PSYCHOLOGICAL INSIGHTS FOR JUDGING EXPERTISE

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Abstract

This review addresses a critical societal problem that psychology is uniquely positioned to address: the challenge of distinguishing genuine experts from pseudo-experts. Determining which experts to trust is essential for both routine and high-stakes decisions, yet evaluating expertise can be difficult. We examine the cognitive processes that underpin genuine expertise—such as learning, information search, memory, problem-solving, and skill transfer – and explore the disconnect between psychological insights into expertise and the practical methods used to evaluate it. In settings where expertise must be evaluated by laypeople, such as adversarial legal trials, laypeople face significant challenges, including knowledge disparities hindering analysis, communication barriers that impact the clear explanation of expert methods, and systemic constraints that limit the scrutiny of expert evidence. These challenges complicate the assessment of expert claims and contribute to wrongful convictions and unjust outcomes. To assist, we distinguish between 'show-it' and 'know-it' expert performances. The key difference is in their visibility, measurability, and immediacy: 'know-it' performances are particularly challenging and critical to interrogate. This distinction serves as a heuristic for identifying when evaluations of expertise require greater care and

should incorporate a range of diagnostic factors including foundational and applied validity. Finally, we highlight key knowledge gaps and propose promising directions for future research to improve evaluations of expertise in a range of contexts.

PSYCHOLOGICAL INSIGHTS FOR JUDGING EXPERTISE

INTRODUCTION

Expertise is a staple of modern life [1, 2], influencing everything from entertainment choices [3, 4] to daily problem solving [2]. Scholars from diverse fields including psychology, sociology, and philosophy have studied expertise and define it in different ways [2, 5-8]. Yet, there is general agreement that experts demonstrate remarkable performance despite the limitations imposed by human physiology, perception, and cognition [9-11]. These performances are typically efficient, effective, and vastly superior to those of the average person [6, 12]. Here, we define an expert as someone who can repeatedly perform a specific task in a way that is measurably superior to that of non-experts and novices.

Some forms of expertise, especially expert opinions, shape pivotal decisions affecting lives and liberty, such as policy, elections and legal verdicts [13, 14]. In the legal arena, expert opinions not only affect the outcomes of individual court cases, they are also instrumental in shaping our understanding of the effectiveness and fairness of justice systems [15-21]. For example, true crime 'infotainment', live-streamed expert evidence, and expert whistle-blowers all allow the public to observe and evaluate expert performances, revealing strengths and weaknesses of justice processes. However, the rules and procedures governing the use of expert evidence in legal contexts can make evaluations of expertise uniquely challenging.

In this Review, we explore the literature on expertise focusing on how this knowledge can inform the critical evaluation of expertise, particularly in adversarial legal systems. Our focus on this context is guided by watershed reports from the National Research Council and President's Council of Advisors on Science and Technology [22, 23], signaling significant legal misunderstandings of expertise; as well as recent updates to the US Federal Rules of Evidence [24] responding to these issues. Starting with definitions and an overview of the psychological foundations of expertise, we provide a framework for thinking about expert evaluations. We then examine key difficulties in evaluating expertise, using adversarial legal systems as an illustrative context. Finally, we draw on the broader literature to consider potential improvements in legal and other settings.

THE NATURE OF EXPERTISE

Our definition of an expert as someone who repeatedly performs a specific task in a way that is measurably superior to that of non-experts and novices emphasizes the importance of

superior performance in specific tasks, rather than across entire domains or fields. While some scholars define expertise in the latter sense [25], doing so fails to recognize that expertise can vary within and between discrete tasks in a field or domain [10, 25-29]. Evaluating expertise in the context of specific tasks is therefore essential to avoid the unwarranted attribution of expertise to non- and pseudo-experts. Defining expertise at the level of the field might lead one to mistakenly assume that expertise extends to all tasks within that field; or conversely that there is no expertise in an entire field because there is no expertise in a particular task [30].

With this task-focused definition in mind, we summarize decades of research revealing a number of cognitive processes behind expert performance, including learning, information search, memory, problem solving, and transfer [6, 9].

LEARNING

Experts possess a wealth of task-specific knowledge acquired through extensive training, study, and experience [9, 31]. Research on expert learning has been dominated by the deliberate practice framework [32-38]. According to this framework, expertise requires purposeful, goal-directed, repetitive practice and feedback, aimed at improving task-relevant skills. While scholarly debates persist regarding the exact nature of deliberate practice and its role in expertise [6, 35, 39-42], it is clear that experts must dedicate substantial time and intentional effort to achieve the highest levels of performance.

INFORMATION SEARCH

Experts develop specialized ways of searching for information relevant to specific tasks [43, 44]. For example, studies of eye gaze behaviors generally show that compared to novices, experts have an enhanced ability to focus visual attention on relevant information. They possess an extended visual span for features relevant to the task, and they make better use of their peripheral vision [45-48]. They also show more efficient visual scanning patterns such as fewer fixations, longer saccades, and swift detection of critical information features [49-52].

Experts also differ from non-experts in other aspects of information search, such as the use of highly selective search strategies. Among the many actions that could be considered, experts contemplate and enact only a very small number [6, 53]. Even so, expert search is not strictly rational or economical because it involves returning to the same information repeatedly at progressively deeper levels [53]. This iterative process reduces dependence on short-term memory and allows new findings to be integrated into the problem space [49].

MEMORY

Experts typically store and recall more task-relevant material than non-experts. For example, chess experts given just seconds to view chess boards are able to recall the location of more pieces than non-experts [53, 54]. Similar results have been found in many domains, including

games, sports, science, and the arts, despite large variations in information presentation times and modifications to the materials presented [6, 33, 55].

Experts also develop a 'skilled memory' [29, 30, 34, 56] incorporating organizational structures to facilitate superior encoding, retention, and retrieval [57]. During training, experts come to recognize perceptual patterns called 'chunks' [54]: groups of elements that commonly occur together, but rarely co-occur with elements in other groups [58]. Chunks provide efficient access to rich information held in long-term memory [6, 59]. For instance, chess experts show enhanced recall of chess pieces presented in conceptually meaningful groupings compared to arbitrary arrangements like rows and columns, or presented randomly [60]. Even in situations where the grouping of information is random, experts in various domains can use chunks to their advantage, as some naturally occurring patterns will emerge by chance [61-65].

Chunks then combine to form complex templates [66], fostering dense networks of memory structures that support more abstract thinking. These templates are organized through mental schemas that connect knowledge into coherent wholes [6, 53, 67]. Overall, compared to novices, experts tend to recall task details in compressed informational units of increasing size and complexity, rather than as ensembles of discrete pieces which require greater cognitive resources [9].

PROBLEM SOLVING

Experts are capable of rapidly extracting the essential features of large amounts of information by conceptualizing and resolving task-related problems in qualitatively different and more efficient ways than non-experts [53, 68]; perceiving dynamic aspects of situations quickly, such as anticipating potential next steps [69-71]; and applying complex, abstract representations of their knowledge to new problems [6]. For instance, non-experts given physics formulae to sort focus on superficial similarities and group based on those characteristics. Experts, however, see deeper unifying themes and classify accordingly [72]. These types of sophisticated conceptualizations enable experts to adopt better problem-solving strategies than novices [9, 48, 55, 73-76].

The features that enable superior encoding and recall also facilitate skilled intuition [77-80]. Without much thinking, experts in a range of tasks rapidly evaluate routine situations to reach accurate (or effective) resolutions [48, 55, 73-76, 81]. Task-relevant problems activate chunks, which in turn provide access to possible solutions via templates and schemas. Thus, the chunk suggests possible actions through pattern recognition, allowing experts to find shortcuts and skip intermediate steps. In routine cases, for example, experienced clinicians reach fast and accurate diagnoses [74, 82-84].

Despite the benefits of intuition, cognitive shortcuts and heuristic methods of problem solving can sometimes lead to systematic errors or biases, even among experts [6, 10, 85-97]. For example, clinicians can overestimate the likelihood they would have made a correct diagnosis when seeing a case for the first time [i.e., hindsight bias; 98, 99]; ignore the

prevalence of a symptom when making a diagnosis [i.e., base rate neglect; 100]; or seek evidence confirming rather than disconfirming their initial diagnosis [i.e., confirmation bias; 101]. There is also clear evidence that expert judgments can be tethered to irrelevant information [i.e., anchoring effects; 102, 103] and suffer from other contextual influences [104-106].

The tendency to rely on heuristics and patterns to quickly solve problems can also mean that specific details of a problem will be overlooked or ignored in favor of more routine responses, sometimes leading to serious mistakes [107]. Experiments in chess show that expert players often choose familiar solutions even when more efficient but less common alternatives are available [i.e., the Einstellug effect; 108, 109, 110]. There is also evidence that the highly-refined pattern recognition of some experts, such as pilots [111] and intelligence analysts [94], may paradoxically *increase* vulnerability to some errors compared to novices [see 92, 112]. However, it is important to note that even though the intuitions of experts are not always correct, skill and intuition quality are positively correlated [73] .

TRANSFER

Finally, expertise is task-specific. Individuals performing at very high levels on one task are not necessarily also better at other tasks [9, 25, 27, 113, 114]. Successful transfer of expertise depends on the similarity of tasks: the more rules and features tasks share, the greater the transfer of expertise [115, 116]. For instance, superior performance in one type of pattern matching (e.g., fingerprints) affords some benefits in other similar visual pattern-matching tasks [117, 118]. Yet, expertise does not automatically or widely generalize - even across subspecialties of the same domain [e.g., from familiar to unfamiliar face matching; 119, 120-123].

ASSESSING EXPERTISE

Overall, research shows that expertise is underpinned by a range of cognitive mechanisms. Psychologists have developed a variety of specialized measurement methods to distinguish genuine experts from novices and pseudo-experts. For example, card sorting tasks help reveal experts' mental models and how they organize information. Coherent ordering is key for efficient knowledge retrieval and application [72]. Eye tracking technology provides insights into experts' superior information search strategies by monitoring where and how long they focus on specific areas or pieces of information [43, 44]. Timed performance tasks show an experts' proficiency and ability to effectively transfer learned skills by measuring the speed and accuracy with which experts complete specific tasks [124]. Think-aloud protocols reveal real-time decision-making and problem-solving strategies by having expert's verbalize their thought processes while completing a task [125]. Finally, neuroimaging techniques like Functional Magnetic Resonance Imaging (fMRI) and Electroencephalography (EEG) provide evidence of structural and functional brain adaptations associated with the development of expertise [126, 127].

These tools allow psychologists to identify genuine expertise through internal cognitive markers that are often invisible to others. Even so, members of the general public can effectively evaluate expert performance when it involves clear, immediately observable outcomes. For instance, expertise in areas like chess, sports, or surgery can be assessed in real time based on tangible results such as victories, points scored, or successful procedures. However, in many other fields, expertise cannot be directly observed or easily measured at the time of the performance without the use of specialized tools. This is particularly relevant when experts provide predictions, judgments, or complex analyses for which there may be no immediate, visible, or practical way to determine whether their performance led to correct or objectively superior outcomes. Yet some of these kinds of expert performances are genuinely expert and others are not.

This distinction between observable and non-observable expert performances can be thought of as the difference between 'show-it' and 'know-it' forms of expertise, drawing on the well-established distinction between 'procedural' and 'declarative' forms of knowledge [2, 5, 6, 29, 128-131]. However, in this case the key difference between the two types of expert performance lies in their **visibility, measurability,** and **immediacy** (see Figure 1). The show-it/know-it distinction serves as a heuristic for identifying when evaluations of expertise are more challenging and require evaluators to adopt strategies they might not otherwise consider, particularly for 'know-it' expert performances. As such, this framework can be used by evaluators to make more informed and accurate judgments about experts, toward improving outcomes in both routine and high-stakes situations.

'Show-it' expertise refers to tasks where performance is externally visible (e.g., as in sports), outcomes are clear, and superior performance can be objectively measured at the time of the performance in reference to ground truth. Laypeople can usually determine expert-level performance in these contexts by directly observing the performance and evaluating the outcomes.

