*Law, Probability and Risk* (2015) **14**, 169–173 doi:10.1093/lpr/mgv003
Advance Access publication on April 21, 2015

# The need for reporting *standards* in forensic science

Alex Biedermann[†]
*University of Lausanne, Faculty of Law, Criminal Justice and Public Administration, School of Criminal Justice, 1015 Lausanne-Dorigny, Switzerland*

Joëlle Vuille
*University of Neuchâtel, Faculty of Law, Av. du 1er-Mars 26, 2000 Neuchâtel, Switzerland*

Franco Taroni
*University of Lausanne, Faculty of Law, Criminal Justice and Public Administration, School of Criminal Justice, 1015 Lausanne-Dorigny, Switzerland*

and

Christophe Champod
*University of Lausanne, Faculty of Law, Criminal Justice and Public Administration, School of Criminal Justice, 1015 Lausanne-Dorigny, Switzerland*

[Received on 30 October 2014; revised on 2 December 2014; accepted on 3 December 2014]

## 1. Introduction

When scientists are asked to assist a court in the evaluation of the results of forensic examinations, a fundamental question arises: what are the generic principles underlying sound inference to which scientists ought to adhere? This question is the object of on-going discussions and diverging opinions in the forensic science community. In this commentary, we discuss this topic from three perspectives. The first pertains to the need for scientists to agree on the generic precepts which evaluative reasoning ought to conform to, and the requirement that these should be stated clearly. Secondly, we shall argue that—as conveyed by the label 'generic'—these inferential requirements are independent of the forensic area of practice. Thirdly, we maintain that these precepts ought—if encoded—to take the form of a standard, not a mere guideline.

The general argument pursued in this commentary is that adherence to sound principles of reasoning is not a matter of choice but a matter of scientific integrity. However, since it is insufficient to rely on the good will of professionals to warrant such integrity, logical principles *should be* enforced through a standard (contrary to an opinion recently expressed in this *Journal*, Simmross, 2014).

We limit our considerations mainly to forensic science practice, rather than to the broader topics of the nature of judicial inference and the functioning of judicial processes and systems as a whole. We believe that the forms framing scientific reasoning (and leading to a forensic scientist's conclusions) necessarily precede the reporting stage, so that these forms can be considered independently of whether or not other parts of the judicial system also endorse these generic principles of reasoning. We believe that the forensic scientist should first comply with these agreed principles and then report

[†]Corresponding author. E-mail: alex.biedermann@unil.ch

his or her findings in a way that conforms to the law. In that transition—from findings to reporting—the scientist should not compromise the principles that we will expose below.

## 2. The need to agree on generic principles

The evaluation of forensic science results must be based on agreed principles for two main reasons. First, a particular practice can only be deemed scientific if it is based on foundational understandings, which is theory that is formally stated and open to inspection. With no understanding and theory of the kinds that characterize science, forensic practice would be reduced to mere technology, which does not necessarily demand such fundamental insight (Wolpert, 1993). Secondly, the requirement for a consensus on evaluative principles derives from the intended context of application. Indeed, contemporary criminal justice systems strive to base their verdicts on what is referred to as a *rational* evaluation of evidence, be it scientific or otherwise (Bender *et al.*, 2007, p. 139 ff.; Kauffmann, 2009, p. 185 ff.; Jackson and Summers, 2012, p. 14 ff.; Twining, 2006, p. 35 ff.). Stated otherwise, the application of the reasoning scheme should not lead to logically contradictory conclusions. In a process that ultimately affects the lives of defendants and victims in a most fundamental way, it is a minimum prerequisite that scientists be able to state the generic principles underlying the evaluation of their analytical findings. In particular, where verdicts (especially guilty verdicts) against defendants involve results of forensic examinations, the assessment of their strength *must* be based on principles that qualify as logically valid in the sense mentioned above.

As an auxiliary to the judicial system, forensic science should thus rely on a well-articulated framework. Yet, forensic scientists exhibit a remarkable diversity of practice when reporting the results of their examinations. Many claims are not based on formal logical grounds, and scientists making such claims rely on the trust that courts place in them because of their education and/or long-standing experience. The situation is even more peculiar with some forensic practitioners who, at least in some informal discussion, refuse to articulate any inferential principles explicitly as they do not consider their field to be a conventional area of (scientific) practice. Instead, they refer to it as a form of art. This lack of transparency prevents others, namely the court and the parties, from assessing the logical foundations of the inferential process used in the case at hand and, if necessary, reproducing it. The mere statement of a particular forensic practice or art (e.g. the comparative examination of toolmarks), however, subtle and reliably performed is merely descriptive. It lacks a statement of sound inferential principles and appears to misconceive the normative nature of the inferential framework (Biedermann *et al.*, 2014).

