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# Stop Motion Photography of Bloodstains

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The attempt to describe verbally the dynamics of a blood drop as it falls through air or as it hits a flat or angled surface always seems to lack clarity. This verbal description is the usual way to illustrate what occurs in various actions with blood to students, lawyers, doctors or juries. It falls short of what is needed as most of us have some difficulty forming abstract images in our minds. This is especially difficult when we have not seen any of the actions reduced down to slow motion. An attorney for the defense requested a graphic example of what was being described in talking about geometric bloodstain patterns. Instead of drawing these patterns we decided to photograph with still frame photography these various occurrences.

The objective of our attempts was to capture blood droplets in various stages of their evolution as they fell from a height and struck a surface at varying angles. The obstacles we faced were finding a way to stop the motion at selected times during the fall of the drop and composing photographs that would have a large enough image scale that detail would be visible when the slide was projected. The following photos are examples of some of the shots produced.

The first photograph (#1) shows a drop of blood falling through air and caught just before it lands on the surface below. This shows that the drop is circular in shape and forms a sphere. This is an important principle in the basic understanding of the discipline. If the drop were different shapes such as square or elongated, then it would produce a different pattern and, thus, not be consistent each time. But the individual drop will always be circular in free fall and, therefore, always consistent.

The next photograph shows a drop just after impact onto the surface. This shot shows the drop ballooning outward with the diameter becoming much larger as the drop goes from a sphere to a flat stain. This also shows the elasticity or skin of the individual drop keeping the drop together. Because of the smooth surface the drop does not breakup upon impact as some lay people might think.

Picture #3 shows a drop ready to fall into another drop already on the target surface. Since the surface is no longer clean, the reaction of the drop about to land will change. It will not simply balloon out and settle on the surface. Instead it will create a mini-explosion as it comes into contact with the fluid of the first drop. This will produce satellites that go up into the air and break away from the main body of the blood. Then due to gravity they will be pulled back down to the surface and will look like very small 90° drops surrounding the main pattern. This is shown in photo #4.

The next photos (#5 & #6) show the actual eruption of another drop landing into a preceding drop. This shows several principles at work. The elasticity of the cohesive force is shown as the blood tries to remain a separate entity. Inertia is shown as the satellites break away and continue in their direction of travel until gravity takes over forming a parabola.

The next photographs (#7 & #8) show a drop landing on an angled surface causing the drop to elongate. Blood patterns will always point in the direction of travel except for the very small satellite that, due to inertia, breaks away from the parent drop. This satellite is traveling very close to the surface and will streak into the surface much

Initally, a brief overview of the equipment setup used to capture the images is needed. The equipment is placed on an average sized table and a seamless background is positioned forming the base and background. A lab stand with an arm is used to hold a lab burette which contains the blood, and is placed to one side of the target area with the arm holding the burette over the center of the target. On one side of the target is placed another lab stand and arm which holds a small flashlight. On the other side of the burette is a third stand and arm which holds the trigger mechanism in a manner which causes drops from the burette to pass between the light and trigger, breaking the light beam. The trigger mechanism is connected via PC synch cords to two variable power electronic flash units. The camera is mounted on a tripod and placed between the lights.

Two variable power electronic flashes are used for lighting. Since the flash units will be used to "freeze" the motion, they are placed on low power in order to shorten the flash duration. Flash duration on low power varies from unit to unit but will usually be in the range of 1/10,000 to 1/50,000 of a second. As you can see, the flash will be far superior to using the shutter to stop motion. The electronic flash units are placed on opposite sides of the target area at a 45 degree angle in a standard portrait setup. This will give the falling spheres depth and enhance the detail and texture of the drops as they break up. The flash units are connected via PC cords to the electronic trigger, which fires the flashes at the preselected moment.

Lens selection is largely up to the individual so long as you are able to obtain sufficient image scale while keeping the splashing blood off the lens. In our case, we wished to use slide film, for projection purposes, so we needed to compose a basically finished product in order to avoid copying slides. The lens we selected was a Canon 50mm macro with a 3x teleconverter. This allowed us an image scale range of 2:1 to 3:1, yet kept the camera back and out of the lights and splashing blood. We chose to use the lens at a fairly small operture in order to maximize depth of field. The flash power setting and flash to subject distance will have to be varied in order to obtain the desired operture.