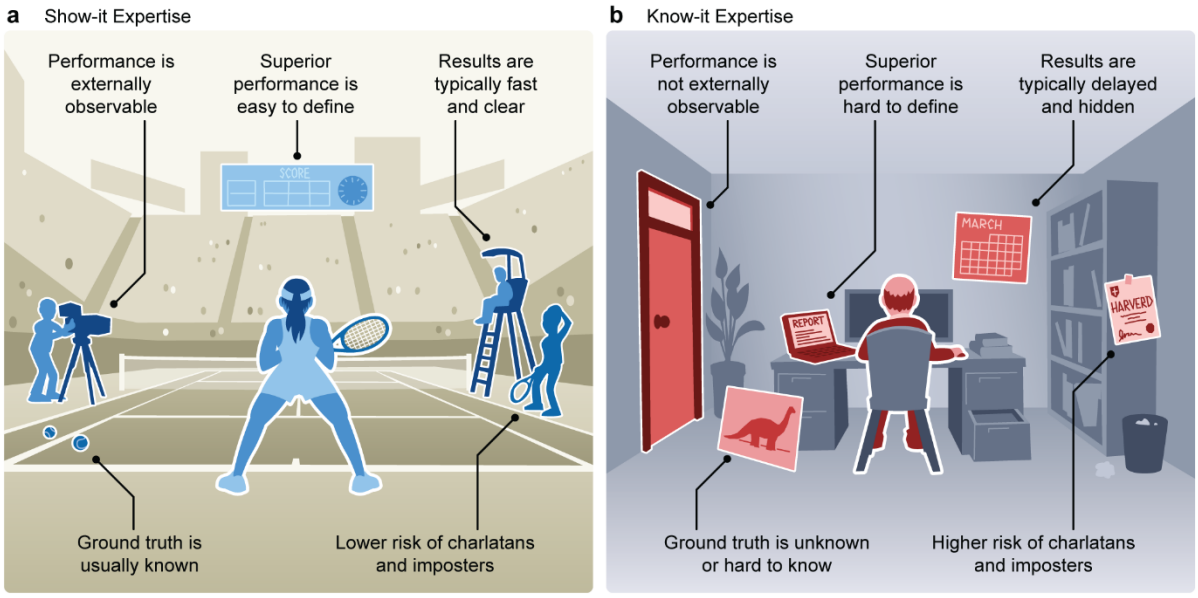

Figure 1. *illustrates differences between 'Show-it' and 'Know-it' tasks. Performance on 'Show-it' tasks is often easy to observe and measure in real time, and success is usually simple to define, leading to a lower risk of imposters. Performance on 'Know-it' tasks is generally hard to observe and measure in real time, and success is typically difficult to define, increasing the risk of imposters. But both can subjected to measurement: measurability itself does not change a performance from the 'know-it' to 'show-it' type. Distinguishing genuine 'know-it' expert performances from imposter 'know-it' performances requires additional diagnostic information. Although expert performances exist on a continuum – at least within these "types" of expertise – the 'show-it/'know-it' distinction serves as a useful heuristic signaling when evaluations require additional care.*

In contrast, 'know-it' forms of expertise involves tasks where success is harder to define or directly observe, such as synthesis, interpretation, judgment, and decision-making [6]. In these cases, experts provide analyses, predictions, opinions, or advice to bridge knowledge gaps [25, 132-136]. Examples include weather forecasts (e.g., the chance of rain), psychological risk predictions (e.g., estimating likelihood of future dangerousness), medical judgments (e.g., diagnosis, treatment selection, estimating outcome probabilities), and forensic feature comparisons (e.g., fingerprint identification). The actual performance of these kinds of 'know-it' tasks is not visible to observers in the way that 'show-it' tasks are, and ground truth tends to be more difficult to establish [7, 137, 138]. As a result, 'know-it' tasks often lack immediate, observable, and unambiguous criteria for success, making performance difficult to measure. Yet such measurement is essential for distinguishing genuine expertise from pseudo-expertise. This challenge frequently arises in everyday evaluations of experts and becomes especially pronounced in adversarial legal systems.

Adversarial legal systems like those in the United States, United Kingdom, Canada, and Australia generally allow expert opinions when judges and juries ('fact-finders') lack the

specialized or technical knowledge needed to interpret evidence in a case - though there are differences between jurisdictions in how these processes unfold, [139]. The content of these expert opinions is typically unfamiliar to the audience, is technical or complex, and is frequently counterintuitive [16, 139, 140]. Even so, expert opinions are not meant to be accepted at face-value. Judges in many adversarial jurisdictions are expected to 'gatekeep' expert evidence, screening out unaccepted or 'junk' opinions derived from unreliable, invalid, or untested methods from purported experts across any and all domains [24, 141-148].

This task may require judges to make assessments of expertise at multiple levels of analysis [149]. Specifically, they may need to assess the probative value and reliability of an entire field represented by an expert witness [23], decide whether a particular witness is a good representative of their field [24], and assess whether the expert's performance on a particular case-specific task was reliable enough to be used as evidence in the trial. If the expert is allowed to give evidence, judges and juries must then evaluate the credibility and reliability of the expert evidence to appropriately weigh it in their verdicts and sentences [24, 141, 150]. Despite the intention to rigorously scrutinize expert testimony, legal questioning and evaluations by judges and juries frequently fall short, leading to misjudgments and even errors in legal outcomes [22, 23, 151-154].

As a striking example, faulty and flawed forensic evidence has been accepted by judges and believed by juries for decades, contributing to many wrongful convictions worldwide [155-162]. In their landmark reports, the US National Research Council [22] and the Presidents' Council of Advisors on Science and Technology [23] revealed that many of the opinions historically accepted by courts as expert were not actually based on techniques proven to be foundationally valid, or valid as applied in specific cases. That is, they were not shown to be reliable (i.e., repeatable, reproducible, and accurate) either *in principle,* or *in practice* [163]. These concerns were echoed in a number of other official inquiries [164-167].

This failure to establish the validity of expert opinions casts serious doubt over judges' and juries' ability to accurately assess whether forensic scientists and others possess genuine expertise [123]. Yet, to fully grasp how these life-altering evaluations go wrong, it is crucial to consider both the nature of expertise, as well as the interplay between adversarial trial procedures and the decision-making of courtroom participants [168]. Doing so reveals a range of psychological considerations that limit or misdirect assessments of expertise in adversarial legal contexts.

CHALLENGES

Courtrooms present several challenges that hinder the effective evaluation of expert opinions by trial participants. First, the expertise required by courts is usually of the 'know-it' variety, where experts provide judgments, diagnoses, comparisons, identifications, and estimations. Successful performance on these tasks is not immediately visible and can be

difficult to observe or measure directly, often requiring years to determine and considerable effort [e.g., defining and tracking if predictions were accurate: 112, 169]. For example, it is impossible to definitively know whether a psychologist's assessment of a child's 'best interests' during a custody dispute was correct, as alternative outcomes cannot be compared, and following the psychologist's advice contaminates the assessment criterion.

This reliance on experts whose successful performance cannot easily be verified forces judges and juries to assess the quality of the expert based on written and oral testimony *describing* the features contributing to their performance rather than evaluating the performance itself. Descriptions may include information about training and experience, cognitive work, intellectual processes, methods, and if available and known - past performance. However, evaluations based on recollections of internal processes are inherently limited and are further constrained by various cognitive and procedural challenges, including the significant knowledge gap between legal actors and expert witnesses.

Knowledge Disparities

Few lawyers and judges receive advanced training in scientific and technical disciplines prior to their legal careers. In fact, most judges report receiving only brief training on related topics, often in a judicial induction course or continuing education seminars [i.e., of less than one week; 170]. The scientific and technical competence of jurors also varies widely and is likely insufficient to accurately evaluate the credibility of the expert witness, or the reliability of their opinion in a courtroom environment. It is therefore non-experts who are left to judge the veracity of expert claims. This paradox is not unique to legal contexts; inexperience and unfamiliarity are problems encountered by most non-experts when asked to evaluate expert opinions, such as patients choosing between doctors advocating different treatments [130, 140, 171-173]. Nonetheless, these knowledge gaps seriously threaten effective evaluations.

Communication Barriers

Communication, comprehension, and insight barriers further complicate evaluations of expertise in legal contexts. 'Know-it' forms of expertise often rely heavily on subjective processes of comparison, evaluation, and judgment - such as when firearms examiners opine that a known bullet and a crime scene bullet were fired from the same gun. Such expert interpretations will often involve skilled intuition (see Box 1: Skilled versus Unskilled Intuition). Yet, these types of quick, automatic, and effortless mental activities are not easily or reliably explained after the fact [e.g., 23, 81, 174]. As a result of this lack of insight, experts may provide inaccurate information about their decision processes, potential biases, and actual performance in their reports and testimony [93, 175-181], unintentionally misleading fact-finders [55, 76, 89, 93, 175, 177, 180, 182]. Errors and misrepresentations, whether deliberate or inadvertent, are difficult for others to detect.

Box 1: Skilled versus Unskilled Intuition

Intuition is often seen as a sign of expertise, but it can be a poor indicator of true skill. Experts can use intuition to make fast, accurate decisions and performances with little effort, driven by deeply rehearsed processes and complex knowledge [53, 78, 183].

However, novices and laypeople also experience intuition [10]. Their 'gut feelings' might seem similar to skilled intuition, but they lack depth of knowledge and experience. Their intuitions are not informed or skilled; they are simply quick, effortless senses of what to do or believe without a solid foundation.

The difference lies in what underpins the intuition. Expert or skilled intuition is built on training, study, and experience; it is informed by feedback relative to ground truth; and leads to better outcomes [184]. Novice or unskilled intuition lacks this foundation and is therefore less reliable.

Caution is necessary when relying on intuition. Anyone can make intuitive judgments and decisions, but only the informed intuition of experts leads to consistently better results [10].

Moreover, some experts may have incomplete knowledge about the evidence underlying their practices [153, 185, 186]; particularly concerning the foundations of the methods and techniques they apply. For example, psychologists using actuarial risk assessment tools may have a limited understanding of their empirical basis, and bench analysts using Polymerase Chain Reaction to amplify DNA may have a limited understanding of how the technique was validated. These knowledge gaps and imperfect insight may lead witnesses to deny, deflect, or guess when areas of weakness or uncertainty are probed by lawyers [187, 188]. For example, because experts can be overconfident about their ability to resist problems and biases in their judgment processes [93], even a sincere expert witness may erroneously claim infallibility [189], or inaccurately reject the possibility of bias [190, 191].

Additionally, experts often have to communicate challenging content to fact-finders. For instance, experts tend to assist with the management and comprehension of uncertainty by offering opinions about past events that may be disputed (e.g., regarding the weapon that inflicted an injury), or future events that are unknown [e.g., the risk of future violence; 133, 134, 136, 192]. There is a wealth of evidence that this is an error-prone process [193-198], particularly in legal contexts where experts are encouraged to speak in probabilistic terms about the evidence under competing hypotheses [199-208]. Probabilistic language is, however, just one type of jargon experts may use in their communication [209-211]. Although a reliance on such jargon is likely a natural consequence of the cognitive efficiencies

developed by experts, these specialized forms of expression interrupt comprehension and engagement among people from outside the domain [212, 213], placing judges and juries at a disadvantage when evaluating opinions provided in reports and testimony. Legal rules and procedure can compound this disadvantage.

Systemic Constraints

Substantive and procedural legal rules evolved to ensure the fairness, consistency, and integrity of justice systems. While these rules work well to solve many evidence problems in law, they are not designed to aid the effective evaluation of expertise – and may in fact unintentionally amplify the challenges associated with the task [214]. Yet, because lawyers, judges, and juries do not have the specialist technical knowledge to make an informed critique of the methods and conclusions of those claiming expertise, they must rely heavily on these systemic legal protections. Often characterized as trial safeguards, protections include cross-examination and opposing experts to interrogate and contest expert evidence [176, 185, 215]. Courts also rely on judicial instructions to guide jurors' assessments of witness credibility and evidence integration [216].

Both effective cross-examination and the use of opposing experts hinge on appropriately informed and adequately resourced lawyers asking well-targeted questions to knowledgeable and honest witnesses, as well as judges and juries understanding the meaning and significance of the answers provided. This dynamic is challenging [185] and can produce general skepticism among fact-finders, rather than better differentiation between pseudo and genuine expertise [217-219]. Access to trial safeguards is also inequitable: the prosecution tends to be better funded than the defense and is often the only side capable of sourcing, preparing for, and funding expert evidence [220, 221]. Consequently, defense experts can be scrutinized more harshly than prosecution experts, impacting evidence evaluations and skewing the trial in favor of the state, even when the experts' abilities are uncertain [222].

Similarly, while it makes intuitive sense that instructions from judges will assist jurors to evaluate experts, in practice their usefulness is limited. Jury instructions are often difficult for laypeople to understand [223-226], and are commonly out of step with contemporary scholarship [216]. Furthermore, jurors generally have poor memory for judicial instructions [227] and struggle to implement them [228], often because instructions amount to general warnings, which can be difficult to apply to a complex array of evidence, multiple charges, or co-defendants.

Finally, the procedural realities of trials add further significant burdens for those evaluating expert witnesses [see 229], limiting the cognitive resources available to complete their evaluations. Fact-finders are routinely presented with large amounts of complex and unfamiliar legal information as well as case-related evidence that they must attend to,

understand, and remember. This information is often disjointed, produced over days of hearings, with limited opportunities for the engagement, elaboration, or consolidation essential for optimizing learning and comprehension [230]. Jurors, for instance, benefit from taking notes [231, 232] and reviewing summaries of expert evidence before hearing testimony [233]. However, access to these resources is limited and inconsistent [234]. Additionally, jurors typically cannot ask live questions to clarify their understanding and must submit questions through the bailiff and judge [see 235], which disincentivizes questions, and delays and filters answers.

Jurors are also usually prohibited from discussing the case with other jurors until all the evidence has been presented, which can be days, weeks, months, or even years after the trial begins. Furthermore, the presentation of evidence during the trial is not always designed to help jurors form a coherent narrative of the case [236]. Adversarial courtrooms are high-pressure environments where witnesses are constrained and unable to speak freely, even to clarify their testimony. The sequence and timing of evidence at trial is also determined by logistical considerations such as witness availability, as well as trial strategy and skill, rather than to optimize comprehension. In such situations, memory for the evidence can be poor [237, 238], potentially impairing evaluations and impacting the fairness and integrity of legal proceedings.

