

## Original Articles

# Motive on the mind: Explanatory preferences at multiple stages of the legal-investigative process

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## ABSTRACT

Much work has investigated explanatory preferences for things like animals and artifacts, but how do explanation preferences manifest in everyday life? Here, we focus on the criminal justice system as a case study. In this domain, outcomes critically depend on how actors in the system (e.g., lawyers, jurors) generate and interpret explanations. We investigate lay preferences for two difference classes of information: information that appeals to opportunistic aspects of a crime (i.e., *how* the culprit could have committed the crime) vs. motivational aspects of that crime (i.e., the *purpose* for committing the crime). In two studies, we demonstrate that people prefer 'motive' accounts of crimes (analogous to a teleology preference) at different stages of the investigative process. In an additional two studies we demonstrate that these preferences are context-sensitive: namely, we find that 'motive' information tends to be more *incriminating* and less *exculpatory*. We discuss these findings in light of a broad literature on the cognitive basis of explanatory preferences; specifically, we draw analogy to preferences for teleological vs. mechanistic explanations. We also discuss implications for the criminal justice system.

## 1. Introduction

Imagine that you are walking down the street in the early evening. In the distance you see what looks like a body lying on the pavement outside a home. As you approach, you realize that the person is unconscious — and that you have just stumbled across an active crime scene. What's the first question that comes to your mind as you evaluate the scene? Suppose that the police arrive: what do you think is the first question on their minds? Perhaps (if you are like us!) your answer to the above questions is: "Why?"

When we ask *why* questions, there are multiple kinds of information we could be seeking (Joo, Yousif, & Keil, 2021). One kind of answer to this question could appeal to the purpose and function of the crime, akin to a *teleological* explanation. Another kind of answer could appeal to *how* the crime occurred, akin to a *mechanistic* explanation. Both kinds of answers may be relevant to solving the crime. But which kind of information do we want first? Which one carries the most weight? The goal of the present paper is to answer these questions — and to explore how their answers may impact outcomes at various stages of the legal-investigative process.

Despite decades of work in philosophy and cognitive science

investigating the kind of explanations people generate and prefer — and the kind of explanations people *ought* to generate and prefer — surprisingly little is known about explanatory preferences in applied domains such as the criminal justice system. Ironically, however, explanations are an integral part of how this system functions. For example, investigators must contemplate multiple explanations for a crime in order to evaluate potential leads (Ormerod et al., 2008). In addition, prosecutors must consider whether they have enough information to provide an explanation for a crime before deciding whether to take someone to court, and, ultimately, lawyers offer explanations to jurors and judges — at which point the merit of those explanations will determine the defendant's fate. Given that explanatory preferences (e.g., for teleological information) might have adverse effects on how the criminal justice process unfolds, the study of explanation (and inferences made based on those explanations) within this domain, is crucial.

### 1.1. Purpose on the mind: a teleology bias in human cognition?

Richard Dawkins wrote that "we humans have purpose on the brain. We find it difficult to look at anything without wondering what it is 'for'

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— what the motive for it, or the purpose behind it, might be” (Dawkins, 1995, p. 80). A popular view in cognitive science shares this outlook by postulating that people are “promiscuously teleological”, preferring explanations about function and purpose over mechanistic explanations for a wide range of phenomena (e.g., see Kelemen, 1993; Kelemen & Rosset, 2009). This view suggests that a tendency to think teleologically is not only an inherent bias detectable in children from a young age (Kelemen, 2004) but one that exists throughout the lifespan; even adults have been found to resort to teleology when explaining certain items, such as parts of animals, or when under cognitive load (Kelemen, Rottman, & Seston, 2013). In other words, it seems that both adults and children seek out and latch onto teleological explanations — possibly even in cases where we might think that they are irrational to do so (see Rose & Schaffer, 2017, where the authors suggest we should “dismiss” folks’ intuitions insofar as they are teleological; but see also Lennox, 1993; Ruse, 2000).

A strong version of this view is that our disposition towards teleology is so powerful that we imbue all things with purpose and/or agency — even in the absence of intentional agents (e.g., we have a propensity to even mentalize *objects*; see Rose, 2021). This view is supported by evidence from many domains of cognitive science. For example, people have improved memory for information about agents; in fact, agency explains memory performance better than any other factor (Nairne, VanArsdall, Pandeirada, Cogdill, & LeBreton, 2013). It has also been suggested that agency per se may explain many known effects of eye gaze (e.g., Colombatto, Chen, & Scholl, 2020; Colombatto, Van Buren, & Scholl, 2019). In other words, even beyond the domain of explanation, we are generally drawn to, and have better memory for, information about agency. Thus, a question arises about how this agency bias may manifest in legal contexts, where motive information plays a substantial role in criminal investigations.

Here, we contrast *motive* information with *opportunity* information. We suggest that these two kinds of information are roughly but not exactly analogous to teleological and mechanistic information respectively. For example, just as mechanistic explanations describe ‘how’ something came to be, opportunity information describes ‘how’ a crime may have occurred. And just like teleological explanations describe the ‘purpose’ of an action or event, motive information describes ‘why’ a crime may have occurred. We recognise that information about opportunity (e.g., “The suspect was near the scene of the crime around the time it happened”) is not itself a mechanism; it only implies a possible mechanism (e.g., “They committed the crime en route from Location A to Location B”). Nevertheless, this rough analogy may help us to understand any information preferences we observe here in light of a broader literature on explanation preferences.

### 1.2. Motive in criminal law

Now consider the example we gave in introducing this paper, where one encounters an ambiguous crime scene. One might reasonably seek both teleological *and* causal-mechanistic explanations about this crime scene, e.g., one could ask about the purpose (i.e., motive), of someone having committed the crime, or about how the crime was actually carried out. *Both* of these kinds of information carry evidential value and could reasonably help investigators to understand what happened, and, ultimately, who was responsible. However, the goal of the present paper is to ask whether people consider these two types of information equally — or whether, on the contrary, they have a preference for one kind of information over the other (perhaps mirroring the ‘promiscuous’ teleological biases observed in other domains). Before empirically addressing these questions, we will briefly outline the role that information pertaining to purpose, such as information on motives, plays in the criminal justice system.

Firstly — it is important to try to distinguish *motive* from *intent*. In general, motive can be described as the underlying reason for committing a criminal act, whereas intent can be described as the willingness to

commit the criminal act itself. For example, in a homicide case, ‘intent’ would refer to the perpetrator’s mental state afore and throughout the offence. Proving intent would therefore involve showing that e.g., by shooting the gun, the perpetrator *intended* to cause harm to the victim. Comparatively, ‘motive’ would refer to the reason(s) for wanting to harm the victim in the first place, e.g., revenge, financial gain etc. Despite what we think we know from watching crime movies, in both UK and US legal systems, information appealing to motive, purpose and reasons (akin to teleological information) is technically irrelevant when determining if someone is *guilty* of a crime, unless it is specifically made relevant as part of the definition of a crime (e.g., hate crimes). This is expressed in the “irrelevance of motive maxim” that states that a defendant’s motives for offending, either good or bad — i.e., the reasons or emotions that propelled them to infringe the law — should have no bearing on assessing liability. As such, the law is only concerned with the ‘guilty mind’ (i.e., intent) and the ‘guilty act’ (i.e., the action) — for a review of these principles see Smith (1978). However, over the past three decades a countermovement challenging this orthodoxy, led by Husak (1989), has gained traction. This movement contends that information pertaining to motive and purpose should be material to both sentencing *and* liability and that the traditional view is mistaken both factually and normatively. Confusion over the role of motive in criminal liability partly stems from the lack of a clear definition of the concept of motive, and the difficulty of distinguishing it from intent (for a review of arguments see Kaufman, 2003). Supporters of the ‘relevance of motive’ movement have put forth a number of ways in which motive may be relevant to liability, including it being fully or partially inculpatory/exculpatory and it being necessary to prove liability for some offences (for an overview see Hessick, 2006).

In the next section, we will pinpoint ways in which information pertaining to motive is sought and utilized at various stages of an investigative, truth-seeking process — stressing the central role it inherently plays in helping people explain, and appraise, the behaviour of others in criminal and in everyday domains alike.

### 1.3. Evidential reasoning with motive

In a scenario in which law enforcement first arrives upon a homicide crime scene, consider again what questions they may be asking themselves, and how these might guide the search for evidence and the investigation more generally.

