
B188 Assigning the Number of Mixture Contributors: A Fool's Errand

Charles H. Brenner, PhD, 6801 Thornhill Drive, Oakland, CA 94611-1336*

After attending this presentation, attendees will understand that the number of contributors to assume for a mixture calculation cannot be anticipated in advance, and frequently isn't even the same for competing hypotheses. Overlooking this possibility, as nearly all currently available advanced software does, entails a substantial risk of very misleading results.

This presentation will impact the forensic science community by illustrating the need to be decidedly more cautious about pushing the envelope with even moderately complicated mixtures.

Some standard advice about DNA mixture analysis is to begin by deciding the number of contributors. This advice is not only bad, it's impossible. The advice was memorialized in a careful and influential 1998 paper.¹ In the context of the times and the paper, practically speaking, the advice was merely: decide if the mixture is two-person, in which case the paper described how to perform calculations. The paper's authors didn't seriously consider more complicated mixtures. Presently, complicated mixtures are considered seriously. This is a good time to review and, without disrespect, to reject the old advice.

As a working definition, "complicated" means that the number of contributors isn't obvious. Sometimes the number doesn't even exist in any practical sense. Imagine a mixture of many contributors with contribution amount ranging from major by gradations down to undetectable. Clearly, an undetectable contributor isn't a contributor in a practical sense. How about barely detectable? A small contribution may or may not count as significant, depending on context.

A clear and concrete example will be presented explaining how the differing contexts of two competing (i.e., prosecution and defense) hypotheses may require the use of different contributor numbers. In the example, the only reasonable analysis for the prosecution hypothesis is as a four-person mixture, but the only fair analysis for the defense hypothesis is as a three-person mixture. The resultant Likelihood Ratio (LR), for four-person versus three, is close to one — neutral evidence. Calculating instead as a four-person mixture throughout manufactures the illusion of strong evidence; it frames the suspect. Conversely, calculating uniformly as three-person mixture per the defense generates the illusion that the suspect is virtually excluded. Correctly employing the unconventional calculation is vital; it makes a huge difference.

Examples are fairly common in practice, and do not follow a single pattern. It is not good to say, after studying the one example, "I see where the problem comes from; I'll just look out for that situation and I'll be okay." A counterexample doesn't simply mean, "Here's an exception." A counterexample to a rule means the rule is wrong.

What is to be done? Since there is no ground-truth number of contributors, it is impossible to begin by "deciding the number of contributors." What can and must be done instead is to calculate likelihoods for the range of possible contributor numbers, each for the prosecution and defense separately. Generally, there will be one standout number for each side — maybe the same number, maybe not — which can be used.

Reference(s):

1. Clayton et al. Analysis and interpretation of mixed forensic stains using DNA STR profiling. *Forensic Science International*. 91 (1998) 55–70.

DNA Mixture, Number of Contributors, Bias

Copyright 2017 by the AAFS. Unless stated otherwise, noncommercial *photocopying* of editorial published in this periodical is permitted by AAFS. Permission to reprint, publish, or otherwise reproduce such material in any form other than photocopying must be obtained by AAFS.