In fact, under challenging conditions like these, where objective evidence of superior performance is not readily available, it is common for those assessing expertise to rely heavily on social criteria and reputation [6, 10, 90]. Courts routinely rely on a practitioner's years of experience, involvement in previous cases, formal qualifications and training, and the plausibility of their claims to decide whether a witness is an expert [11, 239-241]. Relevant education, acculturation, and peer opinions are important [11, 136, 242], but they are not substitutes for the superior performance 'show-it' experts can readily demonstrate [5, 11, 23, 31, 163, 216, 242]. For example, general qualifications in forensic pathology do not necessarily provide information about superior performance on a specific task, such as accurately distinguishing between self- versus other-inflicted stab wounds [6]. Similarly, years of experience may have little or no genuine relationship to superior performance [30, 32, 34, 243, 244].

These findings highlight the trade-offs between observable traits and their usefulness for diagnosing genuine versus pseudo-expertise [see Figure 2; 245]. Highly diagnostic information about performance, such as validity, accuracy, and proficiency, is usually difficult to obtain for 'know-it' experts. As a result, courts and other evaluators faced with this type of expertise may instead rely on the characteristics that are easily accessible such as degrees earned, seniority, memberships, and place of employment. However, these traits can be

misleading because both genuine and pseudo-experts may possess them (i.e., they are high-visibility but low-diagnosticity indicators).

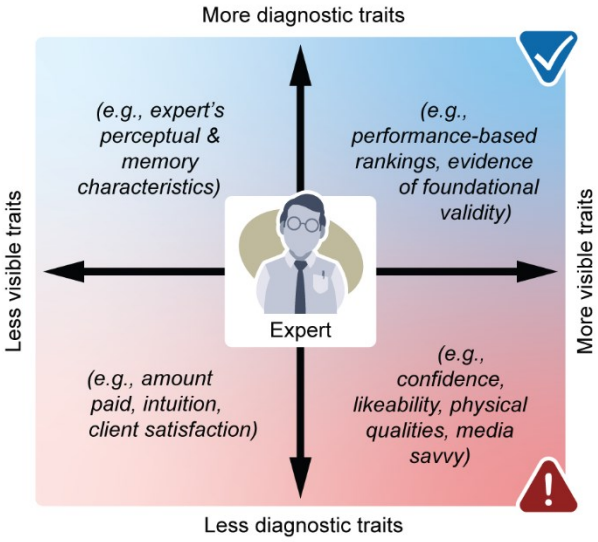

Figure 2 *illustrates the trade-off between the visibility (increasing left to right) and diagnosticity (increasing bottom to top) of expert traits. While psychologists can use specialized methods to access highly diagnostic information across the visibility spectrum (top), legal decision-makers tend to rely on easily observable traits (right). This reliance comes at a cost, as these traits can be unreliable indicators of expertise (bottom right) or are usually not readily available for 'know-it' expertise (top right), limiting the effectiveness of evaluations.*

Even more troubling than relying on inadequate indicators of expertise is the tendency to depend on irrelevant but easily accessible information when diagnostic performance data is unavailable or inaccessible. For example, a range of low-diagnosticity /high-visibility characteristics in the lower right of Figure 2 influence evaluations of experts in the legal arena, including poise and communication style [11, 246, 247], a confident demeanor [169, 247-249], likeability [250-252], and gender [251, 253, 254]. Yet, these factors have no clear connection to superior task performance.

Both the elaboration likelihood model of information processing and the heuristic model of persuasion suggest that when our cognitive resources are limited or we have insufficient knowledge, we are more likely to rely on readily accessible but potentially irrelevant peripheral features of a message [255-258], and we tend to use heuristics and biases rather than systematically processing the core elements of a message [254, 259-271]. Without access to truly diagnostic information, and the ability to interpret it, the reports and testimony of genuine and pseudo- 'know-it' experts are therefore at risk of being confused by judges and juries.

IMPROVING ASSESSMENTS OF EXPERTISE

There are a number of steps that can be taken to improve the admission, presentation, and evaluation of expert opinions in legal settings. The first is to facilitate the development of 'meta-expertise' – expertise about experts [171, 242]. Understanding what information is useful for differentiating genuine from pseudo-experts – and seeking access to that information - is key to this process.

First and foremost, both 'show-it' and 'know-it' experts should furnish courts with direct evidence of their consistently superior performance. While this evidence will usually be imperfect and may be time consuming and costly to obtain for 'know-it' tasks, a demonstrated track record of objectively superior performance on the specific task in question is the single best indicator of expertise, and courts should consistently demand it. For example, although they do not currently do so, fingerprint experts could complete valid ground-truth known fingerprint comparison tests at regular intervals, compare their performance to novices or laypeople, and then provide courts with that proficiency evidence, thereby assisting the court to determine whether they are a genuine expert. Yet despite the clear value of such data courts infrequently request or require fingerprint experts – or other forensic examiners – to provide such information [240, 272]. Similarly, courts could require that experts' complete evidence 'lineups' to provide some immediate information about successful judgments in an instant case, but this rarely occurs [273, 274].

Where data about performance is not readily accessible or available, full and frank disclosures are essential to uncover additional relevant information about expertise. Such transparency is a central element of good scientific practice [275-277] and is necessary for discriminating between 'trustworthy' and 'untrustworthy' (or uncertain) expert opinions [27, 182, 242, 278-282]. When decision-makers understand the quality of the evidence, the risks it will be misused are significantly minimized [31, 283, 284]. To enhance evaluations, we therefore need to clearly identify the specific information experts should provide.

Studies show that learning environments have a powerful impact on the development of expertise. Genuine expertise is more likely to emerge where: (1) it is possible to understand the cause and effect relationships for a task; (2) there is ample opportunity to learn these relationships, usually in a 'kind' learning environment with continuous, fast, and accurate feedback on outcome success [192]; and (3) there have been prolonged periods of structured practice to reduce performance variability and improve outcome accuracy [10]. Yet the value of this background information is somewhat limited for evaluating 'know-it' expertise. This is because many 'know-it' experts will have developed in relatively unkind or 'wicked' learning environments where the relationships between cause and effect are uncertain and feedback is difficult to obtain. Despite the challenge to developing expertise, some people in these difficult learning environments develop genuine expertise on some tasks; others never do. Therefore, simply knowing about the learning environment will not help determine which 'know-it' claims to expertise are genuine.

For instance, two psychologists predicting human behavior are both likely to have learned in relatively 'wicked' environments because the relationships between cause and effect are complex and uncertain for human behavior, and fast, accurate feedback about such predictions is difficult to obtain [192]. Yet, one (or both, or neither) of these psychologists may have genuine expertise in the task at hand. Knowing that both of these psychologists learned in a relatively 'wicked' environment does not help to differentiate between them. Instead, knowing that both claim a 'know-it' form of expertise signals that care should be taken with the evaluation of those claims. Evaluators need to look beyond the learning environment and consider other highly diagnostic information to help them differentiate these experts from pseudo-experts, and each other (see top of Figure 2 and Figure 3).

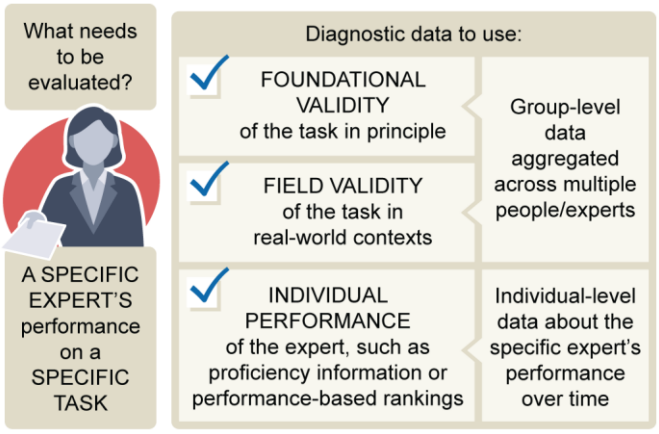

Figure 3 *provides a schematic of the types of diagnostic data to use when evaluating an expert. It emphasizes the task-specific nature of expertise and draws on group and individual-level data, to show how data can be updated to provide more accurate and informative assessments of expertise over time.*

Figure 3 outlines three critical types of highly diagnostic information that can help guide this evaluation: foundational validity (i.e., whether there is valid evidence that the task can reliably be performed in principle), field validity (i.e., whether there is valid evidence that the task can reliably be performed in practice), and diagnostic indicators of the expert's performance over time (e.g., proficiency test results, performance-based rankings) – as already discussed above [22, 23]. These data support inferences about the expected quality of the expert's performance. Each time an expert performs a task, aspects of that performance can be measured and recorded. Those measurements can be used to infer the quality of the expert's performance on the task at hand as compared to other expert's performance on similar tasks (e.g., foundational and/or field validity), or compared to the same expert's track record of previous performances (e.g., proficiency ratings, performance-based rankings). The new measurements can also be used to update the information available about the individual and group performance on the task over time, improving estimates of likely task performance [see also 149].

Evaluators can complete even more nuanced assessments of 'know-it' expertise by employing rich holistic frameworks combining the elements in Figure 3 and additional advice from scholars and authoritative institutions. One such framework directs evaluators to consider the quality of an expert's methods and integrity of the individual expert, as well as the protections and regulations afforded by the profession [see Box 2: Holistic Frameworks for Assessing Expertise; 182]. Another approach (described in Box 2) focuses attention on logically relevant attributes of expertise [174, 286, 287] including relevant training, study, and experience, as well as the modesty of the expert's conclusions. Preliminary evidence supports the usefulness of this framework [252, 287, 288] and the attributes it contains [e.g., 289]. But transparency is vital for the success of these holistic approaches [290-302]. Unfortunately, many 'know-it' experts do not document their work in sufficient detail to sustain these types of assessments [23], and courts do not consistently demand that they do so [303].

Box 2: Holistic Frameworks for Assessing Expertise

Where it is not possible to directly observe the superior performance accompanying claims to expertise, decision-makers can estimate expertise based on the characteristics of the individual, their opinion, and their professional context.

For example, Neal and colleagues identified and described eight best-practices for identifying scientifically credible opinions within their professional context [182]:

1. Foundational validity
2. Validity as applied
3. Bias management
4. Quality assurance
5. Communication of data and opinions
6. Limitations and assumptions
7. Alternative views and disagreements
8. Ethical obligations

The Expert Persuasion Expectancy [ExPEx; 287] framework overlaps with these best practices, but focuses on evaluating expert reports and testimony. The attributes in the ExPEx framework are formally expressed in the following questions:

1. Foundation: Does training, study or experience in the field **F** support assertions like **A**?
2. Field: Does witness **W** have training, study or experience in the field **F**?
3. Specialty: Does **W** have training, study or experience specific to assertions like **A**?
4. Ability: Does **W** provide assertions like **A** accurately and reliably?
5. Opinion: Does **W** convey **A** clearly and with necessary qualifications?
6. Support: Does **W** rely on evidence in making **A**?

7. Consistency: Is **A** consistent with what other experts assert?
8. Trustworthiness: Is **W** personally reliable as a source?

These frameworks can assist non-experts in assessing 'know-it' expertise and improving decision accuracy. However, for these tools to be truly effective, evaluators need to understand which information is relevant and have access to it. Broader strategies, such as increasing transparency and enhancing legal education, are crucial to ensure that experts are asked the right questions and that their answers are clearly understood by judges and juries.

In addition to holistic, diagnostic evaluations, artificial intelligence (AI) and machine learning present promising avenues to address many challenges associated with evaluating 'know-it' expertise. Algorithms and AI systems could assist in verifying expert performance or supplementing human judgment on some tasks[304]. Based on extensive data and advanced reasoning capabilities [6], AI could also enhance trial preparation and cross-examination by generating well-targeted questions [e.g., 305]. Furthermore, AI can help present complex information in rich, clear ways [306], improving the comprehensibility of expert testimony. However, the successful implementation of AI in legal settings requires careful integration and oversight to ensure accuracy, effectiveness, and fairness [307, 308].

The final type of approach for improving evaluations of expertise, and perhaps the most radical, involves structural reforms. Legal rules and procedures could be modified to ensure that experts provide judges and juries with the diagnostic information they need to make informed assessments of expertise; though not without first overcoming a range of significant systemic obstacles. In addition, or instead, panels of experts and multidisciplinary advisory groups could bridge knowledge gaps in challenging areas [172, 242, 309, 310], such as voice or image identification and causes of infant death, by providing systematic reviews, domain- and task-specific knowledge, and methodological expertise. They might also undertake their own informed assessments of expertise based on highly diagnostic cues like repeatability, reproducibility, and accuracy [23], relieving judges and juries of this burden.

Another structural reform involves developing and implementing information management protocols and standardized decision processes for specific 'know-it' tasks. These standards, set by policy, procedure, or ethics codes, reduce error and bias, making expert decision-making more reliable and transparent. Techniques like blinding, sequential unmasking, distributed cognition, algorithmic aids, standard operating procedures, and laboratory information management systems all improve performance without relying on individuals to identify the problems needing to be fixed in a given moment [92, 182, 311-314], thereby avoiding issues like the introspection illusion [93]. However, standards are not magic bullets. They require significant professional and institutional change. Thus, the challenge of knowing which experts to trust remains difficult to address.