It seems entirely rational, upon arriving at a crime scene, to ask *why* the crime occurred, given that answering the ‘why’ can facilitate the identification of the ‘who’ (Eady, 2009). Even textbooks on principles of criminal investigations state that identifying and interpreting motive at the crime scene is crucial in order to create a ‘psychological profile’ of the offender and identify a pool of suspects capable of committing a crime like the one being investigated (Innes, 2003; Osterburg & Ward, 2010). The list of suspects can subsequently be narrowed down by considering who had opportunity and means to commit the crime. Identifying the reason behind the criminal act, therefore, plays a key role in pursuing possible suspects. Despite the intuitive rationality and statistical foundations of this approach (e.g., homicides are for the vast majority committed by someone close to the victim, who had a motive; Brookman, 2005), overly focusing on people close to the victim at early stages of the investigation (“close perpetrator assumption”) was a feature of a number of miscarriages of justice. In these cases, alternative suspicious individuals sighted near the crime scene but with no ties to the victim were largely overlooked (Eady, 2009). Once a primary suspect has been identified through the initial investigation phase, a complete *narrative*, centered around the suspect, must be compiled in order to seek their indictment. This entails outlining how they committed the act, and, in most cases, *why*, (for overview of the case construction process see Innes, 2003). Here, though not an essential component, investigators work under the assumption that when a motive is discovered, it is easier to believe that a given suspect committed the crime than

when no motive is apparent (Morrall, 2006). The failure to produce evidence of motive, though not a fatal flaw, in some cases can weaken the whole body of proof. Ultimately, given that information on motive and reason is used to aid the identification of a suspect, and further, to construct a case against them, it seems that this type of information has already indirectly contributed to determining criminal liability before even reaching trial — despite this not being reflective of its designated role in criminal law.

In trials, the role of motive has been described as being increasingly unregulated, inconsistent and incomplete (Hessick, 2006). Although motive is not a necessary component to establish liability, it is a widely accepted notion, included even in informal guidelines of how to craft a closing argument, that a jury is more likely to be convinced of a defendant's guilt if a motive for committing the crime can be shown (Listrom, 2007). As such, jurors appear to remain concerned with the motives for the defendant behaving a certain way (Hessick, 2006; Listrom, 2007; Pennington & Hastie, 1993), leading legal representatives to use this type of information as a persuasive instrument. This notion that information pertaining to purpose and motive completes the narrative of a crime is formalized in the story model of juror decision-making (Pennington & Hastie, 1991). This model illustrates that when constructing a narrative of 'what happened', jurors use the evidence presented at trial, as well as their personal knowledge of similar events, and their expectations of what makes a complete story. The latter includes an assumption that actions were preceded by certain goals; in other words, there is an assumption that there ought to be a motive. Empirical work has since shown that jurors spontaneously create these narratives and that those creations actually mediate verdict decisions (Huntley & Costanzo, 2003; Pennington & Hastie, 1992). Jurors therefore not only rely on direct evidence and mechanistic information, but also consider information about intentions, goals, desires, etc. when evaluating competing explanations of 'what happened'. As intuitive investigators, people attempt to construct a coherent narrative that is able to explain the known facts and provide a satisfying answer to their 'why' question — and a good narrative implies not only intentionality but a goal or a *motive* preceding the actions. Motive-related information might be particularly salient as it favors both explanation and prediction. As such, it allows people to make sense of the behaviour of a given agent retroactively by providing them with information that helps reconcile the agent with the action (and which facilitates inferences about the values of the agent, thereby influencing judgments of e.g., blameworthiness; see Guglielmo & Malle, 2010; Knobe, 2010). Upon learning this information, the observed behaviour might seem almost *expected*.

#### 1.4. Current studies

So far, we have argued that purpose-oriented information plays a key role at numerous stages of the investigative sense-making process, and, though informative, if weighed *disproportionally* in specialized domains it can have serious consequences within this process. However, research is still needed to empirically address whether people *do* find this information particularly alluring compared to e.g., mechanistic information. Quantifying the diagnostic value of circumstantial evidence relating to mental states such as goals, beliefs and motives, however, is not as straightforward as quantifying the value of e.g., forensic evidence. In the present work we thus addressed the matter of how people evaluate information relating to motive, not by attempting to quantify this in terms of diagnosticity per se, but by adopting the methods employed by classical work on explanation in psychology and philosophy of science (e.g., Kelemen et al., 2013; Lombrozo & Carey, 2006). Ultimately, this enabled us to gain insight into people's overall informational and explanatory preferences in this domain and to compare it to those exhibited in other domains (e.g., teleological preference, Dink & Rips, 2017; Kelemen, 2004).

We will present the findings of four studies that addressed the following outstanding questions: Do people have systematic information

preferences when investigating and reasoning within a criminal domain? What factors influence these preferences? (e.g., investigative stage, context, goals of explainer). To address these questions, we probed lay people's preferences for opportunity vs. motive evidence at different stages of a mock criminal investigation and during a fictitious criminal trial.

## 2. Study 1

In Study 1 we explored whether, given limited information, people differentially prefer investigating a suspect with a known motive (and no known opportunity) versus one with known opportunity (and no known motive) at early stages of an investigation in one of four fictitious criminal cases (Robbery, Homicide, Double Homicide or Bombing). We additionally assessed whether this preference translated to allocating more 'investigative resources' to pursuing a line of inquiry centered around motive.

### 2.1. Materials and methods

Study 1, and all subsequent studies, were completed through Amazon Mechanical Turk. In all studies participants were native English speakers who gave informed consent prior to participation and were paid at the rate of \$7.00 per hour. All procedures were approved by the UCL Ethics Committee. This experiment, and all subsequent experiments, were pre-registered. Those pre-registrations are visible on this project's OSF page alongside our materials, and the data we collected.<sup>1</sup>

245 participants (Mean age = 37.1, SD age = 10.7; N male = 144) completed Study 1. A between-subjects design was used as participants were randomly allocated to one of four independent conditions. All participants were required to reason about a fictitious criminal case, though the type of crime varied across the four conditions (Robbery, Homicide, Double Homicide and Bombing). This allowed us to ascertain whether people's explanatory preferences are robust across contexts. Participants in each condition were initially provided with a 'case briefing' containing a short description of the pertinent fictitious crime. They were tasked as criminal investigators and asked to make certain investigative decisions. Participants in each condition were presented with information about an individual with stated opportunity but no known motive (hereafter dubbed the 'opportunity suspect', and an individual with stated motive but no known opportunity (hereafter dubbed the 'motive suspect'). For example, in the 'Double Homicide' condition the opportunity suspect was the neighborhood gardener, and the motive suspect was an ex-employee of the victim who had been recently fired. See Fig. 1 for a graphical representation of the information provided to participants reasoning in the 'Double Homicide' condition, including the case briefing and the two items of information participants received (for full materials see project link<sup>2</sup>).

After learning both items of information, participants were required to select which individual they wished to make their primary suspect at this stage of the investigation. Finally, using sliders ranging from 0 to 100 (restricted to summing to 100), they were asked to indicate the percentage of resources they would like to allocate in the next stage of the investigation towards pursuing the two leads (the 'opportunity suspect' and the 'motive suspect'). Participants were instructed that they could allocate a percentage of resources to each lead (e.g., 60% to one and 40% to the other) or allocate the entirety of the resources to one lead. They were told that "resources" included things like a monetary budget, number of investigators to be placed on the case and hours they will work on it and that the leads have equal resource demands. After

<sup>1</sup> Project link: [https://osf.io/a8hyk/?view\\_only=ed8ea2fda2334b5cad4fab502a0ffa78](https://osf.io/a8hyk/?view_only=ed8ea2fda2334b5cad4fab502a0ffa78).

<sup>2</sup> Project link: [https://osf.io/a8hyk/?view\\_only=ed8ea2fda2334b5cad4fab502a0ffa78](https://osf.io/a8hyk/?view_only=ed8ea2fda2334b5cad4fab502a0ffa78).

