assistant Manager of the bar also testified that upon entering the bar, Ben took approximately eleven hundred dollars ($1,100) in cash from the cash register. The police apprehended Ben while he was running away. Ben's gun was not loaded.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Ben within this range.

What is, in your opinion, the punishment that Ben should serve? Please type your decision in the blank box below.

Years Months

Once you are happy with your decision, click the "Next" button below.

Back Next

[End-of-sequence treatment]

Case #1

Mary, a thirty-year-old female, is the owner and operator of a Seven-Eleven Store in Hayward, Wisconsin. On December 19, 2020, between 4:00 p.m. and 5:00 p.m., Michael, a masked 41-year-old male, entered the store with a handgun while Mary was stocking the beverage cooler. Michael pushed her towards the cash registers and demanded that she give him the money. Mary then emptied the first register while Michael continued shouting, aimed his gun and threatened to shoot her baby, who was sleeping in a car seat behind the counter. After Mary emptied the second register, Michael fled from the store.

Based on these facts, on May 2021, Michael was convicted of armed robbery by the Eastern district court of Wisconsin. According to the pre-sentencing report, Michael has a long criminal history, including a juvenile armed robbery conviction in 1998, adult convictions for robbery and witness intimidation in 2002, burglary in 2009, aggravated assault in 2013, and possession of T.H.C. and drug paraphernalia in 2020.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Michael within this range.

What is, in your opinion, the punishment that Michael should serve? Please type your decision in the blank box below.

[ ] Years [ ] Months

Case #2

Ben is a 24-year-old male convicted of armed robbery of a bar in his neighborhood. Testimony and a surveillance video indicate that on December 14, 2020, Ben entered the bar through the back door. He encountered the General Manager as she was climbing up the stairs from her basement office. Ben opened his coat and showed the manager that he was carrying a handgun. In response, the manager returned to the office, picked up a bag containing the bar's weekly revenue in the amount of $50,000 in cash, tossed it to Ben, and triggered a silent alarm. The Assistant Manager of the bar also testified that upon entering the bar, Ben took approximately eleven hundred dollars ($1,100) in cash from the cash register. The police apprehended Ben while he was running away. Ben's gun was not loaded.

In Wisconsin, a conviction for armed robbery carries a maximum sentence of 40 years. You have complete discretion to sentence Ben within this range.

What is, in your opinion, the punishment that Ben should serve? Please type your decision in the blank box below.

[ ] Years [ ] Months

Once you are happy with your decision, click the "Next" button below.

Next

Please answer the following questions**. Remember**: Your identity will remain confidential.

To compute your overall truth score, we will ask you to estimate the sentences that other respondents have imposed on each of the two defendants.

Out of 100 respondents, how many do you think will impose each of the following?
(**note:** your answers must sum up to 100)

	Less than 5 years	6 to 10 years	11 to 20 years	More than 20 years	Total
Michael	0	0	0	0	0
Ben	0	0	0	0	0

Please provide a short explanation of what affected your decision regarding the appropriate punishment in each of the two cases.

What is your age?

How would you describe your gender?

- Male
- Female
- Transgender Male
- Transgender Female
- Non-binary
- Other
- Prefer not to say

What is the highest level of school you have completed or the highest degree you have received?