SUMMARY AND FUTURE DIRECTIONS

Expert opinions are an integral part of modern life, but not all claims to expertise are genuine. Where successful performances are visible and the quality of outcomes can be measured in a timely and reliable way, it is relatively straightforward for non-experts to identify those with genuine expertise. Where the claim relates to less visible performances, like judgment, decision-making, and prediction, expertise is far harder to assess. For these types of 'know-it' tasks there are few externally observable hallmarks that are reliable and accessible to laypeople This challenge arises not only in legal trials but also in other high-stakes environments, such as healthcare and public policy. As a result, laypeople – such as judges and juries – face a formidable challenge in determining which experts to trust and to what extent. Their task is further complicated by unavoidable knowledge gaps, communication barriers and a complex web of interconnected systemic constraints, all of which inhibit comprehension and culminate in a reliance on readily available, but often unhelpful – or even worse, irrelevant – information when assessing expertise.

In such situations, there is an increased risk that expertise will be incorrectly attributed to pseudo-experts, threatening trial outcomes and undermining the fairness of adversarial legal proceedings. This risk also extends to other decision-critical contexts where misjudging expertise can have severe consequences. To counteract these risks, it is vital that those assessing expertise are knowledgeable about the valid predictors of expertise, and that information about these attributes is sought, disclosed, and relied upon. Where the task is of the 'know-it' variety, rich frameworks for evaluation are necessary, involving consideration of learning environments as well as foundational and applied validity of the task of interest, alongside information about the individual offering the opinion and the field within which they are trained and regulated.

To facilitate improved assessments of expertise in adversarial legal contexts and beyond, additional empirical and theoretical work is required. It is vital to further develop and refine models and frameworks that explicitly deal with the nuances of 'know-it' expertise. Many existing discussions and theories simply defer to 'reputation' and rely heavily on 'experience' rather than probing for deeper, more valid ways to test for and assess expertise. While some work is already underway in this area, there is considerable scope for psychologists to engage more broadly with scholars from other disciplines such as science and technology studies, history and philosophy of science, science communication and rhetoric and argumentation to enrich and innovate our approach to understanding and addressing the challenge of assessing 'know-it' expertise.

Additional empirical studies are then also needed to test the impact of these frameworks on improving assessments of expertise. Specifically, research is needed to clarify whether they result in more objectively credible opinions being given more weight than those with a less credible basis, and to identify which attributes – or combination of attributes – are instrumental in shaping effective assessments. Findings from such research could then be

used to guide disclosure recommendations or obligations for experts in legal and other contexts and form the basis of educational resources to help evaluators hone their assessment skills.

The opportunities arising through the increasing accessibility of artificial intelligence must also be explored. Artificial intelligence is readily applied to a wide range of intellectual tasks, and may therefore have implications for 'know-it' expertise. Yet, the opaque nature of AI, and the ethical, procedural, and professional appropriateness and acceptability of AI input – particularly for legal systems where there are obligations to act fairly and operate transparently – requires careful exploration. Psychologists have a key role to play in gathering empirical evidence gauging perceptions and testing the effects of any potential changes to legal procedures, including but not limited to those incorporating AI. Beyond legal settings, similar efforts will be needed to understand how AI systems affect expertise-based decisions, for example in healthcare. To safeguard the legitimacy of adversarial trials and other critical systems, a rich and relevant evidence-base will be needed to guide any reforms aiming to improve assessments of expertise.

REFERENCES

1. Evans, R., *The Sociology of Expertise: The Distribution of Social Fluency.* Sociology Compass, 2008. **2**(1): p. 281-298 DOI: 10.1111/j.1751-9020.2007.00062.x.
2. Grundmann, R., *The Problem of Expertise in Knowledge Societies.* Minerva, 2017. **55**(1): p. 25-48 DOI: 10.1007/s11024-016-9308-7.
3. Campbell, W., et al., *Sports versus esports–a comparison of industry size, viewer friendliness, and game competitiveness.* Global esports: Transformation of Cultural Perceptions of Competitive Gaming, Bloomsbury, London, 2021: p. 35-59.
4. Karadakis, K. and M.M. Painchaud, *Esport knowledge, skills, and abilities: Perspectives from subject matter experts.* Athens Journal of Sports, 2022. **9**(2): p. 79-100.
5. Farrington-Darby, T. and J.R. Wilson, *The nature of expertise: a review.* Applied Ergonomics, 2006. **37**(1): p. 17-32 DOI: 10.1016/j.apergo.2005.09.001.
6. Gobet, F., *Understanding Expertise: A Multi-Disciplinary Approach*. 2016: Palgrave.
7. Shanteau, J., et al., *Performance-based assessment of expertise: How to decide if someone is an expert or not.* European Journal of Operational Research, 2002. **136**(2): p. 253-263 DOI: 10.1016/s0377-2217(01)00113-8.
8. Selinger, E. and R.P. Crease, *The philosophy of expertise*. 2006: Columbia University Press.
9. Bédard, J. and M.T.H. Chi, *Expertise.* Current Directions in Psychological Science, 2016. **1**(4): p. 135-139 DOI: 10.1111/1467-8721.ep10769799.
10. Kahneman, D. and G. Klein, *Conditions for intuitive expertise: a failure to disagree.* American Psychologist, 2009. **64**(6): p. 515-26 DOI: 10.1037/a0016755.
11. Martire, K.A. and G. Edmond, *Rethinking expert opinion evidence.* Melbourne University Law Review, 2017. **40**(3): p. 967-998.
12. Herling, R.W., *Operational Definitions of Expertise and Competence.* Advances in Developing Human Resources, 2016. **2**(1): p. 8-21 DOI: 10.1177/152342230000200103.
13. Faigman, D.L., et al., *Modern Scientific Evidence: The Law and Science of Expert Testimony*. 2023.
14. Guisinger, A. and E.N. Saunders, *Mapping the boundaries of elite cues: How elites shape mass opinion across international issues.* International Studies Quarterly, 2017. **61**(2): p. 425-441 DOI: 10.1093/isq/sqx022.
15. Australian Associated Press, *More than 100,000 DNA samples may need retesting as Queensland lab bungle worsens*, in *The Guardian*. 2023, Australian Associated Press.
16. Gross, S.R., *Expert evidence.* Wisconsin Law Review, 1991: p. 1113.
17. Jankowicz, M., *Psychiatrist who testified for Amber Heard recounts tide of 'horrific' and 'vile' social-media responses*, in *Business Insider*. 2022: Online.
18. MacLean, C.L., L. Smith, and I.E. Dror, *Experts on trial: Unearthing bias in scientific evidence.* University of British Columbia Law Review, 2020. **53**: p. 101.
19. Rickard, D., *Truth or doubt: questioning legal outcomes in true-crime documentaries.* Law and Humanities, 2022. **17**(1): p. 60-89 DOI: 10.1080/17521483.2022.2148385.
20. Stern, B., *Social Media's Influence on the Outcome of Trials: State v. Casey Anthony & Depp v. Heard - How Florida Can Prevent a Breakdown in the Adversarial Process Notes and Comments.* Nova Law Review, 2022. **47**(1): p. [i]-136.
21. Sutherland, E.E., *Undue deference to experts syndrome.* Indiana International & Competition Law Review, 2005. **16**: p. 375.
22. Council, N.R., *Strengthening forensic science in the United States: a path forward*. 2009: National Academies Press.
23. Presidents' Council of Advisors on Science & Technology, *Forensic science in criminal courts: Ensuring scientific validity of feature-comparison methods*. 2016.
24. *Federal Rules of Evidence*. 2023.

25. Shanteau, J., *Why task domains (still) matter for understanding expertise.* Journal of Applied Research in Memory and Cognition, 2015. **4**(3): p. 169-175 DOI: 10.1016/j.jarmac.2015.07.003.
26. Einhorn, H.J., *Expert judgment: Some necessary conditions and an example.* Journal of Applied Psychology, 1974. **59**(5): p. 562-571 DOI: 10.1037/h0037164.
27. Shanteau, J., *Competence in experts: The role of task characteristics.* Organizational Behavior and Human Decision Processes, 1992. **53**(2): p. 252-266 DOI: 10.1016/0749-5978(92)90064-e.
28. Neal, T.M.S. and T. Grisso, *The cognitive underpinnings of bias in forensic mental health evaluations.* Psychology, Public Policy, and Law, 2014. **20**(2): p. 200-211 DOI: 10.1037/a0035824.
29. Patel, V.L., J.F. Arocha, and D.R. Kaufman, *Diagnostic Reasoning and Medical Expertise*, in *Advances in Research and Theory*, D.L. Medin, Editor. 1994, Academic Press. p. 187-252.
30. Meehl, P.E., *Clinical versus statistical prediction: A theoretical analysis and a review of the evidence*. 1954, Minneapolis, MN, US: University of Minnesota Press. x, 149-x, 149.
31. Eyal, G., *The Crisis of Expertise*. 2019: John Wiley & Sons.
32. Chow, D.L., et al., *The role of deliberate practice in the development of highly effective psychotherapists.* Psychotherapy, 2015. **52**(3): p. 337-45 DOI: 10.1037/pst0000015.
33. Ericsson, K.A., R.R. Hoffman, and A. Kozbelt, *The Cambridge Handbook of Expertise and Expert Performance*. 2018: Cambridge University Press.
34. Ericsson, K.A., R.T. Krampe, and C. Tesch-Römer, *The role of deliberate practice in the acquisition of expert performance.* Psychological Review, 1993. **100**(3): p. 363-406 DOI: 10.1037/0033-295x.100.3.363.
35. Macnamara, B.N., D.Z. Hambrick, and F.L. Oswald, *Deliberate practice and performance in music, games, sports, education, and professions: a meta-analysis.* Psychological Science, 2014. **25**(8): p. 1608-18 DOI: 10.1177/0956797614535810.
36. Macnamara, B.N., D. Moreau, and D.Z. Hambrick, *The Relationship Between Deliberate Practice and Performance in Sports: A Meta-Analysis.* Perspectives on Psychological Science, 2016. **11**(3): p. 333-350 DOI: 10.1177/1745691616635591.
37. Platz, F., et al., *The influence of deliberate practice on musical achievement: a meta-analysis.* Frontiers in Psychology, 2014. **5**: p. 646 DOI: 10.3389/fpsyg.2014.00646.
38. Ward, P., et al., *The road to excellence: deliberate practice and the development of expertise.* High Ability Studies, 2007. **18**(2): p. 119-153 DOI: 10.1080/13598130701709715.
39. Ericsson, K.A. and K.W. Harwell, *Deliberate Practice and Proposed Limits on the Effects of Practice on the Acquisition of Expert Performance: Why the Original Definition Matters and Recommendations for Future Research.* Frontiers in Psychology, 2019. **10**: p. 2396 DOI: 10.3389/fpsyg.2019.02396.
40. Hambrick, D.Z., et al., *Deliberate practice: Is that all it takes to become an expert?* Intelligence, 2014. **45**: p. 34-45 DOI: 10.1016/j.intell.2013.04.001.
41. Staff, T., F. Gobet, and A. Parton, *Investigating the period of practice needed to acquire expertise in Great Britain 2012 track and field Olympic athletes.* Journal of Expertise, 2020. **2**(3).
42. Sternberg, R.J., *Costs of expertise*, in *The road to excellence*. 2014, Psychology Press. p. 347-354.
43. Gegenfurtner, A., E. Lehtinen, and R. Säljö, *Expertise Differences in the Comprehension of Visualizations: a Meta-Analysis of Eye-Tracking Research in Professional Domains.* Educational Psychology Review, 2011. **23**(4): p. 523-552 DOI: 10.1007/s10648-011-9174-7.
44. Ziv, G., *Gaze behavior and visual attention: A review of eye tracking studies in aviation.* The International Journal of Aviation Psychology, 2016. **26**(3-4): p. 75-104 DOI: 10.1080/10508414.2017.1313096.

