

# NEIAI

Bridget, Mariana, and Kay at last year IAI Conference. Please remember that NEIAI can award a \$500.00 scholarship to attend the IAI Conference. Submit scholarship requests to the NEIAI President.



## NEIAI 2010 Annual Conference April 6-7, 2010

Mahoney State Park  
Ashland, Nebraska

Key Speaker  
**Pat Wertheim**  
Internationally Known Fingerprint Expert

The NEIAI Web site can be found at  
[www.neiai.com](http://www.neiai.com).

There are numerous PowerPoint presentations and articles available at no charge.

Please visit the NEIAI WEB site for information on our Sponsors, Board of Directors, and Conference Details.

# Significant Numbers, Precision and Accuracy: Bloodstain Examples

by  
Larry Barksdale

Significant figures, precision and accuracy are important concepts to understand before one delves into the subjects of error and error rates in the forensic sciences.

All measurements are approximations. There can be no measurement in forensic science without uncertainty. The significant figures of a measurement are those numbers in which there is a reasonable degree of certainty. As an example, if a length is measured as 12.3 cm with a scale that has units in centimeters we can be reasonably certain, given that the person doing the measurement correctly read the scale, that the length is 12.3 centimeters or 12.2 centimeters or 12.4 centimeters. The example gives three significant figures with the possibility that there can be no more uncertainty than 0.1. If the example was 12.34 centimeters we could be reasonable certainty that the measurement was no less than 12.33 and no more than 12.35.

Significant figures, it can be seen, define the precision of a measurement. In the 12.3 example, if everyone used the same scale and repeated the measurement many times all of the measurements should be within 12.2 centimeters and 12.4 centimeters. This is precision.

The issue in forensic science often comes about from reading of the measuring device. A scale with units in millimeters can only be used to measure to the value of a millimeter. Some analysts make the mistake of estimating a measurement. As an example, they might see the length of a bloodstain in which it appears that it falls between the 4 and 5 millimeter mark. they estimate that the length is 4.5 millimeters or 4.25 millimeters. This is an incorrect reading. The mark is either closer to 4 or closer to 5. One can only report the measurements in terms of the limits of the instrument. One would report the measurement as 4 or as 5, whichever, in the opinion of the analyst, was closer to the length. There would be one significant figure and one could be reasonably certain the real measurement would fall between 3 millimeters and 5 millimeters if it was reported as 4 millimeters.

Accuracy refers to the correctness of a measurement in terms of true value. You can be precise, but not near the true value. You may have

measured a bloodstain width at 2 millimeters ten times. You were precise. If the actual value was 4 mm you were not accurate. If the actual was 2 millimeters you were precise and accurate.

In October 2008 19 crime scene techs were provided additional training in significant figures, precision, and accuracy and asked to measure bloodstains for length and width, and to calculate an angle of impact. The same group was provided two bullet hole impressions and asked to measure the length and width and to calculate the angle of impact.

The bloodstains were dropped on a piece of smooth surface, painted drywall, at a fixed angle. There were well over 40 bloodstains on each side of the drywall. The crime scene techs were asked to take 40 measurements, as a group project, from each side. They were to select what they felt were 40 well formed bloodstains. One tech elected to take all forty measurements himself. This provided 3 examples of 40 measurements for bloodstains and two for bullet impacts.

The exemplars were prepared so that the known angle was not known. This was a control so the instructor could not somehow add biases to the exercise by indicating a known angle. The gunshots were at a known angle with a .45 caliber firearm fired at 45 degrees and at 30 degrees.

## Measurement Results

	Ind.	1 - bld	2-bld	45 dgr	30 dgr
mean	16.6	17	14.9	39.3	35.1
STD	2.68	3.4	1.7	8.9	6.2
range	13-26	10-27	12-19	22-56	30-49

A scale in millimeter units was used for measurements. All final results must be in whole numbers with rules of the limits of the measuring instrument and significant figures. The individual value "Ind." in the above table value would be 17. The "1-bld" turned out to average 17. It can be seen, then, that the means of the two sets of measurements are the same. For known 45 degree bullet the value would be 39, and for known 30 a 35 value.

In future newsletters we will consider the importance of variation in precision and accuracy in terms of error and error rates. Notice that range values could indicate considerable lack of each?