Film choice is entirely up to the individual depending on what you want the finished product to look like. We used both Kodachrome 64 and Ektachrome 100 slide films. The slow film speed was chosen for fine grain and to allow the flash units to be positioned fairly close to the target area. The excellent color saturation of Kodachrome 64 also enchances the clarity and dynamics of the subject when shot with a complimentary background color.

Exposure, in this case, is determined by the film speed, flash power setting, and flash to subject distance. The equipment is set up and a reading taken at the target using a flash exposure meter. Our target operture was usually f16 or f11. If adjustment is necessary for the desired meter reading, you may reduce the power of the flash units or increase the flash to subject distance. Of course, you may also use neutral density filters if they are available. The camera is set on bulb and fitted with an air release or cable release. The exposure was made with the room lights dimmed and the shutter opened on bulb.

Once the equipment is set up, a reading taken, and your operture set, you're ready to start the photographing process. First, dim the room lights to the extent possible while still being able to see your equipment. Turn on the flashlight and position the beam such that it strikes the hole in the side of the trigger housing. Then turn on the trigger and electronic flash units. Now pass your hand through the beam insuring that the flash units fire at some point after the beam is broken. Position the burette so that the blood drops pass between the flashlight and the operture in the trigger housing for the phototransistor. By adjusting the two potentionmeters on the side of the trigger housing, you can vary the delay between the time the beam is broken and the time the flash units are triggered. By increasing the delay, the drop will be caught at a later point in the fall or later in the evolution of the splatter. If you are photographing drops in mid air, set the camera where you wish to catch the drop and adjust the trigger while allowing blood drops to fall until the drops are caught in the field of view of the camera. If you are photographing splatters, allow a drop to fall to determine the target area. Focus the camera on the target area, then adjust the trigger while allowing drops to fall until the flash catches them at the desired moment. To take the photograph, open the shutter of the camera, allow one drop to fall, then close the shutter of the camera.

The key to this technique is the trigger unit which gives you the flexibility to photograph the splatter at any point in its evolution. The basic trigger was taken from an article written by James Bailey and published in the January, 1985, issue of Modern Photography. The basic circuitry remains the same with a few modifications for increased accuracy and flexibility. Basically, the trigger is a variable electronic time delay that starts when the light falling on the phototransistor is interrupted. The trigger and light are set up in a manner such that the light beam falls on the phototransistor until a blood drop falls, breaking the beam and starting the time delay. The delay time is independant of the length of time the beam is broken. The time delay is set using two potentiometers, one a 500k ohm pot for coarse adjustment, and a 50k ohm pot for fine adjustment. This gives you an approximate range of 10-560 milliseconds delay time. Once the trigger fires, there is approximately a 1/2 second delay until the trigger can be fired again. This delay gives you time to close the camera shutter before another drop can fall. The trigger is based on a Schmitt trigger IC and costs less than twenty dollars to build, depending on the case and other niceties you chose.

The circuit is quite easy to build and can be built on a 2"x3" perforated board and fit in a box of similar dimensions. The circuit utilizes one IC, an SCR, one phototransistor, a nine volt battery, and assorted resistors and capacitors in a light-tight case. The phototransistor used is a Radio Shack infrared phototransistor, catalog #276-145, which is placed in a length of plastic tube to make it as directional as possible. The open end of the plastic tube is placed against a hole made in the side of the case where the light from the flashlight will enter.