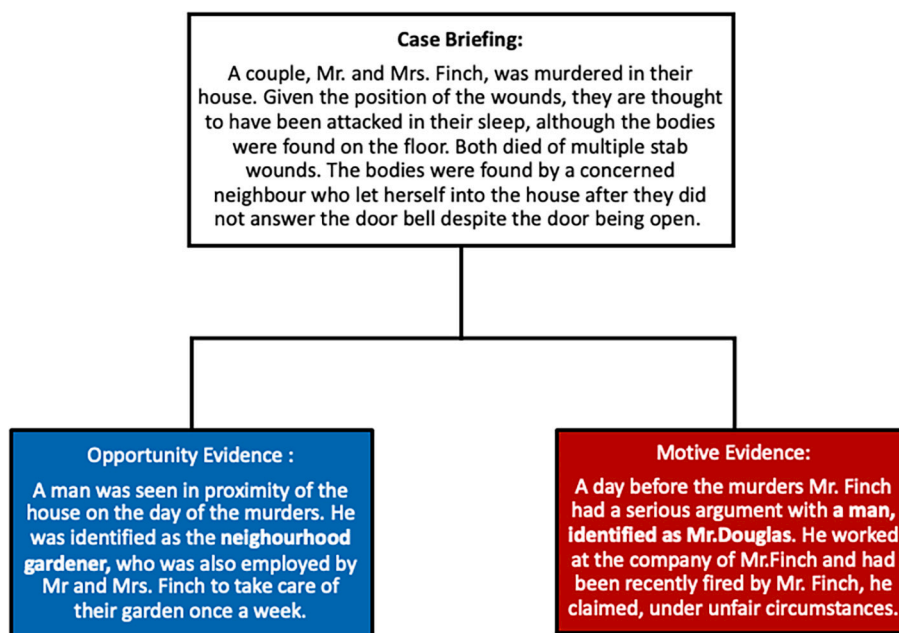


Fig. 1. Graphical representation of information presented to participants in ‘Double Homicide’ scenario.

each question (primary suspect choice and resource allocation) participants provided written explanations for their answers.

2.1.1. Materials check

In order to ensure that the information given to participants (i.e., motive vs. opportunity) was equated in terms of informativeness and strength of evidence, we carried out a ‘materials check’ on an independent sample of participants. To do so we allocated an additional 222 participants (Mean age = 32.9; SD age = 10.4; N male = 126) to one of 8 independent conditions – each including only one of the pieces of evidence we employed in Study 1 (e.g., either the motive or the opportunity evidence for one of the 4 scenarios). For example, in one condition participants were only shown motive-related information for the ‘Double Homicide’ scenario whereas in another condition, participants were shown only opportunity-related information for the ‘Robbery’ scenario.

In each condition, participants were given the relevant case briefing, followed by an individual piece of evidence. They were then asked four questions, in a randomised order, about the value of the evidence that was shown to them. For example, if shown the opportunity-related evidence in the ‘Double Homicide’ scenario (see Fig. 1), participants were then asked about i) the probability of the evidence given the suspect is guilty, ii) the probability of the evidence given the suspect is not guilty, iii) the probability of guilt of the suspect given the evidence is true and iv) how useful and/or valuable the viewed evidence would be to the investigation. In the first three questions we elicited probabilistic estimates using a scale from 0 to 100, whereas in the fourth question we elicited value/utility ratings using a scale from 1 (not useful/valuable at all) to 7 (extremely useful/valuable). For full questionnaire see project link<sup>3</sup>. For results of our materials check, see Section 2.2.1.

2.2. Results

Findings from Study 1 illustrated that participants were partial to the suspect with known motive rather than the one with known opportunity. As such, binomial tests revealed that a greater proportion of participants selected the ‘motive suspect’ as their primary suspect in the ‘Robbery’

condition (proportion = 0.7,  $p = 0.002$ ), in the ‘Double Homicide’ condition (prop. = 0.76,  $p < 0.001$ ), in the ‘Homicide’ condition (prop. = 0.83,  $p < 0.001$ ) and in the ‘Bombing’ condition (prop. = 0.71,  $p = 0.001$ ) – compared to the ‘opportunity suspect’. Pearson’s Chi-Square test of independence ensured us that this ‘motive preference’ did not vary across the four conditions,  $\chi^2(3) = 3.17, p = 0.37, V = 0.11$ .

Next, we explored participants’ resource allocation behaviour. One-Way ANOVAs showed no significant between-condition difference in the amount that participants allocated to pursuing the ‘opportunity suspect’,  $F(3,241) = 2.24, p = 0.08, \eta_p^2 = 0.03$  and therefore the motive suspect either, given resources allocated between the two parties had to sum to 100. As such, we collapsed the four crime type conditions in order to investigate whether the proportion of resources that participants allocated between investigating the two suspect ‘types’ differed (see Fig. 2 for distribution of resource allocation).

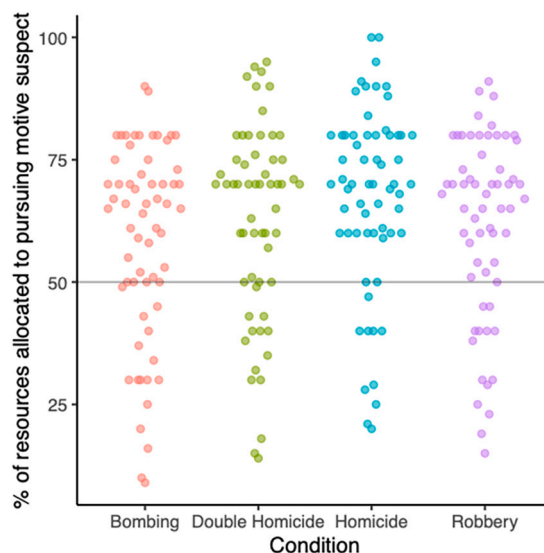


Fig. 2. Study 1 results relating to resource allocation. Horizontal line represents null hypothesis median of attributing 50% of resources to pursuing each suspect.

<sup>3</sup> Project link: [https://osf.io/a8hyk/?view\\_only=ed8ea2fda2334b5cad4fab502a0ffa78](https://osf.io/a8hyk/?view_only=ed8ea2fda2334b5cad4fab502a0ffa78).



Given the non-parametric nature of our data, we carried out two Wilcoxon Signed Rank tests, testing the median resource allocation of each lead to a (null) hypothesized median of 50 (%). Our analyses showed that the previously observed partiality towards the ‘motive suspect’ led to an asymmetric allocation of resources, in favour of pursuing a ‘motive’ line of inquiry. As such, we found that participants allocated more resources to pursuing the motive suspect (median = 68),  $Z^4 = 8.3, p < 0.001$  compared to the opportunity suspect. As can be seen from Fig. 2 however, this preference was somewhat nuanced, given that few participants allocated 100% (or close to) of resources to pursuing the motive suspect.

2.2.1. Materials check results

Given that the primary purpose of the additional material check study was to ensure that the evidence given *within* each scenario was equated in terms of perceived strength, below we report findings relating to the value/usefulness ratings elicited from participants, and a diagnosticity measure. We obtained the latter by calculating the ratio of participants’ estimates of questions ii) and iii) stated in section 2.1.1 e. g., the ratio of participant’s  $P(\text{Evidence} \mid \text{Suspect guilty})$  and  $P(\text{Evidence} \mid \text{Suspect not guilty})$  estimates (see Table 1 for descriptives of these estimates). This equates to calculating the likelihood ratio for each piece of evidence, which ultimately gives us a measure of how diagnostic this piece of evidence is perceived to be. While the exact measure of diagnosticity is debated, the standard view in forensic science (and elsewhere) is that it can be captured by the likelihood ratio (not the posterior probability  $P(H|E)$  alone – e.g., see European Network of Forensic Science Institutes guidelines; ENoFS, 2015). Here, we adopted this approach and used the likelihood ratio as a measure of diagnosticity of evidence.

2.2.1.1. Value/usefulness ratings. We carried out four independent samples *t*-tests on the value ratings given by participants to motive and opportunity evidence in each of the four scenarios (for graphical representation see Fig. 3). We found no significant difference in the ratings of participants who viewed opportunity evidence and those who viewed motive evidence relating to the ‘Bombing’ scenario,  $t(54) = 0.16, p = 0.87, d = 0.04$ ; the ‘Double Homicide’ scenario,  $t(56) = 0.09, p = 0.93, d = 0.018$ ; the ‘Homicide’ scenario,  $t(50) = 0.53, p = 0.6, d = 0.15$  and the ‘Robbery’ scenario,  $t(54) = 1.5, p = 0.14, d = 0.39$ . As such, within each scenario, it appears that the perceived value of the motive and opportunity evidence is adequately equated.

Table 1

Mean and SD (in brackets) of  $P(E|H)$ ,  $P(E| \sim H)$  and  $P(H|E)$  ratings given by participants in each condition.

