

# CAPILLARITY DISTORTION ANALYSIS

by

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## Introductory Statement:

*The examination of capillarity distortion may enhance the investigative analysis of crime scene reconstruction involving bloodstain pattern interpretation.*

## Cause and Effect:

Fluid dynamics, the study of liquids in motion, is of critical importance in the understanding of bloodstain pattern analysis. The motion of fluids is dependant upon several variables including surface tension, viscosity, and specific gravity. 1

Surface tension is the result of molecular cohesive forces that cause the surface of a liquid to resist penetration and separation. 2  
Viscosity is the condition, or degree of being viscous, or resistant to flow (tacky). 3

As liquid blood, in contact with a solid surface, is pulled or distorted from its original shape, or form, surface tension will resist separation causing a higher accumulation of volume at the location of departure. Therefore, motion or directionality may be determined through the examination of the concentration level of liquid blood upon a flat, horizontal surface.

## Definition of terms:

**CAPILLARITY**, *noun* - The interaction between contacting surfaces of a liquid and a solid that distorts the liquid surface from a planar (*flat*) shape.

**DISTORTION**, *verb* - Twisting or deforming out of a natural, normal, or original shape, form, or condition.

**ANALYSIS**, *noun* - A statement of the result of such a study.



*Above captioned photo illustrates molecular cohesive resistance to separation and surface tension.*

## Motion/Directionality:

Bloodstain pattern interpretation, as a forensic science, has been proven effective in the enhancement of violent crime scene reconstruction in numerous criminal cases throughout the world. Crime scene reconstruction is based upon the application of scientific principles, interpreted from the physical evidence, to determine events or movement of suspects or victims.

1 - Bloodstain Pattern Interpretation, Herbert Leon MacDonell, NY 1982. 2- Interpretation of Bloodstain evidence at Crime Scenes, William G. Eckert, M.D. and Stuart H. James, Elsevier Science Publishing Co., Inc., The Netherlands 1989. 3 - American Heritage Dictionary, Second College Edition, Del Publishing, NY 1993.

The examination of capillarity distortion, in certain bloodstain pattern cases, may lend itself as physical evidence to directionality or movement and in some cases sequencing of events. As the surfaces of two solids begin to separate from a liquid, interfacial tension partially overcomes the surface tension resisting separation. The liquid itself stretches or becomes distorted from its original form and will be drawn toward the direction of the force.

Once the force separating the two solid surfaces exceeds surface tension, the liquid is "drawn" away from the solid surfaces until it separates depositing the greater accumulation of the volume at, or near the point of departure. *(given a planar surface)*

In the photograph at the right, directionality of the bloody shoe impression, or transfer "swipe" or "smear" may be determined by the heavier volume of blood at the left edge of the shoe impression.

The examination of the blood transfer rings deposited from the champaign glass, or the palm print, provides a capillarity distortion indicating directionality of movement. *(Glass tilted to left or - 9 o'clock, hand rolled to left and lifted, etc.)*

### **Event Sequencing:**

Should the examination of the patterns provide an overlap, or layering of the transfers, one could determine sequence. Event sequencing is of particular interest to the bloodstain pattern analysts as the first blood transfer, if discernible, is often closer in time (sequence) and distance (spatial relationships) to the "first harmful event".

### **Documentation Considerations:**

As with most bloodstain patterns, it is of critical importance to document the pattern with quality photographs taken both with and without a good photographic reference scale. *(The author has been very impressed with the ABFO No. 2 scale available from Lightning Powder Co., 1-800-852-0300)*

Crime scene field and/or laboratory notes should be taken in such a manner as to allow the observations to be later articulated with reference to the concentration levels visible within the bloodstain pattern. Where possible, consideration should be given to collecting the bloodstain pattern intact, in order to preserve the capillarity distortion. Collection of control standards should be considered from the various surfaces in contact with the bloodstain.



*Above photo illustrates capillarity distortion and directionality of bloodstain pattern analysis.*

### **Conclusion:**

In the crime scene reconstruction of violent crimes, bloodstain pattern interpretation may be enhanced by the examination of capillarity distortion. Supplemental testing of duplicate or similar surfaces is encouraged to establish the scientific certainty of the analysis. Capillarity distortion analysis may also prove useful in those cases where event sequencing, motion, and/or directionality is important to the reconstruction effort.

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## **About the Author:**

**John Wesley Anderson** is a Sergeant with the Colorado Springs Police Department and is currently assigned to the Office of Professional Standards. Sgt. Anderson holds an AAS degree in Police Science, a BS in Business Administration, and is two classes from graduating with an MBA. Sergeant Anderson, a court qualified expert in bloodstain pattern interpretation and criminal investigations, spent six years in the detective bureau where he was involved in over one hundred homicide investigations.

Sergeant Anderson has extensive teaching experience, primarily in the areas of violent crime investigation. He has lectured and made professional presentations on behalf of a number of law enforcement organizations to include the International Associations of Chiefs of Police (IACP), Federal Bureau of Investigation (FBI), Law Enforcement Training Network (LETN), Colorado Association of Chiefs of Police (CACP), as well as his own firm the Criminal Investigations Institute, Inc., (CII) located at 1115 War Eagle Drive North, Suite 221B, Colorado Springs, Colorado, USA (719) 260-0375.

Sergeant Anderson is a charter member and past president of the Rocky Mountain Association of Bloodstain Pattern Analysts, and a past President and Chairman of the Board of Directors for the Rocky Mountain Division of the International Association for Identification. Sergeant Anderson is also a member of the International Association of Bloodstain Pattern Analysts and currently serves as the Chairman of the Ethics Committee of the IABPA.

### **Previous bloodstain pattern analysis publications include:**

**Out on a Tangent, with Bloodstain Pattern Interpretation**, co-authored with IABPA President Tom J. Griffin, International Association of Bloodstain Pattern Analysts, March 1993.

**Bloodstain Pattern Interpretation, the State of the Art, the The Colorado Policeman**, November/December 1991 issue.

**Sherlockian Theories, Lessons from the Greatest Detective who *Never* Lived**, the Canadian Society of Forensic Science, Scientific Journal, June 1991, with a reprint in the International Association of Bloodstain Pattern Analysts News, September 1992.

## **Photo Credits:**

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