45. Brams, S., et al., *The relationship between gaze behavior, expertise, and performance: A systematic review.* Psychological Bulletin, 2019. **145**(10): p. 980-1027 DOI: 10.1037/bul0000207.
46. Kocak, E., et al., *Eye motion parameters correlate with level of experience in video-assisted surgery: objective testing of three tasks.* Journal of Laparoendoscopic and Advanced Surgical Techniques - Part A, 2005. **15**(6): p. 575-80 DOI: 10.1089/lap.2005.15.575.
47. Krupinski, E.A., A.R. Graham, and R.S. Weinstein, *Characterizing the development of visual search expertise in pathology residents viewing whole slide images.* Human Pathology, 2013. **44**(3): p. 357-64 DOI: 10.1016/j.humpath.2012.05.024.
48. Manning, D., et al., *How do radiologists do it? The influence of experience and training on searching for chest nodules.* Radiography, 2006. **12**(2): p. 134-142 DOI: 10.1016/j.radi.2005.02.003.
49. de Groot, A., F. Gobet, and R.W. Jongman, *Perception and memory in chess*. Vol. 19. 1996: Van Gorcum. 183-185.
50. Gauthier, I., M. Tarr, and D. Bub, *Perceptual expertise: Bridging brain and behavior*. 2010: OUP USA.
51. Helsen, W.F. and J.L. Starkes, *A multidimensional approach to skilled perception and performance in sport.* Applied Cognitive Psychology, 1999. **13**(1): p. 1-27 DOI: 10.1002/(SICI)1099-0720(199902)13:1<1::AID-ACP540>3.0.CO;2-T.
52. Kundel, H.L. and C.F. Nodine, *Interpreting chest radiographs without visual search.* Radiology, 1975. **116**(3): p. 527-32 DOI: 10.1148/116.3.527.
53. de Groot, A.D., *Thought and Choice in Chess*. 1978: Walter de Gruyter.
54. Simon, H.A. and W.G. Chase, *Skill in chess.* American Scientist, 1973. **61**: p. 393-403.
55. Thompson, M.B. and J.M. Tangen, *The nature of expertise in fingerprint matching: Experts can do a lot with a little.* PloS one, 2014. **9**(12): p. e114759 DOI: 10.1371/journal.pone.0114759.
56. Ericsson, K.A. and J.J. Staszewski, *Skilled memory and expertise: Mechanisms of exceptional performance*, in *Complex Information Processing*. 2013, Psychology Press. p. 255-288.
57. Nodine, C.F. and H.L. Kundel, *The Cognitive Side of Visual Search in Radiology*, in *Eye Movements from Physiology to Cognition*, J.K. O'Regan and A. Levy-Schoen, Editors. 1987, Elsevier: Amsterdam. p. 573-582.
58. Gobet, F., et al., *Chunking mechanisms in human learning.* Trends in Cognitive Sciences, 2001. **5**(6): p. 236-243 DOI: 10.1016/s1364-6613(00)01662-4.
59. Swensson, R.G., *A two-stage detection model applied to skilled visual search by radiologists.* Perception & Psychophysics, 1980. **27**(1): p. 11-16 DOI: 10.3758/bf03199899.
60. Frey, P.W. and P. Adesman, *Recall memory for visually presented chess positions.* Memory & Cognition, 1976. **4**(5): p. 541-7 DOI: 10.3758/BF03213216.
61. Dewar, K.M., L.L. Cuddy, and D. Mewhort, *Recognition memory for single tones with and without context.* Journal of Experimental Psychology: Human Learning and Memory, 1977. **3**(1): p. 60 DOI: 10.1037/0278-7393.3.1.60.
62. Gobet, F. and I. Oliver. *Memory for the random: A simulation of computer program recall*. in *Proceedings of the 38th Annual Meeting of the Cognitive Science Society, CogSci 2016*. 2016.
63. Gobet, F. and H.A. Simon, *Recall of random and distorted chess positions: implications for the theory of expertise.* Memory & Cognition, 1996. **24**(4): p. 493-503 DOI: 10.3758/bf03200937.
64. Gobet, F. and H.A. Simon, *Five seconds or sixty? Presentation time in expert memory.* Cognitive Science, 2000. **24**(4): p. 651-682 DOI: 10.1207/s15516709cog2404_4.
65. Sala, G. and F. Gobet, *Experts' memory superiority for domain-specific random material generalizes across fields of expertise: A meta-analysis.* Memory & Cognition 2017. **45**(2): p. 183-193 DOI: 10.3758/s13421-016-0663-2.

66. Gobet, F. and H.A. Simon, *Templates in chess memory: A mechanism for recalling several boards.* Cognitive Psychology, 1996. **31**(1): p. 1-40 DOI: 10.1006/cogp.1996.0011.
67. Chi, M.T.H. and R. Glaser, *Problem-solving ability*, in *Human Abilities; An Information-Processing Approach*, R.J. Sternberg, Editor. 1985.
68. Stokes, D., *On perceptual expertise.* Mind & Language, 2020. **36**(2): p. 241-263 DOI: 10.1111/mila.12270.
69. Blättler, C., et al., *Can expertise modulate representational momentum?* Visual Cognition, 2010. **18**(9): p. 1253-1273 DOI: 10.1080/13506281003737119.
70. Didierjean, A. and E. Marmèche, *Anticipatory representation of visual basketball scenes by novice and expert players.* Visual Cognition, 2017. **12**(2): p. 265-283 DOI: 10.1080/13506280444000021a.
71. Farrow, D. and B. Abernethy, *Do expertise and the degree of perception-action coupling affect natural anticipatory performance?* Perception, 2003. **32**(9): p. 1127-39 DOI: 10.1068/p3323.
72. Chi, M.T., P.J. Feltovich, and R. Glaser, *Categorization and representation of physics problems by experts and novices.* Cognitive Science, 1981. **5**(2): p. 121-152.
73. Chassy, P., et al., *Intuition in chess: a study with world-class players.* Psychological Research, 2023. **87**(8): p. 2380-2389 DOI: 10.1007/s00426-023-01823-x.
74. Gobet, F. and J.L. Borg, *The intermediate effect in clinical case recall is present in musculoskeletal physiotherapy.* Manual Therapy, 2011. **16**(4): p. 327-331 DOI: 10.1016/j.math.2010.12.003.
75. Gobet, F., A. de Voogt, and J. Retschitzki, *Moves in mind: The psychology of board games*. 2004: Psychology Press.
76. Thompson, M.B., J.M. Tangen, and R.A. Searston, *Understanding expertise and non-analytic cognition in fingerprint discriminations made by humans.* Frontiers in Psychology, 2014. **5**: p. 737 DOI: 10.3389/fpsyg.2014.00737.
77. Gobet, F. and P. Chassy, *Expertise and Intuition: A Tale of Three Theories.* Minds and Machines, 2008. **19**(2): p. 151-180 DOI: 10.1007/s11023-008-9131-5.
78. Klein, G.A., *A recognition-primed decision (RPD) model of rapid decision making.* Decision making in action: Models and methods, 1993. **5**(4): p. 138-147.
79. Klein, G., *Naturalistic decision making.* Human Factors, 2008. **50**(3): p. 456-60 DOI: 10.1518/001872008X288385.
80. Simon, H.A., *Explaining the ineffable: AI on the topics of intuition, insight and inspiration.* Proceedings of the 14th International Join Conference on Artificial Intelligence, 1995. **1**: p. 939-949.
81. Dreyfus, H. and S.E. Dreyfus, *Mind over machine*. 1986: Simon and Schuster.
82. Eberhard, J., et al., *The intermediate effect and the diagnostic accuracy in clinical case recall of students and experts in dental medicine.* European Journal of Dental Education, 2009. **13**(3): p. 128-34 DOI: 10.1111/j.1600-0579.2008.00550.x.
83. Patel, V.L. and G.J. Groen, *Knowledge based solution strategies in medical reasoning.* Cognitive Science, 1986. **10**(1): p. 91-116 DOI: 10.1016/S0364-0213(86)80010-6.
84. Rikers, R.M., H.G. Schmidt, and H.P. Boshuizen, *Knowledge Encapsulation and the Intermediate Effect.* Contemporary Educational Psychology, 2000. **25**(2): p. 150-166 DOI: 10.1006/ceps.1998.1000.
85. Drew, T., M.L.-H. Võ, and J.M. Wolfe, *The invisible gorilla strikes again: Sustained inattentional blindness in expert observers.* Psychological Science, 2013. **24**(9): p. 1848-1853 DOI: 10.1177/09567976134793.
86. Edmond, G. and K.A. Martire, *Just cognition: scientific research on bias and some implications for legal procedure and decision-making.* The Modern Law Review, 2019. **82**(4): p. 633-664 DOI: 10.1111/1468-2230.12424.

87. Gilovich, T., D. Griffin, and D. Kahneman, *Heuristics and biases: The psychology of intuitive judgment*. 2002: Cambridge University Press.
88. Growns, B. and T.M.S. Neal, *Forensic Science Decision-making: Expertise Lends Both Skills and Vulnerabilities*, in *The Cambridge Handbook of Psychology and Legal Decision-Making*, M. Miller, et al., Editors. 2024, Cambridge University Press.
89. Kahneman, D., *Thinking, fast and slow*. 2011: Macmillan.
90. Kahneman, D., O. Sibony, and C.R. Sunstein, *Noise: a flaw in human judgment*. 2021: Hachette UK.
91. Kahneman, D., P. Slovic, and A. Tversky, *Heuristics and biases.* New York, 1982.
92. Neal, T.M.S., et al., *A general model of cognitive bias in human judgment and systematic review specific to forensic mental health.* Law & Human Behavior, 2022. **46**(2): p. 99-120 DOI: 10.1037/lhb0000482.
93. Neal, T.M.S. and E. Pronin, *Measuring the Objectivity and Bias of Experts*, in *National Science Foundation Project Outcomes Report*. 2023.
94. Reyna, V.F., et al., *Developmental reversals in risky decision making: Intelligence agents show larger decision biases than college students.* Psychological Science, 2014. **25**(1): p. 76-84 DOI: 10.1177/095679761349702.
95. Reyna, V.F. and F.J. Lloyd, *Physician decision making and cardiac risk: effects of knowledge, risk perception, risk tolerance, and fuzzy processing.* Journal of Experimental Psychology: Applied, 2006. **12**(3): p. 179-95 DOI: 10.1037/1076-898X.12.3.179.
96. Tversky, A. and D. Kahneman, *Judgment under Uncertainty: Heuristics and Biases.* Science, 1974. **185**(4157): p. 1124-1131 DOI: 10.1126/science.185.4157.1124.
97. Tversky, A., D. Kahneman, and P. Slovic, *Judgment under uncertainty: Heuristics and biases*. 1982: Cambridge.
98. Anderson, J.C., D.J. Lowe, and P.M. Reckers, *Evaluation of auditor decisions: Hindsight bias effects and the expectation gap.* Journal of Economic Psychology, 1993. **14**(4): p. 711-737 DOI: 10.1016/0167-4870(93)90018-G.
99. Dawson, N.V., et al., *Hindsight bias: an impediment to accurate probability estimation in clinicopathologic conferences.* Medical Decision Making, 1988. **8**(4): p. 259-64 DOI: 10.1177/0272989X8800800406.
100. Gouvier, W.D., M. Uddo-Crane, and L.M. Brown, *Base rates of post-concussional symptoms.* Archives of Clinical Neuropsychology, 1988. **3**(3): p. 273-8 DOI: 10.1016/0887-6177(88)90019-4.
101. Neal, T.M.S., et al., *Confirmatory information seeking is robust in psychologists' diagnostic reasoning.* Law & Human Behavior, 2024 DOI: 10.1037/lhb0000574.
102. Englich, B., T. Mussweiler, and F. Strack, *Playing dice with criminal sentences: the influence of irrelevant anchors on experts' judicial decision making.* Personality and Social Psychology Bulletin, 2006. **32**(2): p. 188-200 DOI: 10.1177/0146167205282152.
103. Northcraft, G.B. and M.A. Neale, *Experts, amateurs, and real estate: An anchoring-and-adjustment perspective on property pricing decisions.* Organizational behavior and human decision processes, 1987. **39**(1): p. 84-97 DOI: 10.1016/0749-5978(87)90046-X.
104. Cooper, G.S. and V. Meterko, *Cognitive bias research in forensic science: A systematic review.* Forensic Science International, 2019. **297**: p. 35-46 DOI: 10.1016/j.forsciint.2019.01.016.
105. Dror, I.E., D. Charlton, and A.E. Peron, *Contextual information renders experts vulnerable to making erroneous identifications.* Forensic Science International, 2006. **156**(1): p. 74-8 DOI: 10.1016/j.forsciint.2005.10.017.
106. Murrie, D.C. and M.T. Boccaccini, *Adversarial allegiance among expert witnesses.* Annual Review of Law and Social Science, 2015. **11**: p. 37-55 DOI: 10.1146/annurev-lawsocsci-120814-121714.
107. Gobet, F., *The psychology of chess*. 2018: Routledge.

