



### B116 A Simple Method for Comparing Difficult Prints and Stains

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The goal of this presentation is to introduce the reader to a simple tracing method to complement conventional methods of print evidence comparisons in cases where the prints are difficult to decipher or include confusing detail or background. The method will also be applied to stains, and will be illustrated through case examples including shoeprints, ear prints, and stains on carpet and fabric.

Transparent overlays have enjoyed wide use in the comparisons of shoeprints, fabric impressions, and other patterns such as ear prints. Because the value of this method is intuitively obvious, it is rarely questioned. However, the overlay method alone is insufficient when the very ability of the human brain for pattern recognition becomes a source of error in interpreting patterns. The brain infers shape from even discontinuous elements of form, so that a triangle is perceived when observing three isolated "Vs" which would be the apices. This could be a source of error if the object responsible for a print includes three separate "Vs" in its design, or one "V" deposited three times. Conversely, if there are pattern elements that are not readily inferred as a shape, the brain may disregard them. To control for these types of error, we propose a simple method to render the comparison process more objective: manually tracing the observed detail of the evidence print onto a piece of clear plastic, then comparing the tracing with exemplars.

The success of this method depends upon tracing each discrete dot, line or shaded area as it appears in the print. This should include each mark in the area being traced, regardless of whether it appears to be part of a pattern. Instead of "connecting the dots", one should record the "dots" themselves, because that is the actual data. If some of the data points appear to be from the background or from a stray twig or other object, they can be traced in a different color. Several reference points that can be easily recognized, such as the corners of a tape lift or photograph bearing the print, should also be recorded on the tracing.

This method is useful for the following classes of prints: 1) an evidence print with much less detail than exemplars; 2) a print with intermittent or overlapping detail; 3) a print with a strong background or substrate pattern; 4) smeared prints or prints produced in a liquid or suspension; 5) prints, or photographs of prints, having evidence of distortion or motion; and 6) prints on, or produced by, a flexible material such as fabric. Tracings can also be used to compare stains on an item with stains that may have soaked through it to another item that is now separate.

When an evidence print has much less detail or much less area than exemplars, the pattern of the evidence print may fit completely within the pattern of the exemplar. Any differences between the two may be missed because the set of data that constitutes the pattern with less detail appears to overlap completely with the other. However, there may be differences in angles, curvature, or spacing of minute detail. This is not always resolved by producing fainter exemplars, but can be seen in a tracing.

On the other hand, a wealth of detail may be rendered in a tracing of a print that initially appeared to exhibit only the most general class characteristics. A tracing of the data points may yield disconnected elements of a pattern, visible in a conventional overlay, but not readily perceived as significant. When rendered in a tracing, the data points may nevertheless exhibit good spatial correspondence with an exemplar.

A similar situation is encountered when a patterned background interrupts the pattern of the print. If Fourier transform software is available, a scanned image of the background can be subtracted from a scan of the print on the substrate. However, this can also be done manually, by tracing the evidence pattern in one color and the background pattern in another then comparing the tracing with the exemplar.

In the case of a print deposited in a liquid or suspension such as mud or blood, the liquid may collect in some of the spaces between the design elements. If the entire print were like this, it would appear to be a reverse print with little detail. However, when a print is partly produced by the design elements, and partly by runoff between those elements, the result can be confusing and not easily interpreted using conventional overlays. A tracing can allow the examiner to make an interpretation and to find detail that would otherwise have been lost.

A series of tracings can be made when there appears to be displacement of design elements due to movement of the imprinting object relative to the substrate. This allows the examiner to evaluate whether differences between a print and an exemplar are due to motion, or to a different object that produced the print. When it is not possible to distinguish between those options, both conclusions can be presented and their basis documented. At least one tracing should be made of the print as a whole.

Sometimes a print is made into a soft surface such as soft soil or snow. The shoe or other object may curve or bend while producing the print, producing local distortion. Similarly, the object that produced the print may have been curved or bent while producing it, for example, a shoe sole with upturned toe during a kick. The best practice is to produce exemplars under conditions that can mimic the distortion. In the few situations when this cannot be done, the area of distortion can be traced separately for comparison to an exemplar. This also applies to prints made by, or onto, flexible materials such as fabric. The fabric may not have been lying flat, yielding a print produced onto, or by, stretched, twisted or folded material.



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An additional application involves stains rather than prints. When a liquid is seeping through a porous item onto whatever is beneath it, the pattern of stains can be used to compare the porous item with a suspected substrate. Because the top item may retain more of the fluid than the one beneath, the size and shape of the stains may not be the same even if two items were in direct contact. It is the areas of heaviest staining that may be more significant to compare. Tracings of the item with lighter deposits can be overlaid onto the suspected "parent" item to accomplish this.

A record of comparisons made with the assistance of a tracing should include photocopies of several overlays for each print: 1) the tracing overlaid onto the source print to record the fidelity of the tracing; 2) the tracing overlaid onto an exemplar, and in the case of a dissimilar print, onto a series of exemplars taken with different degrees of contact, pressure, motion, or impact (e.g., a kick vs. a step); and 3) if a series of tracings is used, the several tracings overlaid onto a tracing of the print as a whole; and 4) when more than one superposition can be made between the tracing and exemplar, a photocopy of each superposition.

Summary: Overlaying hand-drawn tracings of evidence prints onto exemplars can render the comparisons of difficult prints both more objective and more successful, and can also be used to evaluate stains soaked through from one garment to the next. This method is especially useful with prints having hard-to-decipher or confusing detail or background. Tracings complement, and can be used together with, scans or photographs of prints printed onto transparencies, as well as with the older method using calipers to triangulate points of comparison.

### **Forensic Science, Shoeprints, Ear Prints**