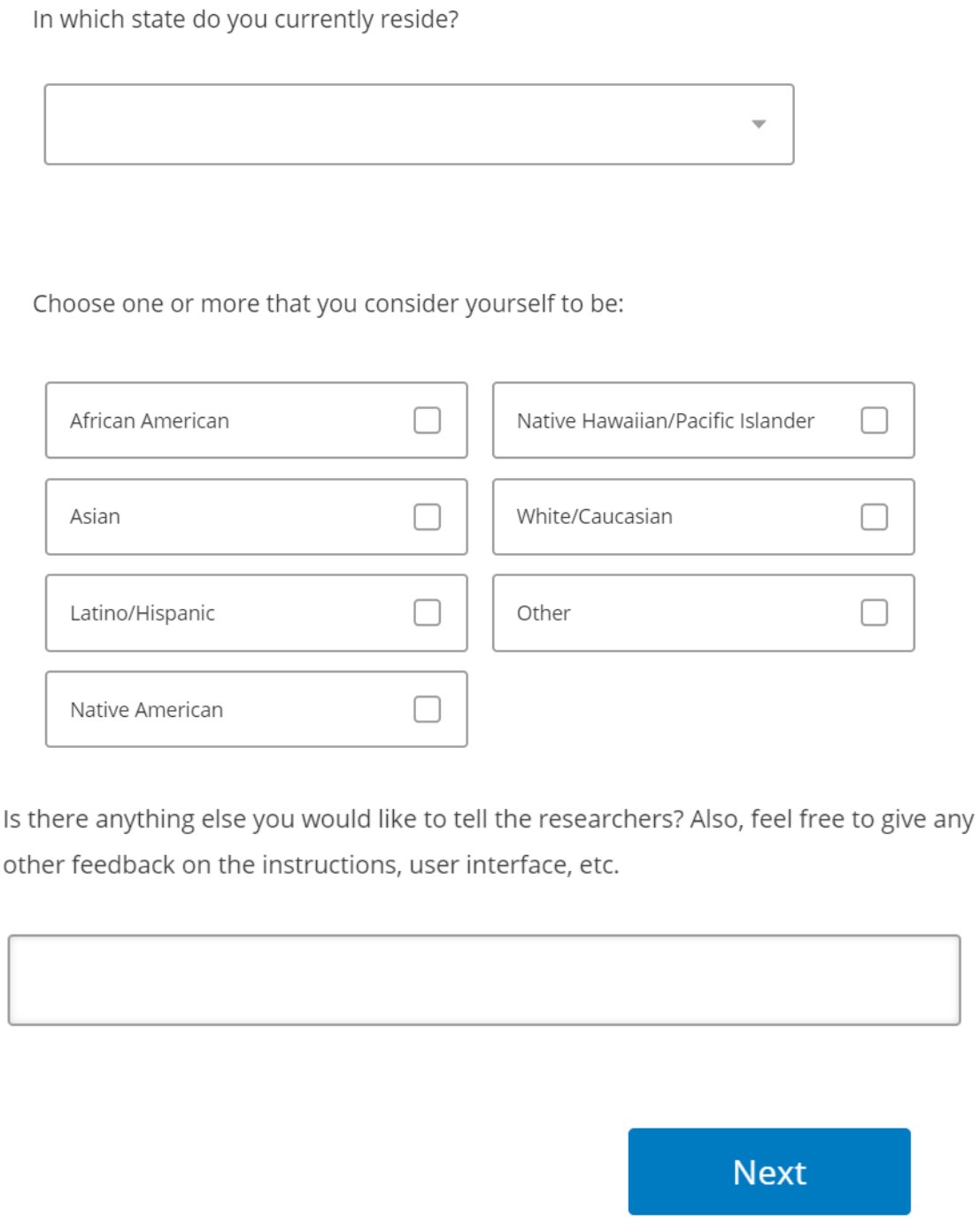
- Less than high school
- High school graduate (high school diploma or equivalent including GED)
- Some college but no degree
- Associate degree in college (2-year)
- Bachelor's degree in college (4-year)
- Master's degree
- Doctoral degree
- Professional degree (JD, MD)

Generally speaking, do you usually think of yourself as a Republican, a Democrat, an Independent, or something else?

- Republican
- Democrat
- Independent
- Other
- No preference

Which of these describes your annual income last year?

- $0
- $1 to $9,999
- $10,000 to $24,999
- $25,000 to $49,999
- $50,000 to $74,999
- $75,000 or more
- I prefer not to say



To ensure that you understood the critical information that is integral to this study, please answer the following questions. You must answer these questions correctly to be eligible to receive the bonus payment (but the basic participation fee will be paid regardless).

Which of the following was a crime scene in one of the two cases you have read?

- A Public Street
- A vacant Home
- A Seven-Eleven Store
- A Jewelry Store

What was the category of cases you evaluated during this study?