108. Bilalic, M., P. McLeod, and F. Gobet, *Why good thoughts block better ones: the mechanism of the pernicious Einstellung (set) effect.* Cognition, 2008. **108**(3): p. 652-61 DOI: 10.1016/j.cognition.2008.05.005.
109. Saariluoma, P., *Error in chess: the apperception-restructuring view.* Psychological Research, 1992. **54**(1): p. 17-26 DOI: 10.1007/BF01359219.
110. Sheridan, H. and E.M. Reingold, *The mechanisms and boundary conditions of the Einstellung effect in chess: evidence from eye movements.* PLoS One, 2013. **8**(10): p. e75796 DOI: 10.1371/journal.pone.0075796.
111. Walmsley, S. and A. Gilbey, *Cognitive biases in visual pilots' weather-related decision making.* Applied Cognitive Psychology, 2016. **30**(4): p. 532-543 DOI: 10.1002/acp.3225.
112. Tetlock, P.E. and D. Gardner, *Superforecasting: The art and science of prediction*. 2016: Random House.
113. Campitelli, G. and F. Gobet, *Herbert Simon's decision-making approach: Investigation of cognitive processes in experts.* Review of General Psychology, 2010. **14**(4): p. 354-364 DOI: 10.1037/a002125.
114. Voss, J.F., et al., *Problem-solving skill in the social sciences*, in *Psychology of Learning and Motivation*. 1983, Elsevier. p. 165-213.
115. Kimball, D.R. and K.J. Holyoak, *Transfer and expertise.* The Oxford Handbook of Memory, 2000: p. 109-122.
116. Singley, M.K. and J.R. Anderson, *The transfer of text-editing skill.* International Journal of Man-Machine Studies, 1985. **22**(4): p. 403-423.
117. Growns, B., et al., *Finding the perfect match: Fingerprint expertise facilitates statistical learning and visual comparison decision-making.* Journal of Experimental Psychology: Applied, 2023. **29**(2): p. 386-397 DOI: 10.1037/xap0000422.
118. Searston, R.A. and J.M. Tangen, *The style of a stranger: Identification expertise generalizes to coarser level categories.* Psychonomic Bulletin & Review, 2017. **24**(4): p. 1324-1329 DOI: 10.3758/s13423-016-1211-6.
119. Bilalic, M., P. McLeod, and F. Gobet, *Specialization effect and its influence on memory and problem solving in expert chess players.* Cognitive Psychology, 2009. **33**(6): p. 1117-43 DOI: 10.1111/j.1551-6709.2009.01030.x.
120. Chiesi, H.L., G.J. Spilich, and J.F. Voss, *Acquisition of domain-related information in relation to high and low domain knowledge.* Journal of Verbal Learning and Verbal Behavior, 1979. **18**(3): p. 257-273 DOI: 10.1016/S0022-5371(79)90146-4.
121. Rikers, R.M., et al., *The robustness of medical expertise: clinical case processing by medical experts and subexperts.* American Journal of Psychology, 2002. **115**(4): p. 609-29 DOI: 10.2307/1423529.
122. Searston, R.A. and J.M. Tangen, *Expertise with unfamiliar objects is flexible to changes in task but not changes in class.* PLoS One, 2017. **12**(6): p. e0178403 DOI: 10.1371/journal.pone.0178403.
123. Towler, A., et al., *Are forensic scientists experts?* Journal of Applied Research in Memory and Cognition, 2018. **7**(2): p. 199-208 DOI: 10.1016/j.jarmac.2018.03.010.
124. Robson, S.G., J.M. Tangen, and R.A. Searston, *The effect of expertise, target usefulness and image structure on visual search.* Cognitive Research: Principles and Implications, 2021. **6**(1): p. 16 DOI: 10.1186/s41235-021-00282-5.
125. Van de Wiel, M.W., *Examining Expertise Using Interviews and Verbal Protocols.* Frontline Learning Research, 2017. **5**(3): p. 112-140.
126. Cantou, P., et al., *How motor, cognitive and musical expertise shapes the brain: Focus on fMRI and EEG resting-state functional connectivity.* Journal of Chemical Neuroanatomy, 2018. **89**: p. 60-68 DOI: 10.1016/j.jchemneu.2017.08.003.

127. Debarnot, U., et al., *Experts bodies, experts minds: How physical and mental training shape the brain.* Frontiers in Human Neuroscience, 2014. **8** DOI: 10.3389/fnhum.2014.00280.
128. Cattell, R.B., *Abilities: Their structure, growth, and action.* 1971, New York: Houghton Mifflin.
129. Ullman, M.T., *Contributions of memory circuits to language: the declarative/procedural model.* Cognition, 2004. **92**(1-2): p. 231-70 DOI: 10.1016/j.cognition.2003.10.008.
130. Goldman, A.I., *Experts: Which Ones Should You Trust?* Philosophy and Phenomenological Research, 2001. **63**(1): p. 85-110 DOI: 10.1111/j.1933-1592.2001.tb00093.x.
131. Healy, A.F., J.A. Kole, and L.E. Bourne, *Training principles to advance expertise.* Frontiers in Psychology, 2014. **5** DOI: 10.3389/fpsyg.2014.00131.
132. Waters, A. and F. Gobet, *Trustworthy experts and untrustworthy experts: Insights from the cognitive psychology of expertise.*, in *Overcoming the myth of neutrality: Expertise for a new world*, M. Farina and A. Lavazza, Editors. 2024, Routledge: London. p. 13-28.
133. Berger, C., *Criminalistics is reasoning backwards.* Nederlands Juristenblad, 2010. **85**: p. 784-789.
134. Gustafson, A. and R.E. Rice, *A review of the effects of uncertainty in public science communication.* Public Understanding of Science, 2020. **29**(6): p. 614-633 DOI: 10.1177/0963662520942122.
135. Martin, T.G., et al., *Eliciting expert knowledge in conservation science.* Conservation Biology, 2012. **26**(1): p. 29-38 DOI: 10.1111/j.1523-1739.2011.01806.x.
136. Mehlenbacher, A.R., *On Expertise: Cultivating Character, Goodwill, and Practical Wisdom*. 2022: Penn State Press.
137. Detterman, D.K., *Introduction to the intelligence special issue on the development of expertise: is ability necessary?* Intelligence, 2014. **45**: p. 1-5 DOI: 10.1016/j.intell.2014.02.004.
138. Simonton, D.K., *Creative performance, expertise acquisition, individual differences, and developmental antecedents: An integrative research agenda.* Intelligence, 2014. **45**: p. 66-73 DOI: 10.1016/j.intell.2013.04.007.
139. Cordner, S., *R v Klamo: an example of miscommunication and misunderstanding of expert evidence where the conviction was overturned.* Australian Journal of Forensic Sciences, 2012. **44**(4): p. 323-331 DOI: 10.1080/00450618.2012.691551.
140. Mnookin, J.L., *Expert evidence, partisanship, and epistemic competence.* Brooklyn Law Review, 2007. **73**: p. 1009.
141. *Daubert v. Merrell Dow Pharmaceuticals, Inc*, in *US*. 1993, Supreme Court. p. 579.
142. Commission, L., *Expert evidence in criminal proceedings in England and Wales*. Vol. 829. 2011: The Stationery Office.
143. Edmond, G., et al., *Admissibility compared: the reception of incriminating expert evidence (ie, forensic science) in four adversarial jurisdictions.* University of Denver Criminal Law Review, 2013. **3**: p. 31.
144. Huber, P.W., *Galileo's Revenge: Junk Science In The Courtroom*. 1991: Basic Books.
145. *R. v. Mohan*. 1994.
146. *R v K-LJ*, in *2 SCR 600*. 2000.
147. Cunliffe, E. and G. Edmond, *Justice without science? Judging the reliability of forensic science in Canada.* Canadian Bar Review, 2021. **99**: p. 65.
148. Maxwell, C., *Preventing miscarriages of justice: the reliability of forensic evidence and the role of the trial judge as gatekeeper.* Australian Law Journal, 2019. **93**(8): p. 642-654.
149. Faigman, D.L., J. Monahan, and C. Slobogin, *Group to individual (G2i) inference in scientific expert testimony.* The University of Chicago Law Review, 2014: p. 417-480.
150. Hand, L., *Expert Testimony, Historical and Practical Considerations Regarding Expert Testimony.* Harvard Law Review, 1901. **15**: p. 40.

151. Caudill, D.S. and L.H. LaRue, *No magic wand: The idealization of science in law*. 2006: Rowman & Littlefield.
152. Cunliffe, E., *Murder, Medicine and Motherhood*. 2011: Bloomsbury Publishing.
153. Neal, T.M.S., et al., *Psychological assessments in legal contexts: Are courts keeping "junk science" out of the courtroom?* Psychological Science in the Public Interest, 2019. **20**(3): p. 135-164 DOI: 10.1177/15291006198888.
154. Saks, M. and J.J. Koehler, *The coming paradigm shift in forensic identification science.* Science, 2005. **309**(5736): p. 892-5 DOI: 10.1126/science.1111565.
155. Bonventre, C.L., *Wrongful convictions and forensic science.* WIREs Forensic Science, 2020. **3**(4): p. e1406 DOI: 10.1002/wfs2.1406.
156. Cole, S.A., *Forensic science and wrongful convictions: from exposer to contributor to corrector.* New England Law Review, 2011. **46**: p. 711.
157. Dioso-Villa, R., et al., *Investigation to exoneration: A systemic review of wrongful conviction in Australia.* Current Issues in Criminal Justice, 2016. **28**(2): p. 157-172 DOI: 10.1080/10345329.2016.12036066.
158. Garrett, B.L. and P.J. Neufeld, *Invalid forensic science testimony and wrongful convictions.* Virginia Law Review, 2009: p. 1-97.
159. Hamer, D. and G. Edmond, *Forensic science evidence, wrongful convictions and adversarial process.* The University of Queensland Law Journal, 2019. **38**: p. 185.
160. Hoyle, C., *Forensic science and expert testimony in wrongful convictions: a study of decision-making at the criminal cases review commission.* The British Journal of Criminology, 2019. **59**(4): p. 919-937.
161. Laporte, G., *Wrongful convictions and DNA exonerations: Understanding the role of forensic science.* National Institute of Justice Journal, 2018. **279**: p. 1-16.
162. Thompson, W.C., *Beyond bad apples: Analyzing the role of forensic science in wrongful convictions.* Southwestern University Law Review, 2008. **37**: p. 1027.
163. PCAST, 2016.
164. Campbell, A., *The Fingerprint Inquiry Report*. 2011: Fingerprint Inquiry by APS Group Scotland.
165. Goudge, S.T., *Inquiry into Pediatric forensic pathology in Ontario: Report*. 2009: Toronto.
166. Kaye, D.H., et al., *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach* in *The Report of the Expert Working Group on Human Factors in Latent Print Analysis*. 2012.
167. Committee, S.T.S., *Forensic science and the criminal justice system: a blueprint for change*, H.o. Lords, Editor. 2019: London.
168. *Diaz v US*. 2024.
169. Tetlock, P.E., *Expert political judgment*. 2017: Princeton University Press.
170. Garrett, B.L., et al., *Judges and forensic science education: A national survey.* Forensic Science International, 2021. **321**: p. 110714 DOI: 10.1016/j.forsciint.2021.110714.
171. Collins, H., *Are we all scientific experts now?* 2014: John Wiley & Sons.
172. Dillon, *Expertise on Trial.* The Columbia Science & Technology Law Review, 2018. **19**(247) DOI: 10.7916/aztb-9v23.
173. Nichols, T., *The death of expertise: The campaign against established knowledge and why it matters*. 2017: Oxford University Press.
174. Walton, D., *Appeal to expert opinion: Arguments from authority*. 2010: Penn State Press.
175. Chi, M.T., *Two approaches to the study of experts' characteristics.* The Cambridge Handbook of Expertise and Expert Performance, 2006: p. 21-30.
176. Edmond, G., et al., *How to cross-examine forensic scientists: a guide for lawyers.* Australian Bar Review, 2014. **39**(174).

177. Evans, K.K., et al., *The gist of the abnormal: above-chance medical decision making in the blink of an eye.* Psychonomic Bulletin & Review, 2013. **20**(6): p. 1170-5 DOI: 10.3758/s13423-013-0459-3.
178. Hammond, K.R., et al., *Direct comparison of the efficacy of intuitive and analytical cognition in expert judgment.* IEEE Transactions on systems, man, and cybernetics, 1987. **17**(5): p. 753-770.
179. Nisbett, R.E. and T.D. Wilson, *Telling more than we can know: Verbal reports on mental processes.* Psychological Review, 1977. **84**(3): p. 231 DOI: 10.1037/0033-295X.84.3.231.
180. Proctor, R.W. and A. Dutta, *Skill acquisition and human performance*. 1995: Sage Publications, Inc.
181. Pronin, E., *The introspection illusion.* Advances in Experimental Social Psychology, 2009. **41**: p. 1-67 DOI: 10.1016/S0065-2601(08)00401-2.
182. Neal, T.M.S., et al., *The Law Meets Psychological Expertise: Eight Best Practices to Improve Forensic Psychological Assessment.* Annual Review of Law and Social Science, 2022. **18**(1): p. 169-192 DOI: 10.1146/annurev-lawsocsci-050420-010148.
183. Chase, W.G. and H.A. Simon, *Perception in chess.* Cognitive Psychology, 1973. **4**(1): p. 55-81 DOI: https://doi.org/10.1016/0010-0285(73)90004-2.
184. Simon, H.A., *What is an "Explanation" of Behavior?* Psychological Science, 1992. **3**(3): p. 150-161 DOI: 10.1111/j.1467-9280.1992.tb00017.x.
185. Edmond, G., et al., *Forensic Science Evidence and the Limits of Cross-Examination.* Melbourne University Law Review, 2019. **42**(3): p. 858-920.
186. Neal, T.M.S., M. Sellbom, and C. de Ruiter, *Personality Assessment in Legal Contexts: Introduction to the Special Issue.* Journal of Personality Assessment, 2022. **104**(2): p. 127-136 DOI: 10.1080/00223891.2022.2033248.
187. Kukucka, J., et al., *Cognitive bias and blindness: A global survey of forensic science examiners.* Journal of Applied Research in Memory and Cognition, 2017. **6**(4): p. 452-459 DOI: 10.1016/j.jarmac.2017.09.001.
188. Neal, T.M.S. and S.L. Brodsky, *Forensic psychologists' perceptions of bias and potential correction strategies in forensic mental health evaluations.* Psychology, Public Policy, and Law, 2016. **22**(1): p. 58 DOI: 10.1037/law0000077.
189. Christensen, A.M., et al., *Error and its meaning in forensic science.* Journal of Forensic Sciences, 2014. **59**(1): p. 123-6 DOI: 10.1111/1556-4029.12275.
190. Thompson, W.C. and N. Scurich, *How Cross-Examination on Subjectivity and Bias Affects Jurors' Evaluations of Forensic Science Evidence.* Journal of Forensic Sciences, 2019. **64**(5): p. 1379-1388 DOI: 10.1111/1556-4029.14031.
191. Crozier, W.E., J. Kukucka, and B.L. Garrett, *Juror appraisals of forensic evidence: Effects of blind proficiency and cross-examination.* Forensic Science International, 2020. **315**: p. 110433 DOI: 10.1016/j.forsciint.2020.110433.
192. Hogarth, R.M., T. Lejarraga, and E. Soyer, *The Two Settings of Kind and Wicked Learning Environments.* Current Directions in Psychological Science, 2015. **24**(5): p. 379-385 DOI: 10.1177/0963721415591878.
193. Bonner, C., et al., *Current Best Practice for Presenting Probabilities in Patient Decision Aids: Fundamental Principles.* Medical Decision Making, 2021. **41**(7): p. 821-833 DOI: 10.1177/0272989X21996328.
194. Budescu, D.V., H.-H. Por, and S.B. Broomell, *Effective communication of uncertainty in the IPCC reports.* Climatic Change, 2012. **113**: p. 181-200 DOI: 10.1007/s10584-011-0330-3.
195. Budescu, D.V., et al., *The interpretation of IPCC probabilistic statements around the world.* Nature Climate Change, 2014. **4**(6): p. 508-512 DOI: 10.1038/nclimate2194.
196. Dhami, M.K. and D.R. Mandel, *Words or numbers? Communicating probability in intelligence analysis.* American Psychologist, 2021. **76**(3): p. 549-560 DOI: 10.1037/amp0000637.

