Cognitive Bias and Its Impact on Expert Witnesses and the Court

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Expert evidence provides a much-needed contribution to the courts in administering justice. Understanding the way humans think and how the brain processes information offers insights into circumstances in which even expert evidence may be influenced by contextual information and cognitive bias. Cognitive science can identify such potential weaknesses and suggest practical ways to mitigate them.

Courts rely on expert witnesses and mostly assume that they provide impartial and objective evidence. Yet cognitive science shows that even the most dedicated and committed experts are influenced, without even realizing it, by factors unrelated to the data relevant to form their expert conclusions. For example, it has been demonstrated that experts' conclusions on whether crime scene evidence was left by a specific person were influenced by whether they were told that the suspect confessed or, alternatively, that the suspect probably did not commit the crime because he has an alibi. Since juries and judges often depend on reports and testimony from experts, it is important to understand the limits and potential vulnerabilities of those witnesses. At the same time it is critical to find ways to increase and improve the contribution experts make to the fact-finding process.

This article will review and summarize the relevant science, discuss how other nations have responded to this problem, and address how the issue of cognitive bias might be confronted in criminal proceedings in this country.

Human Cognition and Expertise

Our brains have limited capacity, but they are nevertheless very effective and efficient. This is because they are not passive but instead actively use context and expectation to determine which information to process and how to process it. The human mind is not a camera but rather selects "parts of a picture" on which to focus. Complex cognitive mechanisms are involved in the way in which humans perceive and interpret information, make judgments, and reach decisions.

These cognitive mechanisms stand at the heart of intelligence and expertise. Paradoxically, as people become experts, their brains change and develop very useful capacities, but these very mechanisms can also increase the susceptibility to bias. For example, the cognitive underpinning of expertise entails filtering information, generating ideas and expectations, focusing on certain elements, and using past experience to guide attention and interpretation. Filtering and other cognitive processes allow experts to possess superior abilities, but sometimes at a cost of missing

and ignoring important information, fixation and escalation of commitment, and bias.[1] These cognitive trade-offs are characteristic of experts across domains, be it medical professionals, forensic examiners, military fighter pilots, or police officers.

Cognitive science research demonstrates that judgments are shaped by a broad range of factors. For example, expectation or hope can cause tunnel vision by directing attention selectively toward certain information while ignoring other important facts.[2] Similarly, context, motivation, and emotions can distort perception and judgments.[3] And starting with an idea or hypothesis can cause experts to fixate and escalate cognitive commitment so much so that they do not objectively and properly consider other alternatives or identify mistakes.[4]

People, for example, judge facial similarity between two individuals as higher when they are made to believe that the two are genetically related,[5] or similarity between a facial composite and a suspect as higher when they believe the suspect is guilty.[6] In other words, a mere expectation can bias the cognitive and brain mechanisms involved in perception and judgment.

It is very important to note that cognitive biases work without awareness, so biased experts may think and be incorrectly convinced that they are objective, and be unjustifiably confident in their conclusions.[7]

Experts in the Courtroom

Experts provide important and valuable contributions to the criminal justice system. Their testimony carries significant weight because they generally appear (and present themselves) as objective, impartial, and scientific. The justice system, however, must make sure that courts are provided with the very best scientific and expert evidence and that it is correctly understood and utilized by the factfinders.

One set of concerns relates to experts who may overstate the evidence.[8] This can occur for two main reasons. First, experts may be overconfident and overestimate their own abilities. This results from metacognition: the ability to "know what you know and know what you do not know"—which is an area that humans are not especially good at. Second, although experts share an understanding that it is their duty to be independent and uninfluenced by the exigencies of litigation, and to be objective and unbiased,[9] experts are most often recruited by one side of the adversarial system and work within the team and objectives of that side.[10] This places many experts in a non-neutral environment and posture, and can subconsciously influence their perception and judgments.[11]

Another set of concerns is that in most domains, expert evidence is not purely objective and scientific. For example, the domain may not have sufficiently detailed methodologies and objective quantification instrumentation.[12] Therefore most "expert" evidence relies on interpretation and judgment and includes subjective elements.[13] Take, for example, forensic science. Most forensic disciplines require human examiners to compare two patterns, one from the crime scene and one from a suspect. These may be shoe or tire marks, fingerprints, a CCTV image, handwriting, or marks on fired cartridge cases. Because the pattern from the crime scene and that from the suspect are never identical (even when they are from the same source), it is the human examiner who needs to determine if they are "sufficiently similar" to conclude that they come from the same source. Subjectivity is required because there are no objective criteria that specify what constitutes "sufficient similarity." It is left to the human examiner—the main "instrument of analysis"—to judge the similarity and to subjectively determine whether the evidence is "sufficiently similar."[14]