Condition	$P(E H)$	$P(E  \sim H)$	$P(H E)$
Bombing Scenario Motive Evidence	76.2 (17.6)	47.3 (18.9)	64.3 (22.6)
Bombing Scenario Opportunity Evidence	95.7 (5.4)	56 (17.4)	51.4 (23.3)
Double Homicide Motive Evidence	73.9 (19.8)	53.5 (21.4)	61.7 (22.8)
Double Homicide Opportunity Evidence	97.4 (3.8)	57.7 (18.8)	57.3 (21.5)
Homicide Scenario Motive Evidence	74.7 (12.9)	47.8 (14.1)	72.8 (16.7)
Homicide Scenario Opportunity Evidence	95.8 (4.9)	54 (11.9)	58.7 (18.1)
Robbery Scenario Motive Evidence	76.4 (12.9)	37.9 (18.7)	66.9 (18)
Robbery Scenario Opportunity Evidence	94.7 (5.8)	47 (18.9)	57.8 (24.9)

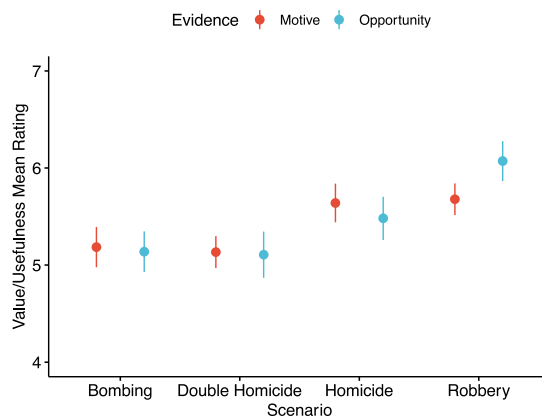


Fig. 3. Plot of mean ‘Value/Usefulness’ ratings within each scenario, for each evidence type. Error bars = SE of mean.

2.2.1.2. Diagnosticity. Similarly, we carried out four independent samples *t*-tests on the diagnosticity values computed for motive and opportunity evidence in each of the four scenarios (for graphical representation see Fig. 4). We found no significant difference in the diagnosticity of opportunity evidence and motive evidence within the ‘Bombing’ scenario,  $t(54) = 0.11, p = 0.90, d = 0.04$ ; the ‘Double Homicide’ scenario,  $t(56) = 1.89, p = 0.06, d = 0.49$ ; the ‘Homicide’ scenario,  $t(50) = 1.1, p = 0.27, d = 0.30$  and the ‘Robbery’ scenario,  $t(54) = 0.3, p = 0.77, d = 0.08$ . As such, within each scenario, the diagnostic value of motive and opportunity evidence was perceived to be equated.

The above findings indicate that the preference for motive information observed in Study 1, is not due to there being an imbalance in the evidential strength or perceived diagnostic value of this type of information in our materials – but of a genuine preference for this type of information when making judgments regarding what suspect to focus on at early stages of an investigative task. It is worth noting that, as can be seen from Table 1, participants believed opportunity evidence was more likely given guilt ( $P(E|H)$ ), and that a suspect was guiltier given motive evidence than opportunity evidence ( $P(H|E)$ ) in some scenarios. This latter estimate, however, is not directly representative of the diagnosticity of the evidence, which is instead typically measured via means of likelihood ratio and which we found to be roughly equated for these two types of evidence. We believe that the fact that participants perceived  $P(H|E)$  to be greater for motive than opportunity evidence illustrates that *despite* the diagnosticity of the evidence being comparable – as evaluated by our own participants – participants are weighing evidence in a biased way by increasing the suspect’s probability of guilt

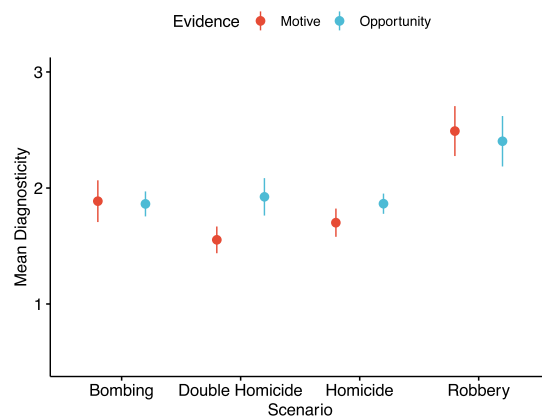


Fig. 4. Plot of mean ‘diagnosticity’ ratings within each scenario by evidence type. Error bars = SE of mean.

<sup>4</sup>  $Z$  represents the *standardized* Wilcoxon test statistic.

more when receiving motive information than opportunity information. This speaks to this type of ‘purpose-oriented’ information providing value above and beyond its diagnosticity and boosting participant’s posterior probability estimates when making judgments of culpability (we will discuss this further in the General Discussion).

### 3. Study 2

In Study 2 we examined whether at a slightly later stage of the investigation of one of two fictitious criminal cases (‘Bombing’ or ‘Double Homicide’), people weigh information pertaining to the ‘motive’ and ‘opportunity’ of a given suspect differently. We additionally examined whether the order in which the information is viewed impacts people’s judgments of guilt.

#### 3.1. Materials and methods

378 participants (Mean age = 35.6, SD age = 24.9;  $N$  male = 234) completed Study 2.<sup>5</sup> A mixed subjects design was used.

All participants completed the same task, although half of the total sample ( $n = 189$ ) reasoned in the ‘Bombing’ criminal case and the other half ( $n = 189$ ) in the ‘Double Homicide’ criminal case. Participants reasoning within each type of cover story were randomly allocated to one of four experimental conditions. Participants in each condition were presented with the relevant case briefing (these were the same as those used in Study 1), tasked as criminal investigators and introduced to a suspect at the outset. Here, minimal information was provided e.g., in the ‘Double Homicide’ case they were told “*Your first suspect is Mr. Douglas, the neighborhood gardener who tended to the houses on the street of Mr. and Mrs. Finch once a week*”. Subsequently, participants received two pieces of information, sequentially. The order and the type of information that was received varied across the four conditions.

In one condition, dubbed ‘Motive Exc.-Inc.’, participants firstly received *exculpatory* information pertaining to the motive of the suspect and subsequently *incriminating* information pertaining to the motive of the suspect. In the ‘Motive Inc.-Exc.’ participants received first incriminating and subsequently exculpatory information pertaining to the motive of the suspect. In another condition ‘Opportunity Exc.-Inc.’ participants received first exculpatory information and subsequently incriminating information pertaining to the opportunity of the suspect. Finally, in the ‘Opportunity Inc.-Exc.’ condition participants received incriminating and subsequently exculpatory information pertaining to the opportunity of the suspect.

Participants were required to submit a quantitative rating of guilt of the suspect (on a scale ranging from 0 to 100) after receiving each of the two pieces of information. After receiving the second piece of evidence, participants were additionally required to indicate (via forced-choice question) whether they thought the probability of the suspect – given the new evidence – would increase, decrease, or stay the same. This allowed us to capture participant’s subjective belief updating in a more intuitive manner. Finally, after having learnt both items of information participants were asked to indicate (via forced-choice question) whether they would like to maintain the current suspect as lead or drop him and pursue a new suspect in subsequent stages of the investigation.

The two items of incriminating and exculpatory information pertaining to motive or opportunity in any given scenario were specifically designed so that they were not mutually exclusive (e.g., both items of

information could be true). This ensured that participants would have to engage in more sophisticated evidence integration, and that neither item of information would push participants’ judgments towards the respective extremes of ‘completely guilty’ or ‘completely innocent’. For full materials see project link<sup>6</sup>.

#### 3.2. Results

Given that we found no influence of scenario on people’s choices in Study 1, we collapsed the data from the two scenarios, leaving us to conduct all subsequent analyses comparing the four experimental conditions in which the type and order of information varied. For results pertaining to participants’ qualitative choice on the direction of change of guilt ratings see Appendix A – these mirrored the quantitative response findings reported below.

Overall our analyses (as visually represented in Fig. 5), revealed that: a) participants rated the suspect as being more likely to be guilty after receiving incriminating motive evidence (this was true compared to receiving incriminating opportunity evidence and either type of exculpatory evidence), b) receiving incriminating motive evidence first, led participants to adjust their guilt ratings significantly less after learning about the exculpatory information on motive, compared to participants who viewed any other type of information first and c) participants who learnt incriminating motive information second, increased their guilt ratings significantly more than participants who learnt incriminating opportunity information second.

Through a mixed ANOVA (with Greenhouse Geisser correct) with a within-subjects factor of ‘time point’ and a between-subjects factor of ‘condition’, we found a main effect of ‘time point’ on participants’ ratings of guilt,  $F(1,374) = 9.8, p = 0.002, \eta_p^2 = 0.03$  and a main effect of ‘condition’,  $F(3, 374) = 34.9, p < 0.001, \eta_p^2 = 0.22$ . A significant interaction effect was also found,  $F(3,374) = 174.8, p < 0.001, \eta_p^2 = 0.58$ . For post-hoc comparison results see Appendix B.