197. Spiegelhalter, D., *Risk and uncertainty communication.* Annual Review of Statistics and Its Application, 2017. **4**: p. 31-60.
198. Visschers, V.H.M., et al., *Probability information in risk communication: a review of the research literature.* Risk Analysis, 2009. **29**(2): p. 267-87 DOI: 10.1111/j.1539-6924.2008.01137.x.
199. Eldridge, H., *Juror comprehension of forensic expert testimony: A literature review and gap analysis.* Forensic Science International: Synergy, 2019. **1**: p. 24-34 DOI: 10.1016/j.fsisyn.2019.03.001.
200. Hilton, N.Z., N. Scurich, and L.-M. Helmus, *Communicating the risk of violent and offending behavior: review and introduction to this special issue.* Behavioral Sciences & the Law, 2015. **33**(1): p. 1-18 DOI: 10.1002/bsl.2160.
201. Martire, K.A. and G. Edmond, *How well do lay people comprehend statistical statements from forensic scientists*, in *Handbook of Forensic Statistics*, D.L. Banks, et al., Editors. 2020, Chapman Hall/CRC: New York. p. 201-224.
202. Howes, L.M., *The communication of forensic science in the criminal justice system: A review of theory and proposed directions for research.* Science & Justice, 2015. **55**(2): p. 145-54 DOI: 10.1016/j.scijus.2014.11.002.
203. Howes, L.M. and N. Kemp, *Discord in the Communication of Forensic Science.* Journal of Language and Social Psychology, 2016. **36**(1): p. 96-111 DOI: 10.1177/0261927x16663589.
204. McQuiston-Surrett, D. and M. Saks, *The testimony of forensic identification science: what expert witnesses say and what factfinders hear.* Law & Human Behavior, 2009. **33**(5): p. 436-53 DOI: 10.1007/s10979-008-9169-1.
205. Martire, K.A., R.I. Kemp, and B.R. Newell, *The psychology of interpreting expert evaluative opinions.* Australian Journal of Forensic Sciences, 2013. **45**(3): p. 305-314 DOI: 10.1080/00450618.2013.784361.
206. Martire, K.A., et al., *On the interpretation of likelihood ratios in forensic science evidence: Presentation formats and the weak evidence effect.* Forensic Science International, 2014. **240**: p. 61-8 DOI: 10.1016/j.forsciint.2014.04.005.
207. Martire, K.A., et al., *The expression and interpretation of uncertain forensic science evidence: verbal equivalence, evidence strength, and the weak evidence effect.* Law & Human Behavior, 2013. **37**(3): p. 197-207 DOI: 10.1037/lhb0000027.
208. Martire, K.A. and I. Watkins, *Perception problems of the verbal scale: A reanalysis and application of a membership function approach.* Science & Justice, 2015. **55**(4): p. 264-73 DOI: 10.1016/j.scijus.2015.01.002.
209. Bali, A.S., et al., *Communicating forensic science opinion: An examination of expert reporting practices.* Science & Justice, 2020. **60**(3): p. 216-224 DOI: 10.1016/j.scijus.2019.12.005.
210. Howes, L.M., et al., *Forensic scientists' conclusions: how readable are they for non-scientist report-users?* Forensic Science International, 2013. **231**(1-3): p. 102-12 DOI: 10.1016/j.forsciint.2013.04.026.
211. Spellman, B.A., *Communicating Forensic Evidence: Lessons from Psychological Science.* Seton Hall Law Review, 2017. **48**(3): p. 827-840.
212. Bullock, O.M., et al., *Jargon as a barrier to effective science communication: Evidence from metacognition.* Public Understanding of Science, 2019. **28**(7): p. 845-853 DOI: 10.1177/0963662519865687.
213. Shulman, H.C., et al., *The Effects of Jargon on Processing Fluency, Self-Perceptions, and Scientific Engagement.* Journal of Language and Social Psychology, 2020. **39**(5-6): p. 579-597 DOI: 10.1177/0261927x20902177.
214. Auld, L.J., *A Review of the Criminal Courts of England and Wales*. 2001.
215. Edmond, G., K.A. Martire, and M.S. Roque, *Expert reports and the forensic sciences.* The University of New South Wales Law Journal, 2017. **40**(2): p. 590-637.

216. Edmond, G., et al., *A warning about judicial directions and warnings.* The Adelaide Law Review, 2023. **44**(1): p. 194-245 DOI: 10.3316/informit.381424200872796.
217. Krauss, D.A. and D.H. Lee, *Deliberating on dangerousness and death: jurors' ability to differentiate between expert actuarial and clinical predictions of dangerousness.* International Journal of Law and Psychiatry, 2003. **26**(2): p. 113-37 DOI: 10.1016/s0160-2527(02)00211-x.
218. Krauss, D.A. and B.D. Sales, *The effects of clinical and scientific expert testimony on juror decision making in capital sentencing.* Psychology, Public Policy, and Law, 2001. **7**(2): p. 267-310 DOI: 10.1037/1076-8971.7.2.267.
219. Levett, L.M. and M.B. Kovera, *The effectiveness of opposing expert witnesses for educating jurors about unreliable expert evidence.* Law and Human Behavior, 2008. **32**(4): p. 363 DOI: 10.1007/s10979-007-9113-9.
220. Findley, K.A., *Innocents at risk: Adversary imbalance, forensic science, and the search for truth.* Seton Hall Law Review, 2008. **38**: p. 893.
221. Freckelton, I., et al., *Expert Evidence and Criminal Jury Trials*. 2016: Oxford University Press.
222. Giannelli, P.C., *The Right to Defense Experts.* Criminal Justice, 2003. **18**(2): p. 15-22.
223. Baguley, C.M., B.M. McKimmie, and B.M. Masser, *Deconstructing the simplification of jury instructions: How simplifying the features of complexity affects jurors' application of instructions.* Law and Human Behavior, 2017. **41**(3): p. 284 DOI: 10.1037/lhb0000234.
224. Marder, N.S., *Bringing jury instructions into the twenty-first century.* Notre Dame Law Review, 2005. **81**: p. 449.
225. Severance, L.J. and E.F. Loftus, *Improving the ability of jurors to comprehend and apply criminal jury instructions.* Law & Society Review, 1982. **17**: p. 153.
226. Steele Jr, W.W. and E.G. Thornburg, *Jury instructions: A persistent failure to communicate.* North Carolina Law Review, 1988. **67**: p. 77.
227. McKimmie, B.M., E. Antrobus, and C. Baguley, *Objective and subjective comprehension of jury instructions in criminal trials.* New Criminal Law Review, 2014. **17**(2): p. 163-183.
228. Martire, K.A. and R.I. Kemp, *The impact of eyewitness expert evidence and judicial instruction on juror ability to evaluate eyewitness testimony.* Law & Human Behavior, 2009. **33**(3): p. 225-36 DOI: 10.1007/s10979-008-9134-z.
229. Kleider-Offutt, H.M., A.M. Clevinger, and A.D. Bond, *Working memory and cognitive load in the legal system: Influences on police shooting decisions, interrogation and jury decisions.* Journal of Applied Research in Memory and Cognition, 2016. **5**(4): p. 426-433 DOI: 10.1016/j.jarmac.2016.04.008.
230. Slavich, G.M. and P.G. Zimbardo, *Transformational Teaching: Theoretical Underpinnings, Basic Principles, and Core Methods.* Educational Psychology Review, 2012. **24**(4): p. 569-608 DOI: 10.1007/s10648-012-9199-6.
231. Hans, V.P. and N. Vidmar, *Judging the jury*. 2013: Springer.
232. Rosenhan, D.L., S.L. Eisner, and R.J. Robinson, *Notetaking can aid juror recall.* Law and Human Behavior, 1994. **18**(1): p. 53-61 DOI: 10.1007/bf01499143.
233. ForsterLee, L., et al., *The bottom line: the effect of written expert witness statements on juror verdicts and information processing.* Law & Human Behavior, 2000. **24**(2): p. 259-70 DOI: 10.1023/a:1005415104323.
234. Thorley, C., R.E. Baxter, and J. Lorek, *The impact of note taking style and note availability at retrieval on mock jurors' recall and recognition of trial information.* Memory, 2016. **24**(4): p. 560-74 DOI: 10.1080/09658211.2015.1031250.
235. *Tootle v The Queen*. 2017, New South Wales Court of Criminal Appeal.
236. Pennington, N. and R. Hastie, *Explaining the evidence: Tests of the Story Model for juror decision making.* Journal of Personality and Social Psychology, 1992. **62**(2): p. 189-206 DOI: 10.1037/0022-3514.62.2.189.

237. Costabile, K.A. and S.B. Klein, *Finishing Strong: Recency Effects in Juror Judgments.* Basic and Applied Social Psychology, 2010. **27**(1): p. 47-58 DOI: 10.1207/s15324834basp2701_5.
238. Pritchard, M.E. and J.M. Keenan, *Memory monitoring in mock jurors.* Journal of Experimental Psychology: Applied, 1999. **5**(2): p. 152 DOI: 10.1037/1076-898X.5.2.152.
239. Chin, J.M. and S. Dallen, *R v. Awer and the Dangers of Science in Sheep's Clothing.* Criminal Law Quarterly, 2016. **63**: p. 527.
240. Edmond, G., E. Cunliffe, and D. Hamer, *Fingerprint Comparison and Adversarialism: The Scientific and Historical Evidence.* The Modern Law Review, 2020. **83**(6): p. 1287-1327 DOI: 10.1111/1468-2230.12565.
241. Brewer, S., *Scientific expert testimony and intellectual due process.* Yale Law Journal, 1997. **107**: p. 1535 DOI: 10.2307/797336.
242. Collins, H.M. and R. Evans, *Rethinking Expertise*. 2007, Chicago: University of Chicago Press.
243. White, D., et al., *Passport officers' errors in face matching.* PLoS One, 2014. **9**(8): p. e103510 DOI: 10.1371/journal.pone.0103510.
244. Collins, H.M. and R. Evans, *The third wave of science studies: Studies of expertise and experience*, in *The Philosophy of Expertise*, E. Selinger and R.P. Crease, Editors. 2006, Columbia University Press.
245. Martire, K., et al., *Observability x Diagnosticity Tradeoffs Affecting Cue-Based Evaluations of Expertise*. 2024: PsyArXiv DOI: 10.31234/osf.io/bcdyw.
246. Cramer, R.J., et al., *The Observed Witness Efficacy Scale: a measure of effective testimony skills.* Journal of Applied Social Psychology, 2013. **43**(8): p. 1696-1703 DOI: 10.1111/jasp.12124.
247. McCarthy Wilcox, A. and N. NicDaeid, *Jurors' perceptions of forensic science expert witnesses: Experience, qualifications, testimony style and credibility.* Forensic Science International, 2018. **291**: p. 100-108 DOI: 10.1016/j.forsciint.2018.07.030.
248. Brodsky, S.L., M.P. Griffin, and R.J. Cramer, *The Witness Credibility Scale: an outcome measure for expert witness research.* Behavioral Sciences & the Law, 2010. **28**(6): p. 892-907.
249. Goldberg, L.R., *Simple models or simple processes? Some research on clinical judgments.* American Psychologist, 1968. **23**(7): p. 483 DOI: 10.1037/h0026206.
250. Brodsky, S.L., et al., *Credibility in the courtroom: How likeable should an expert witness be?* Journal of the American Academy of Psychiatry and the Law, 2009. **37**(4): p. 525-532.
251. Neal, T.M.S., et al., *Warmth and competence on the witness stand: implications for the credibility of male and female expert witnesses.* Journal of the American Academy of Psychiatry and the Law, 2012. **40**(4): p. 488-97.
252. Younan, M. and K.A. Martire, *Likeability and Expert Persuasion: Dislikeability Reduces the Perceived Persuasiveness of Expert Evidence.* Frontiers in Psychology, 2021. **12**: p. 785677 DOI: 10.3389/fpsyg.2021.785677.
253. McKimmie, B.M., et al., *Jurors' responses to expert witness testimony: The effects of gender stereotypes.* Group Processes & Intergroup Relations, 2004. **7**(2): p. 131-143.
254. Neal, T.M.S., *Women as expert witnesses: a review of the literature.* Behavioral Sciences & the Law, 2014. **32**(2): p. 164-79 DOI: 10.1002/bsl.2113.
255. Chaiken, S., *The Heuristic Model of Persuasion*, in *Social Influence*. 2014, Psychology Press. p. 3-39.
256. Petty, R.E. and J.T. Cacioppo, *The effects of involvement on responses to argument quantity and quality: Central and peripheral routes to persuasion.* Journal of Personality and Social Psychology, 1984. **46**(1): p. 69-81 DOI: 10.1037/0022-3514.46.1.69.
257. Reimer, T., R. Mata, and M. Stoecklin, *The use of heuristics in persuasion: Deriving cues on source expertise from argument quality.* Current Research in Social Psychology, 2004. **10**(6): p. 69-84.