Fingerprinting—powerful expert evidence—has been shown to be susceptible to bias. For example, research has demonstrated that when the same evidence is presented to the same examiner but within different extraneous contexts, the examiner may reach different conclusions. Information irrelevant to the science of fingerprinting (such as whether the suspect confessed to the crime, what the detective thinks, etc.) can influence the way fingerprint examiners perceive the similarity between the prints and the conclusions they reach.[15]

Similar findings have been found in other forensic domains, such as in DNA mixture interpretation.[16] The Court of Appeal in England and Wales has recently determined that there is no objective standard in determining "excluded" or "cannot

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be excluded" from a DNA mixture, and that as a result "[a]n evaluative opinion would necessarily in such cases be subjective."[17] With subjectivity, the potential impact of extraneous influences is greater. As the Court of Appeal states, however, "that does not mean that it should not be admitted provided that there is a reliable scientific basis for it."[18] As long as subjectivity is involved, admitting the evidence with full information to the factfinder regarding the subjectivity and its vulnerability to cognitive bias could be the best way forward.

If such issues arise with DNA experts, we can be quite confident that they apply equally (if not more) to other less established or less scientific forensic domains.[19] Indeed, the United Kingdom Forensic Science Regulator recently concluded that "cognitive bias (also referred to as contextual bias or observer effects) is an issue that is relevant to forensic science,"[20] and similar findings were reached by the U.S. National Institute of Standards and Technology (NIST).[21]

These issues are relevant to many other domains in which the court relies on experts, such as medical expert evidence on shaken baby syndrome. Any expert or scientific domain that requires interpretation, or in which the human examiner is the instrument of analysis (or part of it), is subject to contextual influences that may affect and bias perception and decision making.

Cross-Contamination: The Bias Snowball Effect

The potential problems with expert testimony are not limited to psychological contamination of a specific piece of evidence. Although many types of evidence are often presented in court as independent, most often this claim is overstated. They affect (and potentially contaminate) one another. Hence, expert testimony about one type of evidence is not independent of other (unrelated and different) types of evidence. For example, a forensic examiner may be exposed to other forensic evidence in the case or to what the investigating detective thinks,[22] or a suspect may confess to a crime he did not commit because of erroneous forensic evidence placing him at the crime scene.[23]

If those influences are not explicitly reported, then the factfinder is inadvertently misled. For example if the fingerprint examiner knew that the suspect was also identified by DNA evidence and that affected the conclusion that the fingerprints found at the crime scene matched those of the suspect, when presenting the conclusions that the fingerprints match, the examiner (mis)presents the conclusion as if it were solely based on the fingerprints evidence. This is misleading and misrepresents what the conclusions are really based on. Furthermore, by using the DNA evidence (in this example, but it can be a variety of other effects, such as being influenced by a suspect's confession), this evidence is double counted: first—implicitly—as part of the fingerprint evidence, and then again when the DNA expert testifies.

Such cross-evidence influences and how they may contaminate each other deserve attention. It is up to the factfinder to weigh the value of each type of evidence and to integrate unrelated lines of evidence, whereas the experts should examine the relevant evidence in isolation, without the potentially biasing influences of other irrelevant evidence or opinions. When such cognitive contamination occurs between different—and supposedly independent—types of evidence, a "bias snowball effect" may take place, whereby the biasing influences grow in strength as more evidence is exposed to the bias and in turn exposes others to bias as well.[24]

Cognitive Bias and the Law in the United States

What science has proved, the law has long intuited. Bias may be subconscious and affect perception and memory, and it is relevant in assessing witness credibility. "Bias is a term used . . . to describe the relationship between a party and a witness which might lead the witness to slant, unconsciously or otherwise, his testimony in favor of or against a party."[25] The relationship between domain-irrelevant information and crime scene evidence runs exactly this risk: it "might lead the witness to slant, unconsciously or otherwise, his testimony in favor of or against a party." This process is no different for expert witnesses than for lay witnesses.