- Fraud
- Assault
- Murder
- Robbery

Was a weapon used in any of the cases?

- Guns were used in both cases
- A gun was used in the first case, and a knife in the second
- A gun was used in the first case, and no weapon in the second
- No weapon was used in any case

APPENDIX B

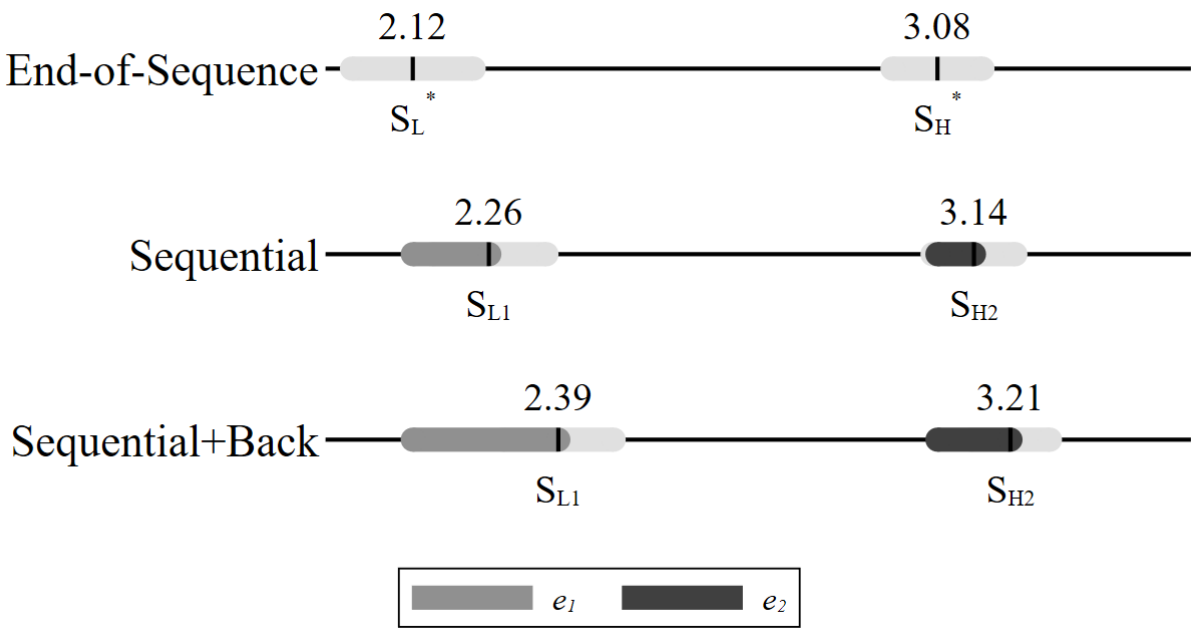


Figure 2B1. Sentencing outcomes in the LH sequence (in log years)