258. SanJose-Cabezudo, R., A.M. Gutierrez-Arranz, and J. Gutierrez-Cillan, *The combined influence of central and peripheral routes in the online persuasion process.* CyberPsychology & Behavior, 2009. **12**(3): p. 299-308 DOI: 10.1089/cpb.2008.0188.
259. Bornstein, B.H. and E. Greene, *Jury Decision Making: Implications For and From Psychology.* Current Directions in Psychological Science, 2011. **20**(1): p. 63-67 DOI: 10.1177/0963721410397282.
260. Chaiken, S., *Heuristic versus systematic information processing and the use of source versus message cues in persuasion.* Journal of Personality and Social Psychology, 1980. **39**(5): p. 752-766 DOI: 10.1037/0022-3514.39.5.752.
261. Cooper, J., E.A. Bennett, and H.L. Sukel, *Complex scientific testimony: How do jurors make decisions?* Law and Human Behavior, 1996. **20**(4): p. 379-394 DOI: 10.1007/bf01498976.
262. Curley, L.J., J. Munro, and I.E. Dror, *Cognitive and human factors in legal layperson decision making: Sources of bias in juror decision making.* Medicine, Science and the Law, 2022. **62**(3): p. 206-215 DOI: 10.1177/00258024221080655.
263. Daftary-Kapur, T., R. Dumas, and S.D. Penrod, *Jury decision-making biases and methods to counter them.* Legal and Criminological Psychology, 2011. **15**(1): p. 133-154 DOI: 10.1348/135532509x465624.
264. Heuer, L. and S. Penrod, *Trial complexity: A field investigation of its meaning and its effects.* Law and Human Behavior, 1994. **18**(1): p. 29-51 DOI: 10.1007/bf01499142.
265. Ivković, S.K. and V.P. Hans, *Jurors' Evaluations of Expert Testimony: Judging the Messenger and the Message.* Law & Social Inquiry, 2003. **28**(2): p. 441-482 DOI: 10.1111/j.1747-4469.2003.tb00198.x.
266. Lord, C.G. and C.A. Taylor, *Biased assimilation: Effects of assumptions and expectations on the interpretation of new evidence.* Social and Personality Psychology Compass, 2009. **3**(5): p. 827-841 DOI: 10.1111/j.1751-9004.2009.00203.x.
267. Maeder, E.M., et al., *Jurors' perceptions of scientific testimony: The role of gender and testimony complexity in trials involving DNA evidence.* Cogent Psychology, 2016. **3**(1): p. 1264657 DOI: 10.1080/23311908.2016.1264657.
268. Schuller, R.A., D. Terry, and B. McKimmie, *The Impact of Expert Testimony on Jurors' Decisions: Gender of the Expert and Testimony Complexity1.* Journal of Applied Social Psychology, 2005. **35**(6): p. 1266-1280 DOI: 10.1111/j.1559-1816.2005.tb02170.x.
269. Shuman, D.W., A. Champagne, and E. Whitaker, *Assessing the believability of expert witnesses: Science in the jurybox.* Jurimetrics, 1996. **37**: p. 23.
270. Shuman, D.W., E. Whitaker, and A. Champagne, *An empirical examination of the use of expert witnesses in the courts-Part II: a three city study.* Jurimetrics, 1993. **34**: p. 193.
271. Simon, D. and S.J. Read, *Toward a General Framework of Biased Reasoning: Coherence-Based Reasoning.* Perspectives on Psychological Science, 2023: p. 17456916231204579 DOI: 10.1177/17456916231204579.
272. Edmond, G., *Latent justice? A review of adversarial challenges to fingerprint evidence.* Science & Justice, 2022. **62**(1): p. 21-29 DOI: https://doi.org/10.1016/j.scijus.2021.10.006.
273. Kukucka, J., et al., *The impact of evidence lineups on fingerprint expert decisions.* Applied Cognitive Psychology, 2020. **34**(5): p. 1143-1153 DOI: 10.1002/acp.3703.
274. Quigley-McBride, A., *Practical Solutions to Forensic Contextual Bias.* Zeitschrift für Psychologie, 2020. **228**(3): p. 162-174 DOI: 10.1027/2151-2604/a000409.
275. Merton, R.K., *The normative structure of science.* The sociology of science: Theoretical and empirical investigations, 1979: p. 267-278.
276. Moher, D., et al., *The Hong Kong Principles for assessing researchers: Fostering research integrity.* PLoS Biololgy, 2020. **18**(7): p. e3000737 DOI: 10.1371/journal.pbio.3000737.

277. Nosek, B.A., J.R. Spies, and M. Motyl, *Scientific Utopia: II. Restructuring Incentives and Practices to Promote Truth Over Publishability.* Perspectives on Psychological Science, 2012. **7**(6): p. 615-31 DOI: 10.1177/1745691612459058.
278. Betz, G., *Why the argument from inductive risk doesn't justify incorporating non-epistemic values in scientific reasoning*, in *Current Controversies in Values and Science*. 2017, Routledge. p. 94-110.
279. Elliott, K.C., *A Taxonomy of Transparency in Science.* Canadian Journal of Philosophy, 2020. **52**(3): p. 342-355 DOI: 10.1017/can.2020.21.
280. Farina, M., A. Lavazza, and D. Pritchard, *Expertise: Philosophical Perspectives*. 2024: Oxford University Press.
281. Koppl, R., *Expert failure*. 2018: Cambridge University Press.
282. Oreskes, N., *Why trust science?* The University Center for Human Values Series. 2021: Princeton University Press.
283. Chin, J.M. and C.M. Ibaviosa, *Beyond CSI: Calibrating public beliefs about the reliability of forensic science through openness and transparency.* Science & Justice, 2022. **62**(3): p. 272-283 DOI: 10.1016/j.scijus.2022.02.006.
284. Weinberg, A.M., *Science and trans-science.* Science, 1972. **177**(4045): p. 211 DOI: 10.1126/science.177.4045.211.
285. Mnookin, J.L., *The uncertain future of forensic science.* Daedalus, 2018. **147**(4): p. 99-118.
286. Walton, D. and N. Zhang, *An argumentation interface for expert opinion evidence.* Ratio Juris, 2016. **29**(1): p. 59-82.
287. Martire, K.A., G. Edmond, and D. Navarro, *Exploring juror evaluations of expert opinions using the Expert Persuasion Expectancy framework.* Legal and Criminological Psychology, 2020. **25**(2): p. 90-110 DOI: 10.1111/lcrp.12165.
288. Robson, S.G., et al., *People Who Believe Implausible Claims are not Cognitive Misers: Evidence from Evaluation Tasks.* in press.
289. LaBat, D.E., et al., *Improving juror assessments of forensic testimony and its effects on decision-making and evidence evaluation.* Law and Human Behavior, 2023. **47**(5): p. 566-578 DOI: 10.1037/lhb0000539.
290. Bishop, D., *Rein in the four horsemen of irreproducibility.* Nature, 2019. **568**(7753): p. 435 DOI: 10.1038/d41586-019-01307-2.
291. Ballantyne, K.N., G. Edmond, and B. Found, *Peer review in forensic science.* Forensic Science International, 2017. **277**: p. 66-76 DOI: 10.1016/j.forsciint.2017.05.020.
292. Carr, S., E. Piasecki, and A. Gallop, *Demonstrating reliability through transparency: A scientific validity framework to assist scientists and lawyers in criminal proceedings.* Forensic Science International, 2020. **308**: p. 110110 DOI: 10.1016/j.forsciint.2019.110110.
293. Chin, J.M., G. Ribeiro, and A. Rairden, *Open forensic science.* Journal of Law and the Biosciences, 2019. **6**(1): p. 255-288 DOI: 10.1093/jlb/lsz009.
294. Searston, R.A. and J.M. Chin, *The legal and scientific challenge of black box expertise.* The University of Queensland Law Journal, 2019. **38**(2): p. 237-260.
295. Earwaker, H., et al., *A cultural change to enable improved decision-making in forensic science: A six phased approach.* Science & Justice, 2020. **60**(1): p. 9-19 DOI: 10.1016/j.scijus.2019.08.006.
296. Edmond, G., et al., *Model forensic science.* Australian Journal of Forensic Sciences, 2016. **48**(5): p. 496-537 DOI: 10.1080/00450618.2015.1128969.
297. Edmond, G., S. Carr, and E. Piasecki, *Science friction: Streamlined forensic reporting, reliability and justice.* Oxford Journal of Legal Studies, 2018. **38**(4): p. 764-792 DOI: 10.1093/ojls/gqy025.
298. Edmond, G., et al., *Forensic science evidence and the limits of cross-examination.* Melbourne University Law Review, 2018. **42**: p. 858.

299. Gelman, A. and E. Loken, *The garden of forking paths: Why multiple comparisons can be a problem, even when there is no "fishing expedition" or "p-hacking" and the research hypothesis was posited ahead of time.* Department of Statistics, Columbia University, 2013. **348**: p. 1-17.
300. Georgiou, N., R. Morgan, and J. French, *Conceptualising, evaluating and communicating uncertainty in forensic science: Identifying commonly used tools through an interdisciplinary configurative review.* Science & Justice, 2020. **60**(4): p. 313-336 DOI: 10.1016/j.scijus.2020.04.002.
301. Sjerps, M.J. and C.E. Berger, *How clear is transparent? Reporting expert reasoning in legal cases.* Law, probability and risk, 2012. **11**(4): p. 317-329 DOI: 10.1093/lpr/mgs017.
302. Wagenmakers, E.-J., et al., *An Agenda for Purely Confirmatory Research.* Perspectives on Psychological Science, 2012. **7**(6): p. 632-8 DOI: 10.1177/1745691612463078.
303. Chin, J.M., H.J. Cullen, and B. Clarke, *The prejudices of expert evidence.* Monash University Law Review, 2022. **48**(2): p. 59-96 DOI: 10.3316/informit.935723515586202.
304. Galante, N., et al., *Applications of artificial intelligence in forensic sciences: C urrent potential benefits, limitations and perspectives.* International Journal of Legal Medicine, 2023. **137**(2): p. 445-458 DOI: 10.1007/s00414-022-02928-5.
305. El Zini, J., et al. *Towards a deep learning question-answering specialized chatbot for objective structured clinical examinations*. in *2019 International Joint Conference on Neural Networks (IJCNN)*. 2019. IEEE. 10.1109/IJCNN.2019.8851729.
306. Androutsopoulou, A., et al., *Transforming the communication between citizens and government through AI-guided chatbots.* Government Information Quarterly, 2019. **36**(2): p. 358-367 DOI: 10.1016/j.giq.2018.10.001.
307. Hunter, D., M. Bagaric, and N. Stobbs, *A framework for the efficient and ethical use of artificial intelligence in the criminal justice system.* Florida State University Law Review, 2019. **47**: p. 749.
308. Edmond, G., et al., *Facial recognition and image comparison evidence: Identification by investigators, familiars, experts, super-recognisers and algorithms.* Melbourne University Law Review, 2021. **45**: p. 99.
309. Edmond, G. and A. Roberts, *The law commission's report on expert evidence in criminal proceedings*, in *Expert Evidence and Scientific Proof in Criminal Trials*. 2017, Routledge. p. 533-551.
310. Steiner-Dillon, J.R., *Epistemic Exceptionalism.* Indiana Law Review, 2019. **52**(2): p. 207-256.
311. Dror, I.E., et al., *Letter to the Editor- Context Management Toolbox: A Linear Sequential Unmasking (LSU) Approach for Minimizing Cognitive Bias in Forensic Decision Making.* Journal of Forensic Sciences, 2015. **60**(4): p. 1111-2 DOI: 10.1111/1556-4029.12805.
312. Krane, D., et al., *Sequential unmasking: a means of minimizing observer effects in forensic DNA interpretation.* Journal of Forensic Sciences, 2008. **53**(4): p. 1006-7 DOI: 10.1111/j.1556-4029.2008.00787.x.
313. Lilienfeld, S.O., R. Ammirati, and K. Landfield, *Giving debiasing away: Can psychological research on correcting cognitive errors promote human welfare?* Perspectives on Psychological Science, 2009. **4**(4): p. 390-398 DOI: 10.1111/j.1745-6924.2009.01144.x.
314. Robertson, C.T. and A.S. Kesselheim, *Blinding as a solution to bias: Strengthening biomedical science, forensic science, and law*. 2016: Academic Press.
315. Vuille, J., *Admissibility and appraisal of scientific evidence in continental European criminal justice systems: past, present and future.* Australian Journal of Forensic Sciences, 2013. **45**(4): p. 389-397 DOI: 10.1080/00450618.2012.738248.

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Declaration of competing interest

The authors have no competing interests to disclose.