Federal Rule of Evidence 702, which governs the admissibility of expert testimony, requires not only that the expert's methodology be reliable but also that, in any particular case, "the expert has reliably applied the principles and methods to the facts of the case." This requirement can put questions of cognitive bias squarely at issue. Specifically, a claim that biasing information affected the forensic expert—either because there is demonstrable proof of the same or because the lab or analyst has no procedure in place to mitigate the risk—goes to the heart of this Rule 702 concern.

Nonetheless, most courts tend to treat issues similar to cognitive bias as relevant to weight rather than the threshold question of admissibility. "[Q]uestions as to whether an expert has applied a particular methodology correctly typically go [to] the weight of the evidence."[26] This reaction is not surprising given the frame courts typically use to assess the reliability of methodology. It has been historically common that courts are hesitant to make decisions precluding the introduction of the underlying evidence.[27]

While courts have the authority to consider the methodology, flaws and all, when deciding whether to exclude testimony, the prevailing view is that "errors in application should result in the exclusion of evidence only if they render the expert's conclusions unreliable; otherwise, the jury should be allowed to consider whether the expert properly applied the methodology in determining the weight or credibility of the expert testimony."[28]

This hesitation to exclude the testimony as a remedy for problematic methodology is also found in *Frye* jurisdictions, where the focus of the inquiry is intended to be limited to the general acceptance of the methodology. "[I]f an expert improperly uses a generally accepted methodology, any such errors go to the weight to be given to his testimony, not its admissibility, at least where the

expert honestly followed the methodology as he understood it."[29] In other words, unlike *Daubert*, the *Frye* test has arguably embedded the preference for weight relevance over admissibility relevance.

Factoring in the risk of cognitive bias is thus thought of as inherent to methodology. Given this background understanding, it will be the rare case where exclusion is a viable option under *Daubert* or *Frye*. The counter, therefore, is vigorous time-of-trial testing of the testimony. "Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence."[30] It is in this context that discovery and judicial protocol will have an important impact.

Full disclosure of information is a critical principle of science. In the context of a criminal prosecution, that principle can have constitutional significance. Disclosure of issues relating to cognitive bias might be required by due process, and in particular by *Brady v. Maryland*[31] and its progeny.

Brady requires disclosure beyond just what is contained in the prosecutor's files. The prosecutor "has a duty to learn of any favorable evidence known to the others acting on the government's behalf in the case, including the police."[32] And *Brady* evidence includes bias and interest, classic impeachment evidence. Cognitive bias failures or lapses plainly fit within this category.

Regardless of the *Brady* obligation, a court may also establish its own protocol for addressing cognitive bias concerns. And there is a model for doing so. In 2010, then federal District Court Judge Nancy Gertner directed a specific protocol for "trace evidence" cases, requiring that the parties examine the evidence and determine whether a pretrial admissibility hearing was needed.[33] An analogous protocol for addressing cognitive bias might direct any party seeking to admit forensic evidence to determine, and then disclose, whether the lab or practitioner has in place any process addressing cognitive bias and all information received by the examiner prior to conducting the testing and drawing conclusions. With the information provided ahead of a witness's testimony, the parties and the court can make a meaningful relevance determination.

That final step is where the action is. Once the information is disclosed to counsel, the court's concern must be that evidence of cognitive bias and its potential or actual impact on the examiner and the resulting conclusion(s) are appropriately treated. As mentioned, this evidence will be relevant in evaluating the admissibility of, or at least the weight that should be given to, the expert's testimony. But apart from these questions of evidentiary admissibility and relevance with respect to the expert's testimony, the Constitution may require admitting the evidence of cognitive bias.

The accused in a criminal case has the constitutional right to expose witness bias. This has been recognized as a core Sixth Amendment right since at least 1974 in *Davis v. Alaska*.[34] "Hidden sometimes subconscious bias is just this sort of information."[35]

Thus, showing bias or potential bias by cross-examination is critical. If a court is concerned with meaningful jury assessment of the risks of cognitive bias, we advocate considering three additional mechanisms. First, if the jurisdiction has adopted the "public records" exception to the ban on hearsay, the National Academy of Science's 2009 report, *Strengthening Forensic Science in the United States: A Path Forward,* should be admissible as a government report, including its discussion of cognitive bias.[36] Second, in cases where a court determines that the risk of a bias-impaired expert opinion is core or substantial, expert testimony on cognitive bias and its impact should be considered. Third, courts should consider giving a jury instruction regarding cognitive bias and the risk factors that may affect an expert's judgment and conclusion. This is already somewhat common in eyewitness identification cases where jury instructions on how memory works are now regularly given. There is ample science to support an instruction for evaluating expert cognitive bias.