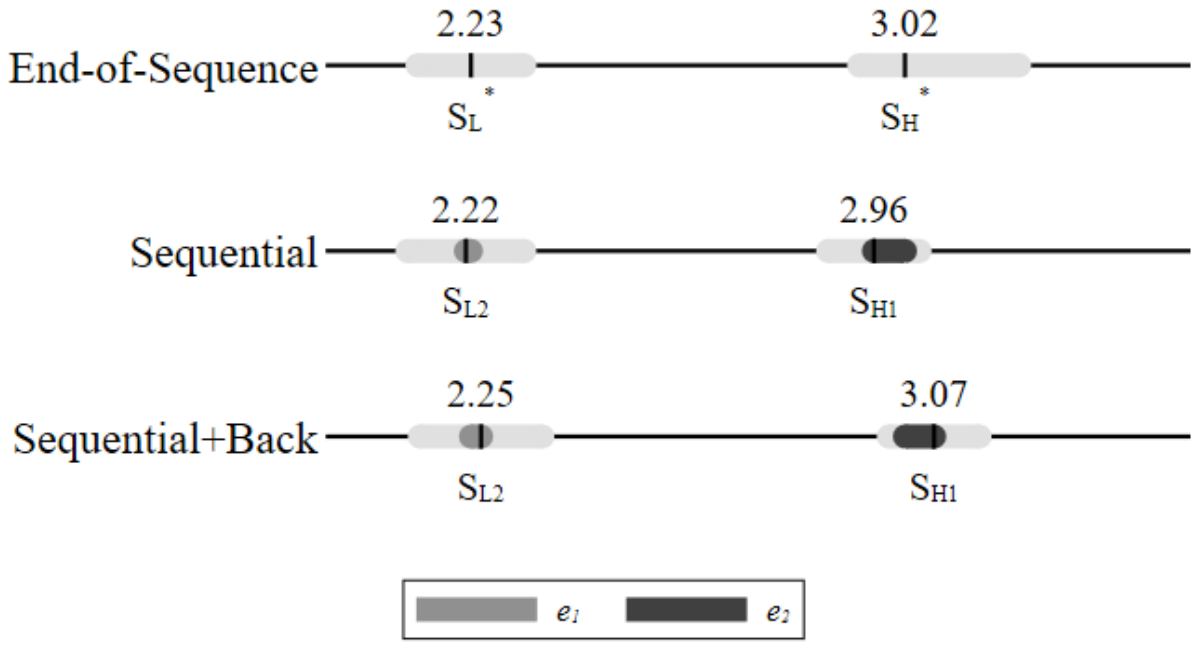


Figure 3B1. Sentencing outcomes in the HL sequence (in log years)

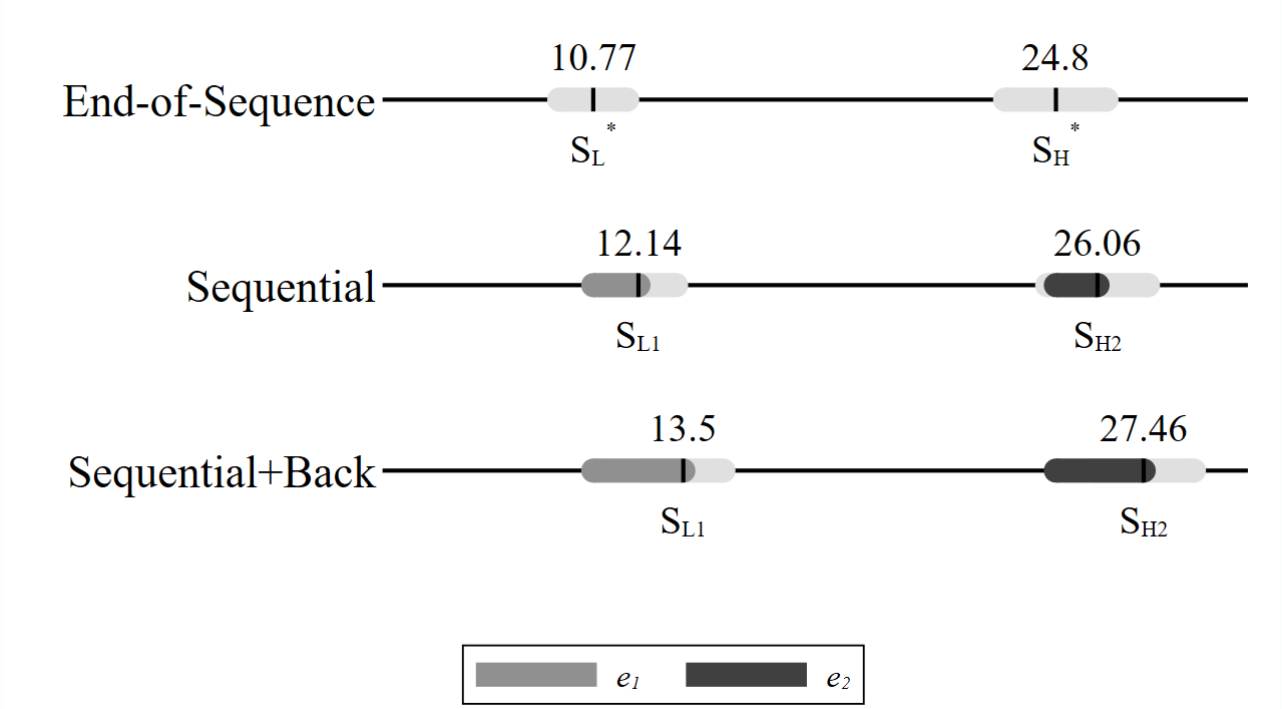


Figure 2B2. Sentencing outcomes in the LH sequence (including participants who used the Back option)