## Notes From the Editor

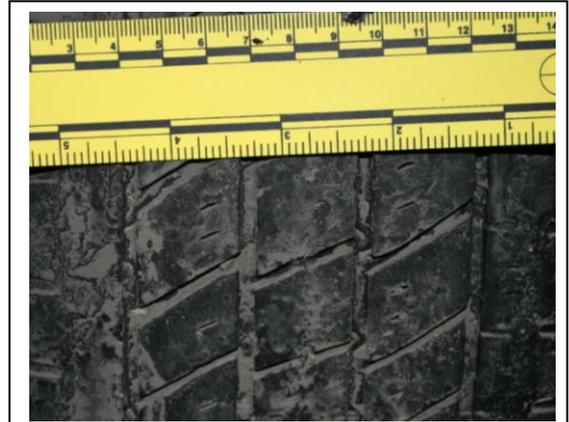
In future issues we will discuss how to interpret data to get a sense of error and error rates. Please send comments to the editor for inclusion in the next newsletter.

Crime Lab Report, February 2010, reports New York State has decided to cease all fiber examinations due to discovery of incomplete documentation of examinations, and lack of basic skills and knowledge in the analysis of fibers. Additional error was discovered in drug analysis tests in a lab in Erie County due to deliberate falsification issues with GC/MS instrumentation. NEIAI members can go to [www.crimelabreport.com/library/monthly\\_report/2-2010.htm](http://www.crimelabreport.com/library/monthly_report/2-2010.htm) for additional information.

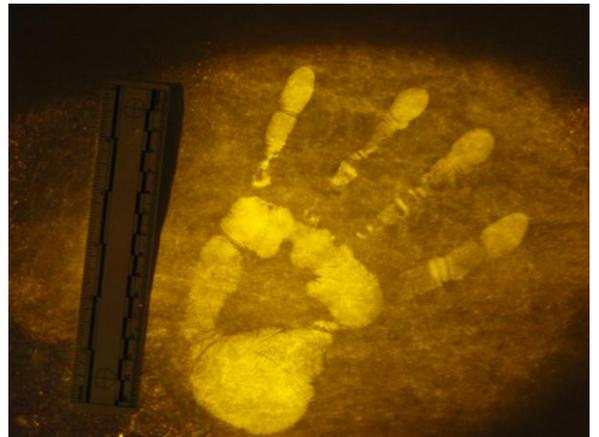
It is important that NEIAI members remain informed on forensic science issues, and fulfill their professional role to be watchdogs over forensic science services within Nebraska. We must be able to police ourselves.

This leads to the question of ethics. Have any of you been required to complete an ethics course that was a tested course of instruction? Does your agency have a written code of ethics? Along with certification perhaps an ethics course should be a requirement for all forensic practitioners.

Please send comments to the editor.



Assume the image is actual size (1:1). How would you report the width of the middle tread pattern from inside edge to inside edge? What are the limits of the scale?



**Here is a question often posed to Advanced Forensic Photography students. How does the 'Stokes Shift' apply to the above image. Explain this in terms of the process to produce and photograph the image.**

**YOU ARE INVITED TO SUBMIT SHORT ARTICLES FOR PUBLICATION IN THE NEIAI NEWSLETTER. LONGER ARTICLES AND RESEARCH PUBLICATIONS CAN BE SUBMITTED FOR PUBLICATION ON THE NEIAI WEBSITE.**

## Snapshots

### Local, Regional, National

I have not received any information on local events. I know there are many around the state who continue to seek certification. Congratulations on those who have continued with this.

Evidence Technology Magazine, Vol. 8, No. 1, Jan.-Feb 2010, 20-23, has an article on "Outsourcing Forensic Analysis." This seems to be most applicable to fingerprint examinations. The gist of the article is that it seems to be difficult for many agencies to maintain within fingerprint examiners who are certified and who can fill a dual role of verifying another examiners identification. Hence, private agencies such as Ron Smith and Associates and Casey Wertheim's, Complete Consultants Worldwide, exist to fulfill this need for the forensic science community. Comments?

*New Book: Aric W. Dutelle, An Introduction to Crime Scene Investigation. Boston: Jones and Bartlett Publishers, 2011.*

### Links from the Newsletter

[www.ronsmithandassociates.com](http://www.ronsmithandassociates.com)

[www.clpex.com](http://www.clpex.com)

[www.crimelabreport.com](http://www.crimelabreport.com)

