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## **Scientification and probability in courts. A radical proposal**

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### **Introduction**

In the next 10 minutes I want to argue for the introduction of probability-judges. The term “probability-judge” is of my own making. I use it to refer to experts in probability theory who are members of a specialized chamber of the court. I restrict myself to a discussion of legal systems such as the Dutch, in which judges decide both on matters of law and evidence.

I propose to replace the advisory model in which experts offer advice to the court, by a decision model in which experts and judges together take judicial decisions. Such a decision model is both possible and necessary. It is possible within existing legal frameworks and it is necessary given the increasing role of probabilistic thinking in court and the mistakes judges make when interpreting and using probabilistic information.

My core claim is that we need probability-judges and thus mixed chambers of courts in evidentially complex cases. In my own work I focus on criminal law, but my argument also applies, for example, to complex liability cases.

### **The problem: ‘scientification and probability in courts’**

Over the last decades, sciences have come to play an increasingly important role in court cases. Eyewitness testimony is no longer the most important type of evidence. Technical evidence, or rather reports and expert witness testimonies on technical evidence such as DNA, gunpowder residue, CCTV images and fingerprints, have become much more important. Forensic experts increasingly report their findings in probabilistic terms, more specifically in terms of likelihood ratios.<sup>1</sup> The question is: how well do judges understand these reports?

Let me offer an example to illustrate the misunderstanding that a forensic report can cause. Take the criminal case of a robbery at a cash dispenser. There are security camera images of the robber and a report of a forensic expert who compared these images with photos of the suspect. The expert reports as follows.

“Two hypotheses have been compared.

The first hypothesis holds that the perpetrator visible on the security camera images is the suspect depicted on photo  $P_1$ .

The second hypothesis holds that the perpetrator is not the suspect depicted on the photo.

Next follows an analysis which we can skip for present purposes. Finally, the report concludes that the findings based on the comparison of the images and the photos are much more likely when the perpetrator and the suspect are the same person (hypothesis 1) than when they are different persons (hypothesis 2).<sup>2</sup>

Now, what can judges correctly derive from this report? Are they, for example, allowed to conclude that it is much more likely that the suspect is the person on the CCTV images than someone else?

What do you think?  
What do judges think?

I take this example from an experiment by Jan de Keijser and Henk Elffers. They asked judges, lawyers and experts to answer this particular question and several other questions about the report. More than 80% of the judges and lawyers and more than 50% of the experts believed this conclusion to be correct.<sup>3</sup>

Unfortunately, however, it is false. In fact, this particular mistake is made so often that it has its own name, the prosecutor's fallacy.<sup>4</sup> I do not have time to explain it. The only point I want to make here is that one needs to have basic knowledge of Bayesian probability theory in order to understand the fallacy and to prevent making it.

What is worrisome about the findings of De Keijser and Elffers is that not only judges and lawyers but even experts, who are assumed to have knowledge of Bayesian probability theory, fell prey to the fallacy. Even more worrisome is the finding that all groups believed to have a rather high level of understanding of the forensic conclusions presented to them. In other words, many of them were blind to their own lack of understanding.<sup>5</sup>

This is a very simple example, but even here a majority of judges goes astray. What will happen in complex cases, with several scenarios and many different pieces of evidence?

### **Probability judges are necessary, less radical alternatives are insufficient**

The problem we need to address is how we can ensure that judges can understand and correctly reason with probabilities and that they can detect flaws in probabilistic reasoning of others. I will discuss two less radical solutions than the introduction of probability-judges and argue that they fail.

#### *1 Education*

First, many have argued that judges should get much more education in probability theory and I agree. However, although such education can result in passive understanding of probability theory, it is much harder to create the ability to actively reason with probabilities and to detect mistakes in probabilistic reasoning. So, education is necessary, but it does not seem sufficient.

## *2 Forensic assistants*

A second solution could be the appointment of forensic assistants with specific probabilistic expertise. In the Netherlands, forensic assistants have been appointed at criminal courts.<sup>6</sup> Among others, these assistants can explicate forensic reports to judges before the court hearing and they can explicate statements of the experts after the hearing.

The experiments with these assistants have been evaluated positively.<sup>7</sup> Nevertheless, their appointment does not suffice in complex cases. I briefly mention three problems. First, current forensic assistants are not specialized in probability theory; secondly, as assistants, they are not allowed to ask questions at the hearing and, thirdly, they are not supposed to join the deliberation in the council chamber.

If we want judges to be able to critically question experts and to actively reason with probabilities, they themselves should be the expert. In other words: we need probability-judges.

## **Probability-judges are possible within existing legal boundaries**

Now that I have argued that we need probability-judges, let us turn to the question whether their introduction is possible within existing legal boundaries. The answer is: yes. It is in accordance with our fundamental notions of the nature and role of courts in democratic states under the rule of law.