Whatever tools a judge selects, given the accused's constitutional right to confrontation and to present a defense, and a court's duty to ensure a reliable verdict, evidence of cognitive bias of experts and its impact must be admissible and made meaningful.

Increasing the Contribution of Experts to Criminal Justice

Experts already make a vital contribution to criminal justice. Beyond the legal issues detailed above, we offer a few practical steps to increase and improve the contributions experts make to the courts. First, it is important to make sure that expert evidence gets its proper and realistic weight within criminal proceedings. By understanding the potentials and limits and the proper scope of expert evidence, criminal justice will be served and enhanced. To this end, we recommend that judges, advocates, and all those involved in criminal justice should receive education about the use and limitations of expert evidence. Such education should demystify expertise, explaining its strength as well as its limitation, including its vulnerability to bias and contextual influences.

Second, best practices and standard operating procedures that strengthen expert evidence should be developed. These should include masking extraneous information that is not relevant to the expert's work. Experts must be blind to information that they do not require and that may influence and bias their work. In cases where contextual information is needed to determine what tests to carry out, or when the expert acts in an investigative capacity, then the work should be divided: one examiner acts as a case manager or as an investigative examiner, while the actual tests and work is carried out by another examiner who is blinded to the contextual information that is not needed or relevant to the actual work being carried out.[37]

Furthermore, experts should use the "Linear Sequential Unmasking" (LSU) procedure to minimize bias, whereby examiners should first examine evidence from the crime scene in isolation from a "target" suspect.[38] Evidence from the

crime scene should be examined by itself, without the influence of the suspect's pattern that is the target for making a match (i.e., without knowledge that there is a suspect, or a "target suspect"). Only then, after the evidence has been examined "context free," can it be compared and evaluated in reference to a suspect. By example, a fingerprint examiner should first examine and analyze the fingerprint from the crime scene before being exposed to the fingerprints of the suspect; once the evidence from the crime scene has been analyzed, then it can be compared to the suspect.[39] Experts should work linearly from the evidence rather than with circular reasoning.

Other best practices and standard operating procedures should include documentation that details the experts' work. Experts doing the actual work should be buffered as much as possible from detectives and others who may influence their work. Any necessary interactions should be kept to a minimum and documented. The conclusions of experts should be blindly verified by other experts. And finally, rather than considering only one hypothesis (typically that of the investigator requesting the testing), experts should consider multiple competing hypotheses. One way to achieve this is to present the expert examiner with a number of plausible matches along with the one from the suspect, and then ask them to conclude which one (if any) matches that from the crime scene. By way of example, if a forensic examiner is trying to match a CCTV image to the face of a suspect, rather than having *the* target suspect, the examiner can be presented with a few possible (and plausible) matches (not only the suspect)—this is similar to the standard procedure in identification procedures when the suspect is presented within a number of foils.

Third, forensic experts, as well as expert witnesses from other domains, should receive training in cognitive bias and best practices to enhance objectivity and impartiality.[40] This is to help fulfill the formal duty of experts, e.g., to be objective and unbiased, objectives that can (and should) be achieved as much as possible.

Fourth, a lab's quality management system must incorporate cognitive bias concerns. The U.K. Forensic Science Regulator stipulates that "organizations who undertake fingerprint examination should demonstrate within their accredited quality management system that they understand the potential for cognitive bias and build into their technical procedures safeguards to minimize the risk of bias and peer pressure."[41] This is an admirable first step but is not, by itself, sufficient. If safeguards are needed in fingerprinting, then they are likely required in other forensic domains, even in DNA interpretation,[42] as well as in medical and other kinds of expert evidence that require interpretation and involve subjective judgments. Furthermore, the U.K. Forensic Science Regulator's stipulations are only guidelines and therefore cannot be enforced.[43]

As explained above, it is up to the advocates to explore in cross-examination whether the experts received proper training in cognitive bias and have followed best practices so as to enable the judge or jury to assign proper weight and credibility to the experts' testimony. Where the influence of irrelevant contextual information is such that no reasonable jury could properly rely on it, then the judge must exclude the evidence.[44] The hope is that such actions will ensure that experts follow best practices in the first place (rather than having their evidence excluded[45]), and therefore serve the court by providing the best possible and impartial evidence.

