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Spatter from blood-soaked sponges could aid gun forensics

Calling the shots
Marco Prandina/Getty

By **Emily Benson**

Whodunnit? Forensic investigators could soon be able to deduce in much greater detail how specific blood spatter stains were caused at a crime scene.

Detectives can back-calculate some of the details of a shooting by measuring the stains made by splattered droplets of blood. The size of the droplets helps them figure out the speed of the bullet, and their shape can help deduce where in space the victim was hit, whether by a bullet or a fist.

But the current methods for analysing blood spatter patterns are incomplete, says Alexander Yarin at the University of Illinois in Chicago. They only allow investigators to determine general categories of velocity, like low, medium or high impact. The calculations also assume that the drops travel along a straight path.

In reality, gravity and air resistance drag and slow the droplets, causing them to follow curved trajectories. While some newer models incorporate those forces, they still miss another crucial factor, Yarin says – the conditions that affect the creation of the drops themselves. These initial conditions set the scene that the detectives will later investigate, so they are crucial to understand.

"None of these approaches even ask the question, what is the origin of droplets?" Yarin says. "What is the physical mechanism of formation of drops, and their initial sizes and velocity?"

To address those questions, Yarin and his colleagues built a theoretical model to predict the pattern made by blood spraying outward from a gunshot wound as it splashes on the floor. The model includes features of the bullet – its mass, velocity, and angle – as well as the acceleration and density of the spattering blood.

The interplay between a dense liquid like blood and a thinner substance like air is what determines initial drop size and velocity, Yarin says. The model also incorporates the inertia and surface tension of the liquid, which determine the size and configuration of the droplets that emerge as a "blood cloud", and the diminished air drag each droplet feels thanks to the presence its neighbours. Given those inputs, the model spits out the number and size of droplets you should expect to see.

Shooting at sponges

The researchers then verified the model by shooting at sponges soaked in pig's blood, and measuring the resulting spatter patterns. The results were mixed: the experimental droplets were generally within an order of magnitude of the model's predictions, but varied considerably between trials. The team is planning to run more trials with different types of bullets to refine the model further.

This type of research can help us learn about the physical forces controlling blood spatter patterns, says Mike Illes of Trent University in Ontario, Canada. The complexity of blood means that we still don't understand exactly how it behaves in every situation.

"We're just kind of scratching the surface as to what really goes on with it," Illes says.

If the theoretical model were refined and translated into a tool that detectives could easily use, it would be a major improvement, says Lee Hulse-Smith at the Centre for Forensic Sciences in Toronto, Canada.

"It's exciting," he says. "But I would say it's still early days on getting this into use in a crime scene."

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