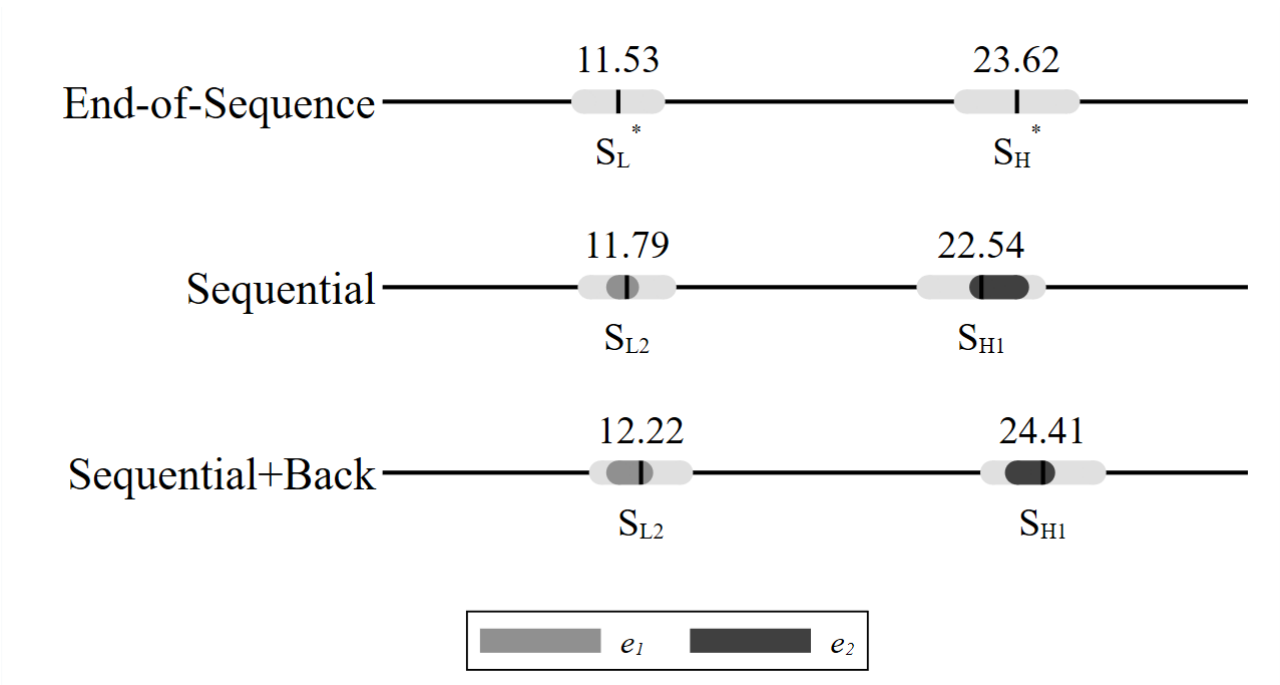


Figure 3B2. Sentencing outcomes in the LH sequence (including participants who used the Back option)