Conclusions

The "human mind is not a camera," and humans have developed a variety of brain mechanisms that enable them to process information effectively and efficiently. These very mechanisms that underlie intelligence and expertise also entail vulnerabilities, such as influences by extraneous information and cognitive biases. It is advisable to consider steps that will ensure that expert evidence is impartial and objective as much as possible and to avoid cognitive contamination. While much of this work should occur in the labs, some of it will inevitably fall to the courts. Cognitive science can be of service to the courts and criminal justice by helping people understand these issues and suggesting practical ways to enhance the quality, and hence the contribution, of expert evidence. ■

Endnotes

1. Itiel E. Dror, *The Paradox of Human Expertise: Why Experts Get It Wrong*, *in* The Paradoxical Brain 177 (Narinder Kapur ed., 2011).

2. Maurizio Corbetta & Gordon L. Shulman, *Control of Goal-Directed and Stimulus-Driven Attention in the Brain*, 3 Nature Rev. Neuroscience 201 (2002); Robert Desimone & John Duncan, *Neural Mechanisms of Selective Visual Attention*, 18 Ann. Rev. Neuroscience 193 (1995).

3. Mark A. Changizi & Warren G. Hall, *Thirst Modulates a Perception*, 30 Perception 1489 (2001); Paula M. Niedenthal et al., *Emotional State and the Detection of Change in Facial Expression of Emotion*, 30 Eur. J. Soc. Psychol. 211 (2000).

4. Merim Bilalić, Peter McLeod & Fernand Gobet, *The Mechanism of the Einstellung (Set) Effect: A Pervasive Source of Cognitive Bias*, 19 Current Directions Psychol. Sci. 111 (2010).

5. Paola Bressan & Maria F. Dal Martello, *Talis Pater, Talis Filius: Perceived Resemblance and the Belief in Genetic Relatedness*, 13 Psychol. Sci. 213 (2003).

6. Steve D. Charman, Amy Hyman Gregory & Marianna Carlucci, *Exploring the Diagnostic Utility of Facial Composites: Beliefs of Guilt Can Bias Perceived Similarity between Composite and Suspect*, 15 J. Experimental Psychol.: Applied 76 (2009).

7. To be clear, we are not attributing deliberate actions on anyone's part, but explain that some cognitive bias is an inherent characteristic and outcome of how the human brain processes information, and that it occurs without consciousness. *See* R v. Deakin, [2012] EWCA (Crim) 2637, ¶ 25 (Eng.) (noting the "very real possibility of unconscious influence"); Sir Thomas Bingham, *The Judge as Juror: The Judicial Determination of Factual Issues*, 38 Current Legal Probs. 1, 19 (1985) (positing that experts are often not objective, "but they are not dishonest").

8. *See* Bento v. Chief Constable of Bedfordshire Police, [2012] EWHC (QB) 1525, ¶ 76 (Eng.) ("[A] court must be careful not to be mesmerised by the confidently expressed views of a senior and distinguished expert.").

9. The duty of experts was set out in *National Justice Cia Naviera SA v Prudential Assurance Co*

Ltd (Ikarian Reefer), [1993] 2 Lloyd's Rep. 68, 81 (Eng.). *See* Blackstone's Criminal Practice F10.35 (Anthony Hooper et al. eds., 2013).

10. Bingham, *supra* note 7, at 19 ("Expert witnesses may be and often are partisan, argumentative and lacking in objectivity.").

11. Indeed, experts' evaluations have been shown to be influenced by their partisan allegiance. *E.g.*, Daniel C. Murrie et al., *Are Forensic Experts Biased by the Side That Retained Them?*, 24 Psychol. Sci. 1889 (2013).

12. *See, e.g.*, Nat'l Acad. of Sci., Strengthening Forensic Science in the United States: A Path Forward 87 (2009) ("The degree of science in a forensic science method may have an important bearing on the reliability of forensic evidence in criminal cases. There are two very important questions that *should* underlie the law's admission of and reliance upon forensic evidence in criminal trials: (1) the extent to which a particular forensic discipline is founded on a reliable scientific methodology that gives it the capacity to accurately analyze evidence and report findings and (2) the extent to which practitioners in a particular forensic discipline rely on human interpretation that could be tainted by error, the threat of bias, or the absence of sound operational procedures and robust performance standards.").