The percentage of participants within each condition who chose to maintain the current suspect as lead vs. drop the current suspect in order to pursue a new lead, after having seen both pieces of information, can be seen in Table 2.

A Chi-Square test of Independence illustrated a significant difference in the percentage of participants who selected each option between conditions,  $\chi^2(3) = 54.3, p < 0.001, V = 0.38$ . Post-hoc pairwise comparisons (adjusted  $\alpha = 0.008$ ) indicated the significant differences to lie between the ‘Motive: Exc.-Inc.’ condition and both the ‘Opportunity:

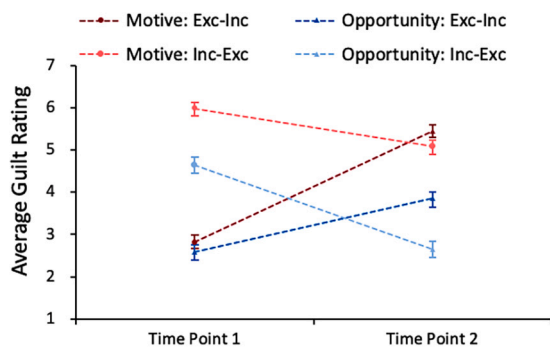


Fig. 5. Study 2 results on guilt ratings within each condition after learning the first piece of information (Time Point 1) and the second (Time Point 2). Error bars = SE of mean. In legend, Exc. refers to exculpatory evidence and Inc. refers to incriminating evidence.

<sup>5</sup> An anonymous reviewer raised concerns about the reliability and quality of data collected from Mechanical Turk. To address these concerns, we replicated this study with a full sample on Prolific, several years after our initial data collection. We also included an attention check not present in the original study. We replicated the original findings. Full data from this replication can be found on our OSF project page ([https://osf.io/a8hyk/?view\\_only=ed8ea2fda2334b5cad4fab502a0ffa78](https://osf.io/a8hyk/?view_only=ed8ea2fda2334b5cad4fab502a0ffa78)), along with the rest of our data.

<sup>6</sup> Project link: [https://osf.io/a8hyk/?view\\_only=ed8ea2fda2334b5cad4fab502a0ffa78](https://osf.io/a8hyk/?view_only=ed8ea2fda2334b5cad4fab502a0ffa78).

**Table 2**

Study 2: percentage of participant choices on maintaining vs. dropping current suspect as lead across conditions.

Condition	Maintain suspect as lead
Motive: Exc.- Inc.	76.8%
Opportunity: Exc.- Inc.	41.5%
Motive: Inc.-Exc.	60%
Opportunity: Inc.- Exc.	26.6%

N.B. 'Exc.' refers to exculpatory evidence and 'Inc.' refers to incriminating evidence.

Exc.-Inc.',  $\chi^2(1) = 24.5, p < 0.001, V = 0.36$  and the 'Opportunity: Inc.-Exc.',  $\chi^2(1) = 47.8, p < 0.001, V = 0.5$  conditions, as well as between the 'Motive: Inc.- Exc.' and the 'Opportunity: Inc.-Exc.' conditions,  $\chi^2(1) = 21.5, p < 0.001, V = 0.34$ .

This solidifies our previous findings of a partiality for motive information, by illustrating that participants are more willing to keep pursuing a suspect given the presence of incriminating motive information than incriminating opportunity information, even given the knowledge of exculpatory information.

#### 4. Study 3

In Study 3 we explored whether explanatory preferences during a trial are mediated by the explainer's adversarial role (e.g., prosecution vs. defence) and therefore one's goal when delivering an explanation.

##### 4.1. Materials and methods

200 participants (Mean age = 37.2, SD = 9.7; N male = 104) completed Study 3. A between-subjects design was used.

All participants reasoned within the same criminal scenario which was closely related to a real criminal case (see Eady, 2009, Chapter 5), involving a man being prosecuted for the murder of his in-laws. After reading the case briefing, half of the sample of participants were tasked as the *prosecution* lawyer and the other half as the *defence* lawyer in the criminal trial. Participants in each condition were asked to review two versions of the closing argument they could deliver in court to convince the jury of the defendant's guilt/innocence. One version of the argument was centered on *motive*-related information, and the other version on *opportunity*-related information. The two closing arguments were equated in length.

After having read each version, participants were asked to choose which version they would like to deliver in court. In addition, they were required to — using a Likert scale — rate each version of the closing argument on four dimensions: persuasiveness, convincingness, completeness and believability. We had no specific predictions about any one of these dimensions; however, we wanted to provide a comprehensive set up in which participants could evaluate the vignettes. For full materials including the case briefing, the closing argument versions and full questionnaire see project link<sup>7</sup>.

##### 4.2. Results

A Chi-Square test of Independence illustrated a significant between-condition difference in participants' closing argument preferences,  $\chi^2(1) = 15.7, p < 0.001, V = 0.28$ . As such, participants tasked as defence lawyers displayed a preference for the 'opportunity-centered' version of the closing argument (prop. Choice = 0.63). Conversely, participants tasked as prosecution lawyers displayed a preference for the 'motive-centered' version of the closing argument (prop. Choice = 0.65).

<sup>7</sup> Project link: [https://osf.io/a8hyk/?view\\_only=ed8ea2fda2334b5cad4fab502a0ffa78](https://osf.io/a8hyk/?view_only=ed8ea2fda2334b5cad4fab502a0ffa78).

People's preference for 'teleological' explanations of the crime is therefore dependent on the goal of the agent delivering the explanation (e.g., convince the jury of the defendant's innocence vs. guilt).

To explore between-condition differences in the average ratings for each dimension in each closing argument version we utilized independent samples *t*-tests. Participants tasked as prosecution lawyers found the motive-centered argument to be more persuasive,  $t(198) = 4.1, p < 0.001, d = 0.58$ ; more convincing  $t(198) = 3.2, p < 0.001, d = 0.45$ , more complete  $t(198) = 2.5, p = 0.012, d = 0.36$  and more believable  $t(198) = 3.3, p = 0.002, d = 0.45$  than participants tasked as defence lawyers. By contrast, participants tasked as defence lawyers found the opportunity-centered argument to be more convincing,  $t(198) = 2.26, p = 0.025, d = 0.32$  than participants tasked as prosecution lawyers. We found no other significant differences in how participants tasked as prosecution and defence lawyers evaluated the 'opportunity-centred' version of the argument. See Appendix C for non-significant *t*-test results.

#### 5. Study 4

In our final study we explored whether the adversarial role of the explainer influences not only people's explanatory preferences when tasked as jurors, but also their judgments of guilt. We additionally explored whether adversarial roles and order of argument presentation influence people's explanatory preferences and judgments of guilt.

##### 5.1. Materials and methods

280 participants (Mean age = 37.2, SD = 11.3; N male = 181) completed Study 4. A between-subjects design was used.

For the present study we used the same criminal case, and thus case briefing, as that used in Study 3. However, participants were now tasked as *jurors* and randomly allocated to one of four conditions. The order and the type of information that was received varied across the four conditions, though the prosecution always delivered their closing argument before the defence — in a manner reflective of real-world trial procedures. In the 'Motive – Motive' condition, participants sequentially read the closing argument of, first the prosecution, and subsequently the defence — these were both centered around motive. Comparatively, in the 'Opportunity – Opportunity' condition participants sequentially read the closing arguments of the prosecution and the defence, when these were both centered on opportunity. In the 'Motive – Opportunity' and 'Opportunity – Motive' conditions the two closing arguments were centered one on motive and one on opportunity and viewed in a counterbalanced order — though again, the prosecution always delivered their argument first.

In this study we elicited three probabilistic judgments: participants were asked to rate the probability of the defendant's guilt (using a Likert scale ranging from 0 to 100) i) after reading the case briefing (this served as a prior estimate), ii) after reading the prosecution's closing argument and iii) after reading the defence's closing argument. Additionally, after reading each closing argument, participants were required to rate it on the same dimensions as those elicited in Study 3 (i.e., persuasiveness, convincingness, completeness and believability).