## 3. The need to be coherent across all areas of forensic science

Discrepancies that cannot be rationalized exist in the way conclusions are constructed and reported by scientists in various areas of forensic science. For example, representatives of the marks and impressions community (e.g. fingermarks, toolmarks, footwear marks, handwriting) widely adhere to a practice based on categorical conclusion scales (involving, e.g. terms such as 'individualization' or 'exclusion'), whereas DNA analysts tend to formulate their conclusions in terms of degree or extent of support with respect to selected propositions of interest. This fundamental difference is not mentioned here to determine 'who is right', but to ask whether it is sensible to have different inferential frameworks in various areas of practice. Our own view is that there is essentially one way to reason under uncertainty, independent of the nature of the discipline considered. We contend that this one way, based on probability theory, should apply across all forensic disciplines, essentially because it ensures

coherence in the reasoning processes. The probabilistic framework provides a reference point against which actual modes of reasoning, intuitive or otherwise unaided can be compared so as to determine whether they are internally consistent (Robertson and Vignaux, 1993). As such, the probabilistic framework provides what is typically referred to as a *standard* (Lindley, 2014).

The law itself does not discriminate between the various fields within forensic science when it comes to assessing the admissibility of a given technique or the probative weight of a set of analytical results. For instance, the so-called *Daubert* trilogy regulating the admissibility of expert evidence in the U.S. federal courts[1] applies transversally to any type of expert knowledge.[2] Similarly, legal systems in Continental Europe tend to subject the evaluation of all types of scientific evidence to the same set of principles and rules (Champod and Vuille, 2011).

More generally, it would be short-sighted to limit our perspective to forensic science. The issue is more fundamental. In fact, disciplines such as philosophy of science and mathematics have worked on inferential procedures for centuries (Howson and Urbach, 2005). Suggesting that fundamental principles of scientific reasoning do not apply to the field of forensic science would be tantamount to claiming that our field has resolved, bypassed or got away with problems that have not yet been resolved in other scientific disciplines. That such is the case is doubtful (Biedermann and Curran, 2014).

## 4. The need to adopt standards, not mere guidelines

If we were to state formally the principles according to which evaluative reasoning should be conducted in the forensic science field, what status ought this statement have? Should it take the form of a guideline or should it be a standard? Some discussants (e.g. Simmross, 2014) argue that a guideline would leave the necessary freedom for forensic scientists to exercise their expert activity within the legal framework of their country. We do not espouse that view because it conveys the idea that the legal context is put forward as a 'deflecting shield' to avoid facing the need for a defined evaluative framework.

By definition, a guideline is not binding, nor is it enforced. It is a non-mandatory statement to direct particular courses in practical proceedings. A standard, in turn, is mandated by policy. The very large majority of forensic science practitioners views standards suspiciously, and would prefer having evaluative principles be encoded in the form of a guideline.[3] The underlying motive for this seems to be that if the prescribed framework of reasoning (e.g. probability) is not endorsed, the resulting non-conformity is not subject to sanctioning. This would obviously place forensic scientists in a comfortable position: they could adhere to the stated guide of reasoning if they wish to do so, and would not need to fear any complications in case of non-conformity. But this effortless attitude does not come without some price and, as we argue below, the cost will be born by criminal defendants.

The idea of a guideline would imply that, in principle, scientists could deviate from the reference approach when evaluating the results of their examinations. But what other approaches are there? Some procedures deviate explicitly from a probabilistic reference, or have features whose logical credentials are unknown, not established or questionable. This is most typically illustrated by the

[1] *Daubert v. Merrell Dow Pharmaceuticals, Inc.* 509 U.S. 579 (1993); *General Electric Co. v. Joiner*, 522 U.S. 136 (1997); *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999).

[2] On the Daubert standard, see Faigman *et al*. (2013) and Rosenblum (2000).