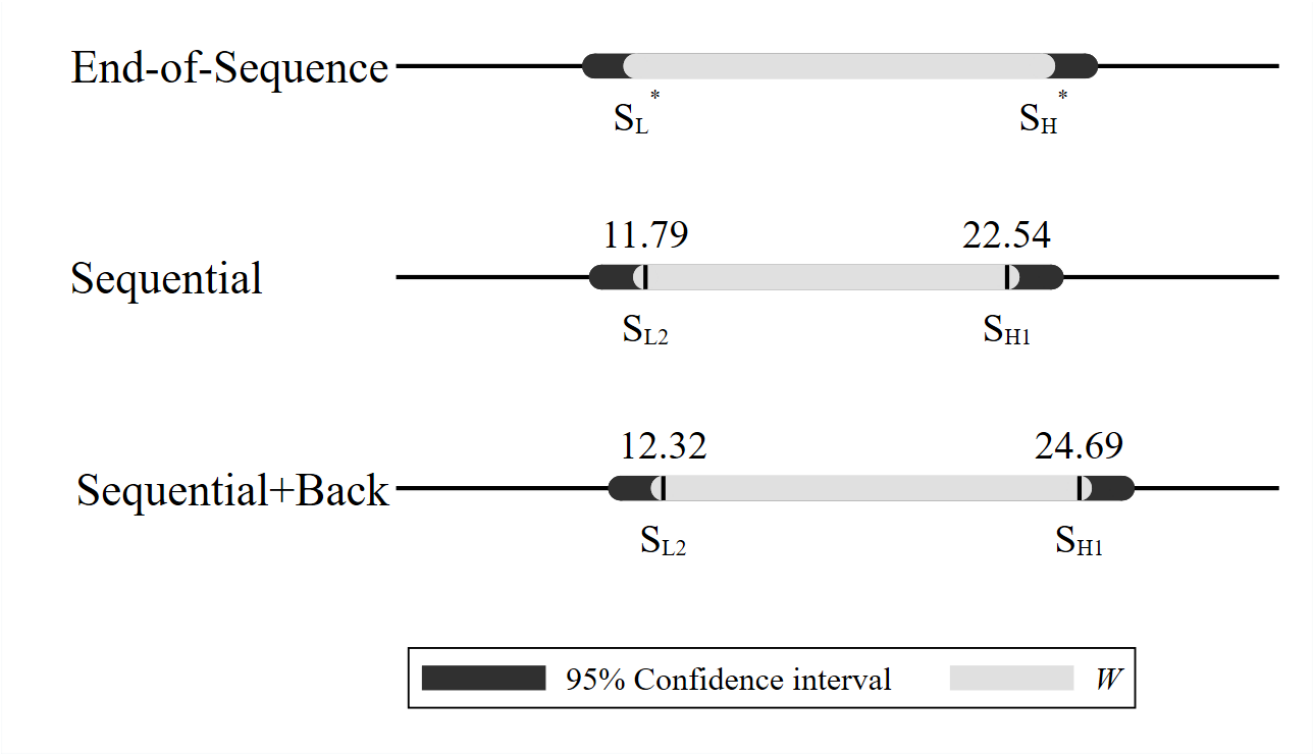


Figure 3. Sentencing Wedge in the HL sequence

Appendix Table 1 Descriptive Statistics by Experimental Condition

	Sequence LH			*Sequence HL*			
	Sequential	Sequential + Back	End-of-Sequence	Sequential	Sequential + Back	End-of-Sequence	*Diff.*
Female	0.54	0.51	0.57	0.52	0.51	0.48	-.788
							(.099)
White	0.76	0.76	0.69	0.74	0.74	0.70	.177
							(.111)
Age	40.84	41.35	39.24	40.99	42.76	39.98	.011***
							(.004)
College	0.64	0.61	0.62	0.70	0.68	0.61	.123
							(.104)
Annual income > $50k	0.45	0.51	0.47	0.56	0.51	0.49	.124
							(.099)
Employed	0.54	0.56	0.51	0.59	0.60	0.57	.160
							(.100)
Republican	0.18	0.26	0.19	0.18	0.20	0.17	.169
							(.124)
Total time (seconds)	661.95	682.88	647.41	689.30	713.58	668.08	0.000*
							0.000
N	197	197	199	198	199	200	

*Notes: This table reports descriptive statistics by treatment. The sample is described in the notes to Table 1. Column 9 reports estimates from an OLS regression of the variables listed on a treatment variable. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.*