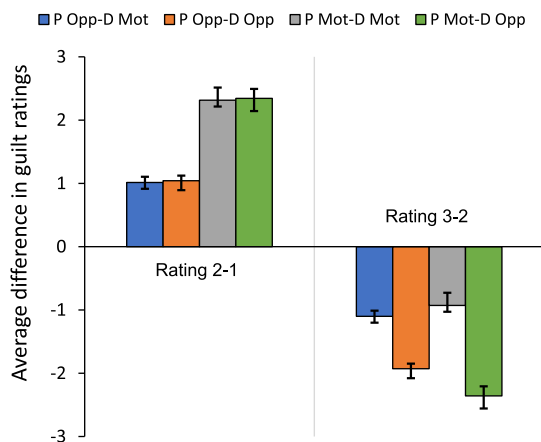
##### 5.2. Results

The results of this experiment can be seen in Table 3 (mean guilt ratings at each time point within each condition) and Fig. 6 (the average difference in guilt ratings at time periods 1 and 2, and 2 and 3, in each condition).

As is evident from Fig. 6, a prosecution argument centered on motive increased guilt ratings significantly more than one centered on opportunity, and conversely a defence argument centered on opportunity decreased guilt ratings significantly more than one centered on motive. This further emphasises the asymmetric preference of teleological

**Table 3**  
Study 4: mean guilt rating at each time point within each condition.

Condition	Rating 1 (SE)	Rating 2 (SE)	Rating 3 (SE)
Opportunity-Motive	4.3 (0.14)	5.3 (0.15)	4.2 (0.15)
Motive-Motive	4.5 (0.14)	6.8 (0.18)	5.9 (0.17)
Opportunity-Opportunity	4.6 (0.15)	5.6 (0.13)	3.7 (0.14)
Motive-Opportunity	4.8 (0.13)	7.1 (0.15)	4.8 (0.2)



**Fig. 6.** Study 4 results on the average difference in guilt ratings 2–1 and 3–2 in each condition. Error bars = S.E. of mean. N.B: in legend ‘Opp’ refers to opportunity evidence; ‘Mot’ refers to motive evidence; ‘P’ refers to prosecution and ‘D’ refers to defence.

information depending on the goal of the agent delivering the explanation. Our One-Way ANOVAs on the average difference of Rating 1 and Rating 2 and on the average difference of Rating 2 and Rating 3 confirm these impressions. For full analyses see [Appendix D](#).

Through our analyses we found a significant between-condition difference in the difference of guilt ratings 1–2,  $F(3,276) = 28.8, p < 0.001, \eta_p^2 = 0.24$ . LSD corrected post-hoc pairwise comparisons illustrated the significant difference to be between condition ‘Opp. - Mot.’ and both conditions ‘Mot. - Mot.’,  $p < 0.001$  and ‘Mot. - Opp.’,  $p < 0.001$ . In addition, a significant difference was found between condition ‘Mot. - Mot.’ and ‘Opp. - Opp.’,  $p < 0.001$  and between condition ‘Opp. - Opp.’ and condition ‘Mot. - Opp.’,  $p < 0.001$ . We also found a significant between-condition difference in the difference of guilt ratings 2–3,  $F(3,276) = 22.1, p < 0.001, \eta_p^2 = 0.19$ . LSD corrected post-hoc pairwise comparisons illustrated the significant difference to be between condition ‘Opp. - Mot.’ and both condition ‘Opp. - Opp.’,  $p < 0.001$  and condition ‘Mot. - Opp.’,  $p < 0.001$ . Significant differences were also found between condition ‘Mot-Mot’ and both condition ‘Opp. - Opp.’,  $p < 0.001$  and condition ‘Mot. - Opp.’,  $p < 0.001$ . Finally, a difference was found between condition ‘Opp. - Opp.’ and ‘Mot. - Opp.’,  $p = 0.04$ .

Overall, as can be seen from [Fig. 6](#), a prosecution argument centered on motive increased guilt ratings significantly more than one centered on opportunity, and conversely a defence argument centered on opportunity decreased guilt ratings significantly more than one centered on motive. This further emphasises the asymmetric preference of teleological information depending on the goal of the agent delivering the explanation.

For results pertaining to between-condition differences on the ratings of each dimension (i.e., believability, convincingness, completeness and persuasiveness) see [Appendix E](#).

## 6. General discussion

In so many contexts, we are drawn to information about purpose. Here, we asked how this ‘purpose bias’ may manifest in an unexplored

domain, the legal system. We showed that at the early stages of an investigation people are partial to purpose-related information by preferring to pursue a suspect with known motive but no known opportunity (rather than the other way round), and that this preference translates to an asymmetric allocation of resources in favour of pursuing a ‘motive-oriented’ line of inquiry (Study 1). In addition, we found that the mere introduction of incriminating motive evidence was enough to increase, and render less flexible, people’s judgments of a suspect’s guilt — significantly more than when incriminating opportunity evidence was learnt (Study 2). As such, evidence relating to why the suspect might have committed the crime carried special weight on people’s judgments of a suspect’s guilt and led to less belief updating in the face of new (even exculpatory) information. As we discuss further at the end of this section, we do not believe these effects were not driven by an imbalance in the evidential/diagnostic strength of the different types of information. Separate groups of participants evaluating the motive/opportunity evidence independently found them equally valuable across several measures, suggesting that there is no obvious bias in our stimuli that gives rise to the observed motive preference.

Although motive does carry evidential value, disproportionately focusing on and weighing motive evidence, can have deleterious consequences. Illustratively, research has found that introducing *conjectural* motives (i.e., akin to speculative teleological explanations) in criminal trials is a feature of a number of wrongful convictions (e.g., see Sion Jenkins case in [Eady, 2009](#)). Given our findings, and their possible implications for the criminal justice system, further research could focus on formalising the role of ‘motive-related’ information in judgments of guilt and operationalizing how its diagnosticity compares to that of variables representing other types of evidence e.g., pertaining to opportunity when these are evaluated within the same narrative. This could be done within a Bayesian causal modelling framework, as exemplified by the work of [Fenton, Neil, and Lagnado \(2013\)](#) and would contribute to the development of normative methods of evaluating competing legal arguments that include evidence both pertaining to internal states of the agent and of the physical environment.

Although our Study 1 and 2 findings suggest that, similar to other domains, teleological or purpose-oriented information is preferred relative to mechanistic information, our subsequent studies showed that participants do not prefer motive information in *all* circumstances. In Study 3, participants preferred a motive-centered closing argument selectively, depending on the role they were given — i.e., whether they were tasked as prosecution lawyers or as defence lawyers. In short, participants preferred to use incriminating ‘motive’ evidence as the prosecution but preferred to use exculpatory ‘opportunity’ evidence as the defence. In Study 4, this asymmetry was verified: when participants were tasked as jurors, their evaluations of the closing arguments were once again dependent on the source delivering the closing argument, finding ‘motive-centered’ arguments to be more effective when delivered by the prosecution and ‘opportunity-centered’ arguments to be more effective when delivered by the defence. This echoes the notion that to persuade a jury of someone’s *guilt*, one must appeal to motive ([Innes, 2003](#); [Listrom, 2007](#)). These findings are also in line with the different tactics employed by attorneys in the real world ([Rostulek, 2010](#)). Given that the burden of proof is on the prosecutor it makes sense that they adopt arguments that are known to be persuasive such as those pertaining to motives and reasons. Comparatively, the primary role of defence lawyers is to introduce reasonable doubt and this — intuitively — can be introduced more successfully by confronting the mechanistic chain of actions put forth by the prosecution rather than by addressing arguments pertaining to motive. In addition, evidence that someone was not at the crime scene is definitive evidence that they are not guilty (for crimes of the type described in this paper) — whereas evidence they were at the crime scene is only weak evidence that they are guilty.

It might seem unsurprising that people favour ‘opportunity-centred’ defence arguments (i.e., if a person was in a different state from where a crime took place, they couldn’t have possibly committed the crime). Yet



it seems less obvious that people should favour ‘motive-centred’ *prosecution* arguments (e.g., “The suspect committed this crime because they felt vengeful.”). This may be problematic for two reasons. Firstly, opportunity should arguably be a crucial piece of information not only when trying to prove someone wasn’t at the crime scene (e.g., as a defence lawyer might do), but also when trying to prove someone might have been. Fenton et al. (2013) demonstrated that opportunity information can be extremely diagnostic during an investigation in many criminal contexts as it narrows down the initial probabilities (referred to as ‘opportunity priors’ in their paper) of a person having had the opportunity to commit the crime. Secondly, our findings corroborate the notion that there is an unspoken *expectation* that the prosecution provide evidence related to motive, and further that a motive-centred argument is more persuasive and is ultimately preferred by lay people when arguing that a defendant is guilty. This might be problematic when considering that motive should technically not be considered when determining criminal liability. Our findings suggest that it plays a key role in people’s attributions of guilt and speak to the fact that its role in various stages of the legal-investigative process (especially later stages such as a trial) is at present inadequately understood.