[3] This is paradoxical in view of the fact that forensic science actually abounds in standards for all kinds of aspects, mainly technical, relating to operational laboratory practice.

known logical flaws adopted by tradition and without full awareness by practitioners involved in the forensic fields aiming at 'individualisation' (e.g. Saks and Koehler, 2005; Champod, 2013; Cole, 2014). This raises a fundamental issue for defendants and other participants in the legal process: should they take comfort in the idea that it is left to the discretion of the scientist to decide what evaluative approach—logical or otherwise—they will retain in the defendant's case? As scientists we must concede that we cannot credibly claim to be able to answer such a question regarding legal implications. Instead, we must realize that our practical choices have fundamental consequences for subsequent parts of the legal process. Thus, if there is essentially one logical framework for reasoning under uncertainty, then, as scientists, we can see no reason not to pursue our effort to adhere to this reference approach. Regarding it as a standard should not be seen as a constraint, but merely as a natural translation of good scientific practice.

## 5. Conclusion

If it can be agreed that there is a scientifically rigorous way of reasoning, which represents a safeguard against fallacious conclusions, we see no persuasive reason in principle why it should *not* be a requirement to follow it and why it could *not* be retained as a standard. An analogy may help to illustrate this proposal: as there are rules governing the logical reasoning under uncertainty, arithmetic deals with fundamental operations for the combination of numbers, such as addition and subtraction that are universally accepted and used in basic day-to-day counting. Would you be happy if you knew that your bank manages the balance of your account according to rules that might, but not necessarily will (for reasons that are left to the sole discretion of your bank), conform to the way prescribed by basic arithmetic? Certainly not. The same precept holds for court proceedings and forensic science. Matters dealt with in court are important and consequential enough to require that information for and against a defendant be assessed according to the most stringent principles of reasoning. Either one applies these principles, or the evidence should not be assessed and retained at all, on pain of incoherence.

## References

Biedermann, A. & Curran, J. (2014). Drawbacks in the scientification of forensic science. *Forensic Science International*, **245**, e38–e40.

Biedermann, A., Taroni, F. & Aitken, C. G. G. (2014). Liberties and constraints of the normative approach to evaluation and decision in forensic science: a discussion towards overcoming some common misconceptions. *Law, Probability and Risk*, **13**, 181–191.

Bender, R., Nack, A. & Treuer, W. -D. (2007). *Tatsachenfeststellung vor Gericht*. C.H. Beck, München.

Champod, C. (2013). Overview and meaning of identification/individualization. In: *Encyclopedia of Forensic Sciences* (A. J. Siegel & P. J. Saukko eds.). 303–309. Elsevier/Academic Press, London; Waltham, MA.

Champod, C. & Vuille, J. (2011). Scientific evidence in Europe – admissibility, evaluation and equality of arms. *International Commentary on Evidence*, **9**(1), 1–68.

Cole, S. A. (2014). Individualization is dead, long live individualization! Reforms of reporting practices for fingerprint analysis in the United States. *Law, Probability and Risk*, **13**, 117–150.

Faigman, D., Blumenthal, J., Cheng, E., Mnookin, J., Murphy, E. & Sanders, J. (2013). *Modern Scientific Evidence*. West Academic Publishing, St-Paul.

Howson, C. & Urbach, P. (2005). *Scientific Reasoning: the Bayesian Approach*, 3rd edn. Open Court, Chicago and La Salle (Illinois).

KAUFMANN, M. (2009). *Beweisführung und Beweiswürdigung, Tatsachenfeststellung im schweizerischen Zivil-, Straf- und Verwaltungsprozess*. Dike, Zürich/St. Gallen.
LINDLEY, D. V. (2014). *Understanding Uncertainty*. Revised Ed., John Wiley & Sons, Hoboken.
JACKSON, J. & SUMMERS, S. J. (2012). *The Internationalisation of Criminal Evidence*. Cambridge University Press, Cambridge.
SAKS, M. J. & KOEHLER, J. J. (2005). The coming paradigm shift in forensic identification science. *Science*, **309**, 892–895.
SIMMROSS, U. (2014). Appraisal of scientific evidence in criminal justice systems: on winds of change and coexisting formats. *Law, Probability and Risk*, **13**, 105–115.
ROBERTSON, B. & VIGNAUX, G. A. (1993). Probability - The logic of the law. *Oxford Journal of Legal Studies*, **13**, 457–478.
ROSENBLUM, M. (2000). On the evolution of analytical proof, statistics, and the use of experts in EEO litigation. In: *Statistical Science in the Courtroom* (J. L. Gastwirth ed.). 161–194. Springer, New York.
TWINING, W. (2006). *Rethinking Evidence*. Cambridge University Press, Cambridge.
WOLPERT, L. (1993). *The Unnatural Nature of Science*. Harvard University Press, Cambridge, Mass.