### *Article 6 ECHR*

Let us take a brief look at article 6 of the European Convention on Human Rights (ECHR) which protects the right to a fair trial. The first paragraph says, among others, that everyone is entitled to an independent and impartial tribunal established by law.

For our purpose, the crucial demands are

1. First, that the tribunal is established via democratic legislation and
2. Secondly, that the tribunal and its members are independent of other state powers, in particular of the executive, and that they are independent of the parties involved.
3. Finally, they must also be impartial, which is to say that they are not prejudiced or biased.

### *2 Mixed chambers of the court*

The appointment of experts as members of chambers of the court is not in conflict with these three demands. In fact, most countries have chambers of a mixed composition. There are two main reasons for having mixed chambers:

1. The first is the representation of those who stand trial and
2. The second is that specific expertise is needed to decide the case.

Military and disciplinary chambers, for example, are mixed both for reasons of representation and expertise. Others, the penitentiary chamber for example, are mixed only for reasons of expertise. Chambers with probability-judges would be mixed only for reasons of expertise.

Whereas chambers that are mixed for reasons of representation might need critical scrutiny of their independence and impartiality, there does not seem to be a reason to be extra cautious about chambers that are mixed only for reasons of expertise. In other words: there are no legal objections to probability-judges and mixed chambers.

## **No risk of opening the floodgates to other types of expert-judges and mixed chambers**

Before concluding my talk, let me briefly discuss one possible point of critique namely that appointing probability-judges might result in opening the floodgates to an endless variety of other types of expert-judges and mixed chambers.

There are at least two reasons why I believe we need not worry about this.

1. First, probability experts differ from other forensic experts. They do not have specific expertise about phenomena in the world; they have expertise about methods and about sound reasoning with probabilities.
2. Secondly, it is precisely because of this specific expertise that probability-judges are able to question all other experts about their reasoning with probabilities and more broadly about the methods they use.

Accordingly, the introduction of probability-judges makes it possible for courts to critically question all other experts and in fact reduces the need for other types of expert-judges.

## **Conclusion**

I have come to the end of my talk.

I look forward to a constructive discussion.

More in particular I would welcome an empirical testing of my proposal.

For now, I thank you for listening.

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<sup>1</sup> See for example <https://www.forensischinstituut.nl/over-het-nfi/publicaties/publicaties/2017/10/18/vakbijlage-waarschijnlijkheidstermen> [annex probability terms]

<sup>2</sup> The example is taken from Jan de Keijser & Henk Elffers (2012), Understanding of forensic expert reports by judges, defense lawyers and forensic professionals, *Psychology, Crime & Law*, 18:2, 191-207, at p 197.

DOI:[10.1080/10683161003736744](https://doi.org/10.1080/10683161003736744). In their experiment, the forensic report was presented as follows: "The question has been interpreted as the request to carry out comparative research and examine if the findings fit better under hypothesis H1 below than under the (alternative) hypothesis H2 below. Hypothesis 1: The perpetrator of the robbery visible on SX1\_C1 is the same person as the suspect depicted on photo SX1\_B1. Hypothesis 2: The perpetrator of the robbery visible on SX1\_C1 is not the same person as the suspect depicted on photo SX1\_B1 (...) I now conclude the following: The findings based on the selected visual materials of the facial comparison reported here are much more likely when the person depicted is one and the same person (hypothesis 1) than when they are different persons (hypothesis 2)." And the question was: "Is this a correct interpretation of the conclusion? It is much more likely that the suspect is the person on the images from the security camera than someone else is the person on those security camera images?" p 198.

<sup>3</sup> De Keijser & Elffers (2012), pp 199-200.

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<sup>4</sup> William C. Thompson & Edward L. Shumann (1987). "Interpretation of Statistical Evidence in Criminal Trials: The Prosecutor's Fallacy and the Defense Attorney's Fallacy". *Law and Human Behavior*. 2 (3): 167-187. [doi:10.1007/BF01044641](https://doi.org/10.1007/BF01044641)

<sup>5</sup> De Keijser & Elffers (2012), pp 201-202.

<sup>6</sup> Evaluatie Pilot Forensische ondersteuning rechtbanken Straf [Evaluation Pilot Forensic Support Criminal Courts], 2014. [https://www.rechtspraak.nl/Organisatie-en-contact/Organisatie/Raad-voor-de-rechtspraak/Nieuws/Documents/\(256140063\)%20EVALUATIE%20PILOT%20FORENSISCHE%20ONDERSTEUNING%20.pdf](https://www.rechtspraak.nl/Organisatie-en-contact/Organisatie/Raad-voor-de-rechtspraak/Nieuws/Documents/(256140063)%20EVALUATIE%20PILOT%20FORENSISCHE%20ONDERSTEUNING%20.pdf) last visited April 3, 2021.

<sup>7</sup> See endnote 6.