13. *See* Déirdre Dwyer, The Judicial Assessment of Expert Evidence (2009); Samuel R. Gross, *Expert Evidence*, 1991 Wis. L. Rev. 1113; J.R. Spencer, *Court Experts and Expert Witnesses: Have We a Lesson to Learn from the French?*, 45 Current Legal Probs. 213 (1992).

14. Itiel E. Dror & Simon A. Cole, *The Vision in "Blind" Justice: Expert Perception, Judgment, and Visual Cognition in Forensic Pattern Recognition*, 17 Psychonomic Bull. & Rev. 161 (2010). Itiel E. Dror, *Cognitive Neuroscience in Forensic Science: Understanding and Utilising the Human Element*, 370 Phil. Tran. Royal Soc. 1674: 20140255 (2015). http://dx.doi.org/10.1098/rstb.2014.0255

15. Itiel E. Dror & Robert Rosenthal, *Meta-Analytically Quantifying the Reliability and Biasability of Forensic Experts*, 53 J. Forensic Sci. 900 (2008).

16. Itiel E. Dror & Greg Hampikian, *Subjectivity and Bias in Forensic DNA Mixture Interpretation*, 51 Sci. & Just. 204 (2011).

17. R v. Dlugosz, [2013] EWCA (Crim) 2, ¶ 26 (Eng.).

18. *Id.*

19. *E.g.*, Sherry Nakhaeizadeh et al., *The Power of Contextual Effects in Forensic Anthropology: A Study of Biasability in the Visual Interpretations of Trauma Analysis on Skeletal Remains*, 59 J. Forensic Sci. 1177 (2013); Mark Page, Jane Taylor & Matt Blenkin, *Context Effects and Observer Bias—Implications for Forensic Odontology*, 57 J. Forensic Sci. 108 (2012).

20. Forensic Sci. Regulator, Developing a Quality Standard for Fingerprint Examination 12 (2011), *available at* http://www.homeoffice.gov.uk/publications/agencies-public-bodies/fsr/dev-quality-std-fingerprint-exam?view=Binary. *See also Guidance on Cognitive Bias Effects Relevant to Forensic Science Examinations FSR-G-217*, Forensic Sci. Regulator, Codes of Practice and Conduct, (2015), available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/470549/FSR-G-217_Cognitive_bias_appendix.pdf.

21. Expert Working Grp. on Human Factors in Latent Print Analysis, U.S. Nat'l Inst. of Standards & Tech., Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach (2012) [hereinafter NIST/NIJ Expert Group Report], *available at* http://www.nist.gov/customcf/get_pdf.cfm?pub_id=910745.

22. *See, e.g.*, R v. Deakin, [2012] EWCA (Crim) 2637, ¶ 25 (Eng.) ("A matter of particular concern, in this court's view, is that Police Constable Gorringe had actually told Detective Constable Churton shortly prior to his examining the CCTV to see if he could recognise the appellant [that] she believed the appellant was on this CCTV. This was highly suggestive and should never have happened. . . . [T]here was always of course the very real possibility of unconscious influence.").

23. In one case, for example, Dwayne Jackson confessed to a crime he did not commit after he was erroneously identified in DNA testing by Las Vegas forensic examiners. *See* Lawrence Mower & Doug McMurdo, *Las Vegas Police Reveal DNA Error Put Wrong Man in Prison*, Las Vegas Rev. J. (July 7, 2011).

24. Itiel E. Dror, *Cognitive Bias in Forensic Science*, 2012 Sci. & Tech. Y.B. 43; Itiel E. Dror, Saul M. Kassin & Jeff Kukucka, *New Application of Psychology to Law: Improving Forensic Evidence and Expert Witness Contributions*, 2 J. Applied Res. Memory & Cognition 78 (2013); Saul M. Kassin, Itiel E. Dror & Jeff Kukucka, *The Forensic Confirmation Bias: Problems, Perspectives, and Proposed Solutions*, 2 J. Applied Res. Memory & Cognition 42 (2013); Sally F. Kelty, Roberta Julian & Alastair Ross, *Dismantling the Justice Silos: Avoiding the Pitfalls and Reaping the Benefits of Information-Sharing between Forensic Science, Medicine and Law*, 230 Forensic Sci. Int'l 8 (2013).

25. United States v. Abel, 469 U.S. 45, 52 (1984).

26. Cholakyan v. Mercedes-Benz USA, LLC, 281 F.R.D. 534, 547 (C.D. Cal. 2012).

27. *See, e.g.*, Wise v. Ludlow, 346 P.3d 1, 15 (Wyo. 2015) ("If Dr. Brunworth did not correctly follow the methodology of differential diagnosis, that could affect the weight and persuasiveness of her opinions, but does not render that evidence inadmissible under *Daubert*.").

