B54 Paradoxical Effects of Surface Structure and Drop Height on Blood Stain Pattern Formation

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After attending this presentation, attendees will understand the influence of surface structure on shape of blood drops is very hard to predict without extensive experimentation. Even if surfaces seem to be very similar, paradoxical effects occur. Systematical variation using the actual surface from a crime scene will still allow scientifically sound statements, e.g., relating to height of blood source. Ultra-high-speed photography and physical analysis of the edges of blood stains during their process of formation (Karsten Loehr, Université Pierre et Marie Curie, Paris) also help to understand the dynamics between the surface, the blood drop and its later shape.

This presentation will impact the forensic community and/or humanity by demonstrating how extensive experimentation is necessary to understand the influence of the actual environment on the shape of blood drops. Even very reasonable and obvious assumptions about the structure of a surface may easily lead to wrong interpretations, and wrong expert witness statements.

During casework, the authors encountered the problem that height of the blood source became relevant. In order to determine the dependence of different types of underground on the shape of the drops, the authors checked the influence of asphalt, paper, linoleum, and plastic against different dropping heights (5, 100, 250, 500, 1000, 2000, and 3000 mm; n (drops) = 520). Then the diameter of the stains was compared, the number of fingers, the maximum distance of satellite drops to the center of a stain, and the total number of satellites.

Initially, asphalt and paper produced effects of rough surfaces whereas linoleum and plastic represented rather smooth surfaces. However, the general tendency of the diameter to increase with drop height, and to remain constant beyond a certain height, was not observed on asphalt. Instead, the diameter remained constant irrespective of drop height.

Also, the number of fingers ("noses") of stains produced on asphalt did not increase like on the other surfaces. The largest number of fingers was observed on paper.

The maximum distance of satellites to their central stain mostly increased linear with drop height. Asphalt presented the largest distances. Drops on the plastic surface showed constantly small distances of the satellites to the center of the stain.

Exact total number of satellites could only be determined on paper and asphalt. Even though both materials showed properties of the rough surface group, they produced very different results (e.g., on asphalt, the number of satellites increases linearly and steeply with height). In contrast, on paper the number of satellites stayed nearly zero.

In many cases it also seemed as if the relationship between height and the respective measured parameter was initially not linear but exponential, inverse exponential, or following a saturation curve. These effects will only become visible if small intervals between drop heights are chosen experimentally, especially in the often neglected range between 0 and 100 cm.

Conclusion: In casework, extensive experimentation is necessary to understand the influence of the actual environment on the shape of blood drops. Even very reasonable and obvious assumptions about the structure of a surface may easily lead to wrong interpretations, and wrong expert witness statements.

Blood Stain Pattern Formation, Crime Scene Reconstruction, Physics of Drop/Surface Interaction

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