Information about a person’s possible motives for carrying out a crime might be favoured by people in legal domains not only because this information retroactively *explains* a crime but because it additionally allows one to make certain *predictions*. For example, knowing that a person was particularly angry or violent might help us to predict their behaviour, including whether they would commit a violent act. Understanding the purpose of someone’s actions might therefore make us more likely to believe that the person did in fact act in that way. This notion is supported by deductive-nomological arguments in philosophy, positing that successful explanations are ones that demonstrate that an event was *expected* (e.g., learning of the presence of an undersea volcanic eruption would make an anomalous event such as a 100-ft wave suddenly seem expected). In this view, the feeling of understanding a phenomenon/event after it is explained to us is because we are no longer surprised that it occurred (Hempel, 1965). In legal contexts, explaining not only the mechanism of a crime but the reason for the actions involved might bolster one’s feeling of understanding of the event itself by making it seem more “expected”, which in turn might make one more willing to accept that particular account of the event — even in cases where motive information was immaterial to the crime itself.

Further, information on motive and purpose may enable us to understand a criminal act by fitting that act within our background knowledge (Schurz & Lambert, 1994). In other words, motive information becomes meaningful evidence insofar as it helps to provide a causal framework for a crime; motive creates a link between the agents, events, and outcomes of a crime (Kosłowski, Marasia, Chelenza, & Dublin, 2008). This view is corroborated by findings suggesting that motive and purpose are key components of the narratives that jurors build when evaluating competing explanations of a crime (Huntley & Costanzo, 2003; Pennington & Hastie, 1992). As such, a persuasive, plausible and complete story is one that addresses both the plausibility of the physical relations between the events in the story, and the plausibility of the agent acting in a particular way (Bex, Bench-Capon, & Atkinson, 2009).

These findings also contribute to our understanding of juror decision-making more broadly (e.g., Berman & Cutler, 1996; Casper, Benedict, & Perry, 1989; Greene & Dodge, 1995; Jones & Kaplan, 2003; Krauss & Sales, 2001). Whereas prior work has emphasized specific information that may sway jurors (e.g., error in eyewitness testimony; Berman & Cutler, 1996; racial stereotypes, Jones & Kaplan, 2003; or prior criminal record, Greene & Dodge, 1995), our work focuses on a broad bias of human cognition — a tendency to find information pertaining to motive highly alluring — and how this bias manifests in a legal context. Our findings also generally cohere with the most influential theory of juror decision-making, the ‘story model’ (Pennington & Hastie, 1992). Consistent with this theory, we suggest not only that jurors are drawn to

consistent narratives, but that motive information may be the glue that binds disparate pieces of evidence together to form a coherent and convincing story.

### 6.1. A true motive bias?

One challenge in this line of research has been to methodologically equate the two types of evidence we pitted against each other — namely, opportunity and motive evidence. It seems entirely possible, in principle, that the present results could be explained by the fact that the ‘motive’ information given to participants was simply more compelling, or interesting, or relevant to the case. In fact, this is a possibility that we cannot definitively rule out: Any measure we could collect on these pieces of information is confounded with the bias we are aspiring to measure. While it is difficult to equate the evidentiary value of these two different types of information in a quantifiable manner whilst maintaining ecological validity in the materials, we tried to experimentally match these pieces of information by, for example, eliciting ‘usefulness’ ratings regarding the two types of evidence in one of the studies, upon which we based most of our materials. In addition, we utilized participants’ own probabilistic estimates to compute the likelihood ratio as a measure of the perceived strength of these types of evidence. Despite this, in both the materials check of Study 1, and in Study 2, participants gave higher guilt ratings of  $P(H|E)$  when  $\underline{E}$  related to motive evidence compared to opportunity evidence, and they had received only one piece of evidence. This could be interpreted as the two types of evidence not being equated. However, we instead believe that this shows that *despite* the diagnosticity of the evidence being comparable, these two types of information are being weighed differently — reflected in increasing the suspect’s probability of guilt more when receiving motive information than opportunity information. As such, we posit that this type of evidence contributes more to people’s belief updating than pure diagnostic value. This is a notion that echoes a purpose/agency bias in different domains including vision science and metaphysical philosophy (Colombatto et al., 2020, Rose, 2021). It additionally fits with the story model of juror-decision-making (Pennington & Hastie, 1992) which illustrates that motive is a key factor that jurors use when evaluating causal narratives of ‘what happened’, as it increases factors such as explanatory completeness and persuasiveness. Ultimately, we believe these results provide a strong indication that there may be a highly domain-general agency/motive bias, and that this bias may surreptitiously influence decision making in legal contexts. Nevertheless, this work is only a first step, and we encourage future research to attempt to operationalize the diagnosticity of these two types of information in order to replicate our findings of a preference for purpose-oriented information.

## 7. Conclusion

We are drawn to information about agency and motive in many different domains. Here, we show that the allure of motive and purpose-oriented information plays an important role in sense-making at various stages of the criminal justice process. We find that people are concerned with issues that go beyond determining whether an act was intentionally carried out and are drawn to information about *why* it was carried out in the first place. This line of inquiry, which might stem from an agentive worldview that bestows purpose to people’s actions, could have serious consequences if weighed disproportionately to other relevant information. Our findings a) add to the psychological literature of the study of people’s explanatory preferences in applied domains and b) add to the growing argument that folk intuitions about the law may not be in accord with the legal system’s statutory guidelines. More work is needed to formalize how purpose-related information is used and *should be* used when making judgments and inferences in the criminal justice system, as well as other applied domains. We hope this work paves the way for future studies to consider the ways in which our explanation preferences

— thus far primarily the subject of philosophical inquiry — have profound implications for our everyday lives and the decisions made in more specialized domains.

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### Declaration of interest

None.

### Acknowledgments

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## Appendix A. Study 2. Analysis on qualitative choice of probability change

A Chi-Square test of independence revealed a significant difference in the amount participants believed the probability of guilt of the suspect increased, decreased and stayed the same after viewing the second piece of evidence,  $\chi^2(6) = 271.1, p < 0.001, V = 0.35$ . For descriptive percentages see Table A1 below.

**Table A1**

Percentage of participants who thought the probability of the suspect being guilty was ‘more’, ‘equal’ and ‘less’ than before viewing second piece of information, in each condition.

Condition	More likely	Equally likely	Less likely
Motive: Exc.- Inc.	82.1%	17.9%	0%
Opportunity: Exc.- Inc.	53.2%	42.6%	4.3%
Motive: Inc.-Exc.	1.1%	40%	58.9%
Opportunity: Inc. – Exc.	0%	23.4%	76.6%

Post-hoc pairwise comparisons (corrected alpha = 0.008) showed the significant difference to be between the Motive Exc.– Inc. and the Opportunity: Exc.- Inc. conditions,  $p < 0.001$ ; between the Motive Exc.– Inc. and the Motive Inc. – Exc. conditions,  $p < 0.001$ ; between the Motive Exc.– Inc. and the Opportunity Inc. – Exc. conditions,  $p < 0.001$ ; between the Opportunity: Exc.- Inc. and the Motive Inc. – Exc. conditions,  $p < 0.001$  and finally between the Motive Inc. – Exc. and the Opportunity Inc. – Exc. conditions,  $p < 0.001$ .

## Appendix B. Study 2. Post-hoc comparisons of repeated-measures ANOVA with between-subjects effect

Post-hoc pairwise comparisons with Tukey HSD correction illustrated that the mean difference ratings between time points of the ‘Motive: Exc.- Inc.’ condition significantly differed from those of the ‘Opportunity: Exc.- Inc.’ condition (mean diff = 0.92),  $p = 0.001$  and from those of the ‘Motive: Inc.-Exc.’ condition (mean diff = -1.4),  $p < 0.001$ . From Fig. 2 we can see that despite reporting similar ratings after the first piece of information, participants in the ‘Motive: Exc.-Inc.’ condition gave a significantly higher end rating than participants in the ‘Opportunity: Exc.- Inc.’. Comparatively, participants in the ‘Motive: Exc.-Inc.’ condition gave a lower initial guilt rating than participants in the ‘Motive: Inc.-Exc.’ condition but increased their rating after the second piece of information, whereas participants in the ‘Motive: Inc.-Exc.’ decreased it.

