

Organization of Scientific Area Committees
Friction Ridge Subcommittee

Commentary on:

President's Council of Advisors on Science and Technology
REPORT TO THE PRESIDENT
Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods

The OSAC FRS is thankful for the attention of the President, and other relevant members of the Executive Office, including the PCAST, to ensure forensic science methods are adequately resourced, properly evaluated, and appropriately applied in practice to safeguard the validity of forensic evidence used in the Nation's legal system. The OSAC, a body of over 500 forensic science practitioners and other experts who represent local, state, and federal agencies; academia; and industry, share this concern and demonstrate commitment by voluntarily serving on various subcommittees with the overarching intent to develop and promulgate forensic science consensus documentary standards and guidelines, and to ensure a sufficient scientific basis exists for each discipline. By nature of its mission, the OSAC FRS acknowledges, and agrees with the PCAST, that there is a need to establish a more formalized research agenda, develop standardized practices, and promote foundational research. Overall, the OSAC FRS considers the PCAST report to be well written and clear with respect to their evaluation criteria and strategic way forward. The aspects of the report the OSAC FRS believes could be further clarified and elaborated upon are:

- (1) The OSAC FRS agrees with the PCAST that there is a need for additional research to build upon an established body of knowledge; however, we disagree that prior research efforts should be disregarded or discounted in their entirety.
- (2) The PCAST states black box studies are the *only* means of establishing foundational validity for subjective feature-based methods and "[i]n the absence of such studies, a subjective feature-comparison method cannot be considered scientifically valid". (p. 66). While the OSAC FRS agrees with the need for black box studies to evaluate the overall validity of a particular method, the OSAC FRS is concerned this view could unintentionally stifle future research agendas aimed at dissecting the components of the black box in order to transition it from a subjective method to an objective method. If the PCAST maintains such emphasis on black box testing as the *only* means of establishing validity, the forensic science community could be inundated with predominantly black box testing and potentially detract from progress on understanding and refining other foundational aspects of the method, such as those previously outlined by the OSAC FRS, in an effort to identify ways in which to emphasize objective methods over subjective methods (see <https://www.nist.gov/topics/forensic-science/osac-research-development-needs>). Given the existing funding limitations, this will be especially problematic and the OSAC FRS is concerned other foundational research will thus be left incomplete.
- (3) The OSAC FRS notes that the PCAST appears to discount or otherwise disregard the role of "experience" and "judgment" in subjective feature-comparison methods. While the OSAC FRS does value empirical testing as hierarchically greater than experience and judgment, they do play an important role and should not be disregarded in their entirety. The disregard for

experience and judgment is reminiscent of what was initially proposed by the Evidence Based Medicine (EBM) movement in the early 1990's. Cohen et al. (2004) in the context of medicine, cautions that experience and judgment remain important elements, especially in situations in which the circumstances of a particular case is underrepresented by empirical tests. (see Cohen et al., "A Categorization and Analysis of the Criticisms of Evidence Based Medicine". *International Journal of Medical Informatics*, 73 (2004) 35-43). Similar principles may be applied to the forensic sciences. Accordingly, the emphasis should not be on blindly banning knowledge gained and assessments made on the basis of experience and judgment; rather, the emphasis should be on clearly distinguishing the source of such knowledge and transparently reporting its basis and associated limitations.

- (4) The PCAST considers the error rate for latent fingerprint analysis to be "substantial" with estimates that an error may be expected to occur up to 1 in every 306 cases (based on the FBI/Noblis study) and 1 in every 18 cases (based on the Miami Dade study). Further, the PCAST states "the actual false positive rate in casework may be higher" (p. 101). The OSAC FRS has some concerns with the approach used by the PCAST to arrive at those estimates.
 - a. The PCAST based their quoted estimates on only a subset of the examination methodology. It is common practice within the latent fingerprint community to ensure conclusions have been verified by a separate examiner prior to a conclusion being released. While the OSAC FRS recognizes that many laboratories may not perform "blind" verifications, the error rates quoted by the PCAST did not consider *any* verification being performed. Accordingly, the error rates quoted by the PCAST do not necessarily reflect actual casework methodology. Both the FBI/Noblis study and the Miami Dade study demonstrate that false positive errors reported by one examiner were rarely reproduced by a second examiner. Taking this into consideration, in practice, the error rate is expected to be lower, perhaps to a substantial degree, than those values reflected by the PCAST.
 - b. The PCAST stated "because examiners were aware they were being tested, the actual false positive rate in casework may be higher" (p. 101). Based on that statement, it appears the PCAST was referring to the Observer "Hawthorne" Effect. The Hawthorne Effect suggests that test subjects may modify or improve an aspect of their behavior in response to their awareness of being observed. The implication of the PCAST is that the error rates observed in the study may represent a lower error rate than what may be expected in casework. While the OSAC FRS recognizes the Hawthorne Effect could be applicable in this situation, the OSAC FRS also notes the research was conducted in an anonymous fashion (as appropriately required by Institutional Review Boards) and participants may paradoxically behave less accurately when they know their identity is concealed and there are no downstream consequences to an incorrect response. Lelkes et al. (2012) observed this phenomenon stating that total anonymity "consistently reduced reporting accuracy and increased survey satisficing [and] complete anonymity may compromise measurement accuracy rather than improve it." (see Lelkes et al., "Complete Anonymity Compromises the Accuracy of Self-Reports". *Journal of Experimental Social Psychology*, 48 (2012) 1291-1299). Although the OSAC FRS does not have empirical evidence to substantiate what the *actual* rate of error is in practice, the OSAC FRS believes strongly that it is not on the level of magnitude reported by the PCAST. If this were true, considering the prevalence of friction ridge evidence examined on an annual basis around the country, the criminal justice system would be inundated with non-corroborative evidence which would draw considerable attention to the issue.