28. State v. Bernstein, 349 P.3d 200, 201 (Ariz. 2015).

29. Murray v. Motorola, Inc., No. 2001 CA 008479 B, 2014 D.C. Super. LEXIS 16, at *90 n.54 (Aug. 8, 2014).

30. Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 596 (1993).

31. 373 U.S. 83 (1963).

32. Kyles v. Whitley, 514 U.S. 419, 437 (1995). Although prosecutors have a duty to do justice, and not merely to obtain a conviction, *see, e.g.*, the U.S. Supreme Court's decision in *Berger v. United States*, 295 U.S. 78 (1935), "There is reason to doubt that prosecutors comply with these obligations fully." *Id.* at 88. *See also* Alex Kozinski, *Criminal Law 2.0* 44 Georgetown L.J. iii (2015).

33. Procedural Order: Trace Evidence, No. 1:08-cr-10104-NG (D. Mass. Mar. 10, 2010), *available at* http://www.mad.uscourts.gov/boston/pdf/ProcOrderTraceEvidenceUPDATE.pdf.

34. 415 U.S. 308 (1974).

35. *In re* Anthony P., 213 Cal. Rptr. 424, 429 (Ct. App. 1985).

36. *See supra* note 12.

37. *See* Itiel E. Dror, *Practical Solutions to Cognitive and Human Factor Challenges in Forensic Science*, 4 Forensic Sci. Pol'y & Mgmt. 105 (2014).

38. Itiel E. Dror et al., *Context Management Toolbox: A Linear Sequential Unmasking (LSU) Approach for Minimizing Cognitive Bias in Forensic Decision Making*, 60 J. Forensic Sci. 1111 (2015).

39. In the case of *R v. Smith*, [2011] EWCA (Crim) 1296 (Eng.), the Court of Appeal of England and Wales quashed a murder conviction because fingerprint evidence was biased as a result of a "target" suspect affecting the evaluation of the evidence. When the evidence was examined in isolation (prior to having a suspect), the fingerprint examiner determined that "there was insufficient detail to be able to make a meaningful comparison," but then "after the appellant

had been charged . . . he concluded that the ridge flow and 12 ridge characteristics could be identified with the fingerprint from the appellant's left forefinger." *Id.* ¶¶ 14, 15. That is, the examiner "revised" his conclusions, changing from insufficient to an identification once there was a suspect. Research studies have also shown the effect of a "target" comparison on the analysis of the evidence. *See* Itiel E. Dror et al., *Cognitive Issues in Fingerprint Analysis: Inter- and Intra-Expert Consistency and the Effect of a "Target" Comparison*, 208 Forensic Sci. Int'l 10 (2011).

40. See the recommendation to provide such training by both the *Fingerprint Inquiry Report* (Recommendation 7) and the *NIST/NIJ Expert Group Report* (Recommendation 8.5). Anthony Campbell, The Fingerprint Inquiry Report 741 (2011), *available at* http://www.webarchive.org.uk/wayback/archive/20150428160106/http://www.thefingerprintinquiryscotland.org.uk/inquiry/files/TheFingerprintInquiryReport_High_res.pdf; NIST/NIJ Expert Group Report, *supra* note 21, at 168–69. We are pleased to note that a number of police departments and agencies now provide their forensic examiners with such cognitive training.

41. See *supra* note 20, at 12.

42. *See* R v. Dlugosz, [2013] EWCA (Crim) 2 (Eng.); Dror & Hampikian, *supra* note 16.

43. Likewise are the conclusions and recommendation of the public judicial inquiry by Sir Anthony Campbell, *supra* note 40, at 628 ("Unless the provision of contextual information is absolutely necessary, it should be avoided.").

44. *See* R v. Deakin, [2012] EWCA (Crim) 2637, ¶ 25 (Eng.) ("[W]ith all respect to the judge, his statement that in 'an ideal world' not naming the appellant would have been 'the perfect situation' is difficult to understand: that solution could easily have been adopted in this present case.").

45. Or having the court of appeal squash convictions because of biased expert evidence. *See, e.g.*, R v. Deakin, [2012] EWCA (Crim) 2637 (Eng.); R v. Smith, [2011] EWCA (Crim) 1296.