Significant post-hoc pairwise comparisons were also found between the ratings of the ‘Opportunity: Exc.-Inc.’ condition and ‘Motive: Inc.-Exc.’ condition (mean diff = -2.3),  $p < 0.001$  and the ratings of ‘Motive: Inc.-Exc.’ condition and the ‘Opportunity: Inc.-Exc.’ condition (mean diff = 1.9),  $p < 0.001$ . Participants in the ‘Opportunity: Exc.-Inc.’ and ‘Opportunity: Inc.-Exc.’ conditions provided lower guilt ratings than participants in the ‘Motive: Inc.-Exc.’ condition, but whereas participants in the ‘Motive: Inc.-Exc.’ and ‘Opportunity: Inc.-Exc.’ conditions decreased their ratings after the second piece of information, participants in the ‘Opportunity: Exc.-Inc.’ condition increased them. The end ratings of participants in the ‘Motive: Inc.-Exc.’ condition however remained higher than those of participants in the ‘Opportunity: Exc.-Inc.’ and the ‘Opportunity: Inc.-Exc.’ conditions.

## Appendix C. Study 3. Between-condition differences in ratings of ‘opportunity-centered’ version of closing argument

We found no significant difference in ‘persuasiveness’ ratings of defence condition ( $M = 1.02, SE = 0.14$ ) and prosecution condition ( $M = 0.77, SE = 0.13$ ),  $t(198) = 1.3, p = 0.2$ . We found no significant difference in ‘completeness’ ratings of defence condition ( $M = 0.98, SE = 0.17$ ) and prosecution condition ( $M = 0.69, SE = 0.17$ ),  $t(198) = 1.2, p = 0.29$ . We found no significant difference in ‘believability’ ratings of defence condition ( $M = 1.4, SE = 0.14$ ) and prosecution condition ( $M = 1.2, SE = 0.15$ ),  $t(198) = 0.95, p = 0.34$ .

## Appendix D. Study 4. Mixed-methods Two-Way ANOVA (with Greenhouse-Geisser correction) to explore effect of time point and condition on guilt ratings

We found a significant main within-subjects effect of time on judgments of guilt,  $F(1.6, 453.8) = 269.7, p < 0.001, \eta_p^2 = 0.49$  and a significant main between-subjects effect of condition on judgments of guilt,  $F(3, 276) = 18.8, p < 0.001, \eta_p^2 = 0.17$ . We found a significant interaction effect of condition and time on judgments of guilt,  $F(4.9, 453.8) = 24.3, p < 0.001, \eta_p^2 = 0.21$ .

To investigate the significant main effect of condition we carried out post-hoc pairwise comparisons with LSD correction. These illustrated the significant between-subjects differences to be between the ratings of participants in the ‘Opportunity-Motive’ and ‘Motive-Motive’ conditions (Mean diff. = -1.1, S.E. = 0.19),  $p < 0.001$ ; participants in the ‘Opportunity-Motive’ and the ‘Motive-Opportunity’ conditions (Mean diff. = -0.9, SE = 0.19),  $p < 0.001$ ; participants in the ‘Motive-Motive’ and ‘Opportunity-Opportunity’ conditions (Mean diff. = 1.1, SE = 0.19),  $p < 0.001$  and participants in the ‘Opportunity-Opportunity’ and the ‘Motive-Opportunity’ condition (Mean diff. = -0.9, SE = 0.19),  $p < 0.0001$ .

To investigate the significant interaction effect, we carried out post-hoc pairwise comparisons with LSD correction. These illustrated a significant between-subject difference in the mean difference of Rating 1 and Rating 2, between participants in the ‘Opportunity-Motive’ and the ‘Motive-Motive’ condition (Mean diff. =  $-1.3$ ; SE =  $0.19$ ),  $p < 0.001$ ; participants in the ‘Opportunity-Motive’ and the ‘Motive-Opportunity’ condition (Mean diff. =  $-1.3$ , SE =  $0.19$ ),  $p < 0.001$ ; participants in the ‘Motive-Motive’ and the ‘Opportunity-Opportunity’ condition (Mean diff. =  $1.3$ , SE =  $0.19$ ),  $p < 0.001$ ; participants in the ‘Opportunity-Opportunity’ and the ‘Motive-Opportunity’ condition (Mean diff. =  $-1.3$ , SE =  $0.19$ ),  $p < 0.001$ .

In addition we found a significant between-subject difference in the mean difference of Rating 2 and Rating 3, between participants in the ‘Opportunity-Motive’ and the ‘Opportunity-Opportunity’ condition (Mean diff. =  $0.83$ ; SE =  $0.2$ ),  $p < 0.0001$ ; participants in the ‘Opportunity-Motive’ and the ‘Motive-Opportunity’ condition (Mean diff. =  $1.3$ , SE =  $0.2$ ),  $p < 0.001$ ; participants in the ‘Motive-Motive’ and the ‘Opportunity-Opportunity’ condition (Mean diff. =  $1$ , SE =  $0.2$ ),  $p < 0.0001$ ; participants in the ‘Motive-Motive’ and the ‘Motive-Opportunity’ condition (Mean diff. =  $1.4$ , SE =  $0.19$ ),  $p < 0.001$ .

#### Appendix E. Study 4. ANOVA’s on ratings of closing arguments between conditions

For the first statement, we found:

- a. Significant differences in ratings of ‘persuasiveness’,  $F(3, 276) = 11.8$ ,  $p < 0.0001$ ;
  - Opportunity-Motive condition – Motive-Motive condition (mean diff. =  $-1.2$ , SE =  $0.2$ ),  $p < 0.001$
  - Opportunity-Motive condition – Motive-Opportunity condition (mean diff. =  $-1.2$ , SE =  $0.2$ ),  $p < 0.001$
  - Motive-Motive condition – Opportunity-Opportunity condition (mean diff. =  $0.79$ , SE =  $0.2$ ),  $p = 0.001$
  - Opportunity-Opportunity condition – Motive-Opportunity condition (mean diff. =  $-0.8$ , SE =  $0.2$ ),  $p = 0.001$
- b. Significant differences in ratings of ‘convincingness’,  $F(3, 276) = 3.3$ ,  $p = 0.02$ ;
  - Opportunity-Motive condition – Motive-Motive condition (mean diff. =  $-0.5$ , SE =  $0.3$ ),  $p = 0.05$
  - Opportunity-Motive condition – Motive-Opportunity condition (mean diff. =  $-0.78$ , SE =  $0.3$ ),  $p = 0.005$
  - Opportunity-Opportunity condition – Motive-Opportunity condition (mean diff. =  $-0.63$ , SE =  $0.3$ ),  $p = 0.02$
- c. No significant differences in ratings of ‘completeness’,  $F(3, 276) = 0.7$ ,  $p = 0.57$ .
- d. No significant differences in ratings of ‘believability’,  $F(3, 276) = 1.9$ ,  $p = 0.14$ .

For the second statement, we found:

- a. Significant differences in ratings of ‘persuasiveness’,  $F(3, 276) = 11.5$ ,  $p = 0.001$ ;
  - Opportunity-Motive condition – Opportunity-Opportunity condition (mean diff. =  $-0.7$ , SE =  $0.2$ ),  $p = 0.002$
  - Opportunity-Motive condition – Motive-Opportunity condition (mean diff. =  $-0.7$ , SE =  $0.2$ ),  $p = 0.002$
  - Motive-Motive condition – Opportunity-Opportunity condition (mean diff. =  $-0.66$ , SE =  $0.2$ ),  $p = 0.006$
  - Motive-Motive condition – Motive-Opportunity condition (mean diff. =  $-0.66$ , SE =  $0.2$ ),  $p = 0.006$
- b. Significant differences in ratings of ‘convincingness’,  $F(3, 276) = 36.4$ ,  $p < 0.0001$ ;
  - Opportunity-Motive condition – Opportunity-Opportunity condition (mean diff. =  $-0.93$ , SE =  $0.3$ ),  $p < 0.001$
  - Opportunity-Motive condition – Motive-Opportunity condition (mean diff. =  $-0.67$ , SE =  $0.3$ ),  $p = 0.01$
  - Motive-Motive condition – Opportunity-Opportunity condition (mean diff. =  $-0.9$ , SE =  $0.3$ ),  $p = 0.001$
  - Motive-Motive condition – Motive-Opportunity condition (mean diff. =  $-0.64$ , SE =  $0.3$ ),  $p = 0.014$
- c. No significant differences in ratings of ‘completeness’,  $F(3, 276) = 1.6$ ,  $p = 0.19$ .
- d. No significant differences in ratings of ‘believability’,  $F(3, 276) = 2$ ,  $p = 0.11$ .

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