- c. The PCAST considers the quoted error rates for the latent fingerprint discipline as a combination of both human/technical failures and coincidental matches and recommends those error rates be reported to the courts. While the OSAC FRS supports the suggestion to provide error rates to the courts, those rates should be accurately calculated, relevant to the circumstances of the individual case, and appropriately articulated. The error rates quoted by the PCAST are generalized across a sample set of latent fingerprints in which their qualities represent the least favorable conditions that may be observed in casework. Accordingly, while on *average*, the quality of samples utilized in those studies may be consistent with the *average* quality of “difficult” or “complex” samples examined in casework, the error rate should not be generalized as a single rate of error for all latent fingerprint casework; rather, the error rate should be relevant to the quality of the fingerprint *in the case at hand*, as noted by the PCAST with the statement, “[t]he false positive rate for latent fingerprint analysis may depend on the quality of the latent print.” (p. 50). The OSAC FRS agrees with the PCAST that error rates should be conditioned upon the quality of the fingerprint sample and encourages this research to be carried out. In the interim, the OSAC FRS believes it is appropriate to inform the fact-finder that the error rate *in the case at hand* may actually be lower than those observed in the black box studies considered by the PCAST. The OSAC FRS believes this is appropriate because the error rates quoted by the PCAST were calculated on the basis of an incomplete methodology (see sub-section 4a), under conditions which do not reflect actual casework (see sub-section 4b), and are not conditioned on the quality of the fingerprint sample *in the case at hand*. Taking these points into consideration, if the friction ridge community were to report error rates quoted by the PCAST without providing appropriate context, the friction ridge community could unduly bias the fact-finder to either undervalue the “true” value of the evidence (in the case of very high quality evidence) or overvalue the “true” value of the evidence (in the case of very low quality evidence).
- d. The PCAST relies heavily on the “Miami-Dade” black box study as a means of estimating the error rate for the latent fingerprint discipline. The OSAC FRS notes that the PCAST failed to detect the calculation error in the false positive rate reported by Miami Dade. The false positive rate is calculated as the number of false positive responses divided by the number of opportunities to make a false positive response (conditions in which non-mated samples were presented to the study participant). The Miami-Dade study differed from the FBI/Noblis black box study in that the FBI/Noblis study consisted of a single latent impression compared to a single reference impression (hence a false positive could only occur in a non-mated trial). The Miami-Dade study, on the other hand, provided participants with *multiple* reference impressions for each trial; thus, even for the trials which contained a mated source, there were also non-mated sources which could have resulted in a false positive response. Indeed, of the 42 false positive results, 39 of them were made to an incorrect reference print during a mated source trial. Accordingly, the accurate calculation for the false positive rate in the Miami-Dade study is 42 false positive responses divided by 3,687 trials in which a false positive response could have occurred and in which a conclusive response was rendered (1,398 non-mated source trials and 3,138 mated source trials with non-mated source reference prints minus 849 inconclusive decisions among both mated and non-mated sets). Rather than a false positive rate of 4.2% (42/995), as stated by the authors and quoted by the PCAST, the actual false positive rate is 1.1% (42/3,687). The upper bound of the 95% confidence interval then becomes 1.5% (not 5.4% as originally calculated by the

PCAST). Further, if the 35 false positive responses believed to be due to clerical errors were removed, the observed false positive rate is 0.19% (7/3,687). The upper bound of the 95% confidence interval then becomes 0.39%.

- (5) The PCAST states “[s]ubjective methods can evolve into or be replaced by objective methods.” (p. 47). The OSAC FRS recognizes the integration of objective methods to measure similarity compared against a pre-defined “matching” criteria will certainly be a step in the right direction; however, the OSAC FRS believes it is a mistake to expect that objective methods will *fully* replace the subjectivity of the human examiner. The human examiner will continue to serve as a critical, albeit subjective, element of the broader methodology. Rather than entire substitution, the human examiner and the measurement instrument will need to work complementary to one another. This is how science of all sorts is practiced.

In closing, the OSAC FRS appreciates the attention and commitment to improving forensic science demonstrated by the PCAST, the President, and other members of the Executive Office. The OSAC FRS believes the forensic sciences and, latent fingerprint analysis in particular, are on the right path forward to build upon an existing foundation of knowledge, improved standards and guidelines, and strategies to transition elements of the methodology which rely on subjective judgment into objective measurements. The OSAC FRS looks forward to a joint commitment to this effort by the general scientific community.