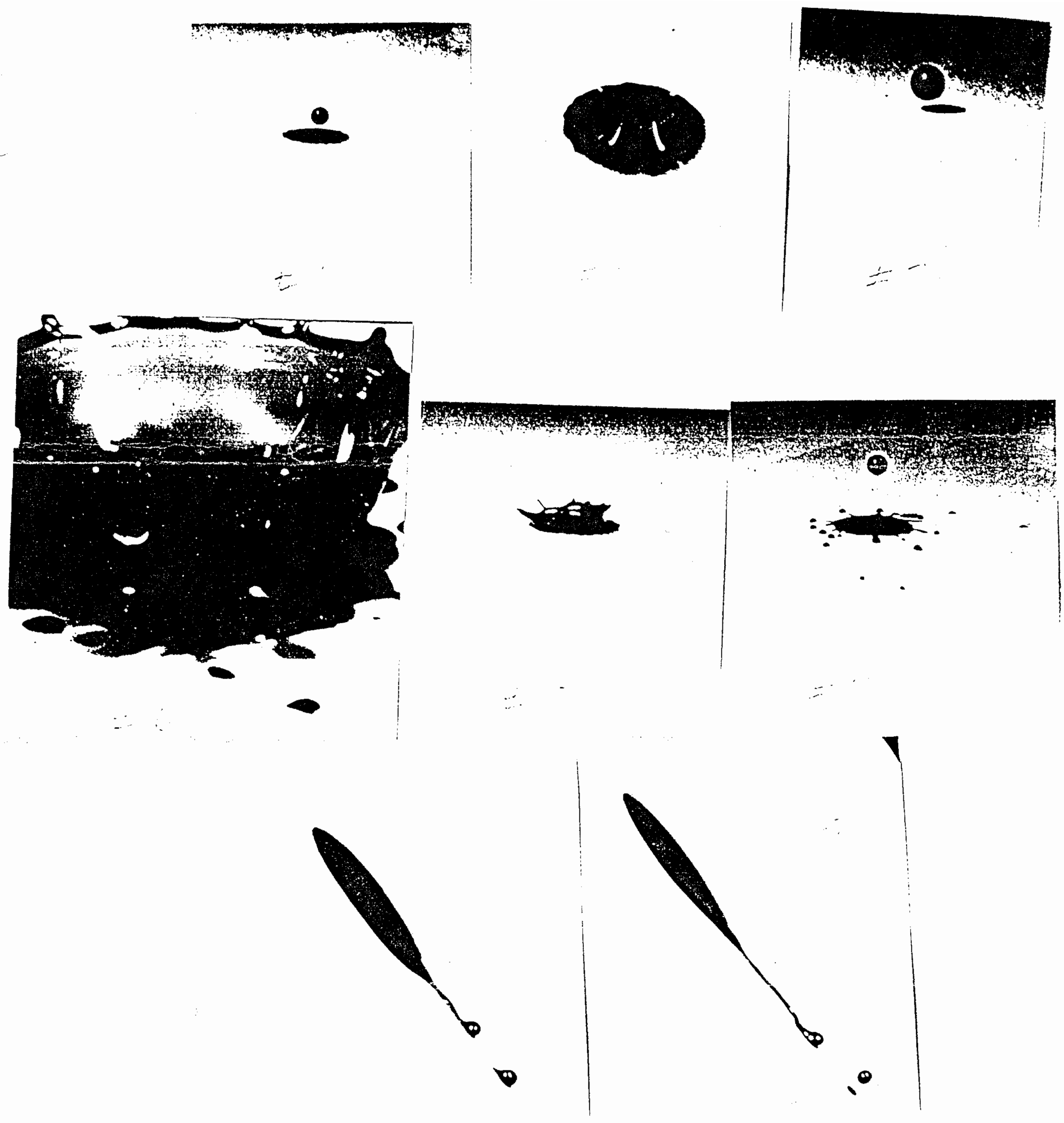
The IC is a 4093BCN, and the SCR, which is the component which actually fires the flash, is a C106D2 which is connected to a male PC cord that connects to the flash units. R3, a 10K ohm resistor, sets the minimum time delay of 10 milliseconds, and R6 and R7 are the coarse and fine adjustment potentiometeres which set the actual delay time. R5, a 680K ohm resistor, sets the time delay between the firing of the flash and the reset of the trigger mechanism. The resistance values of these resistors may be changed according to individual needs. The basic rule is approximately 1 millisecond of delay for each 1000 ohms of resistance. The electronics are powered by a 9 volt battery which will fit in a 3"x2"x1.5" box with the circuit board.

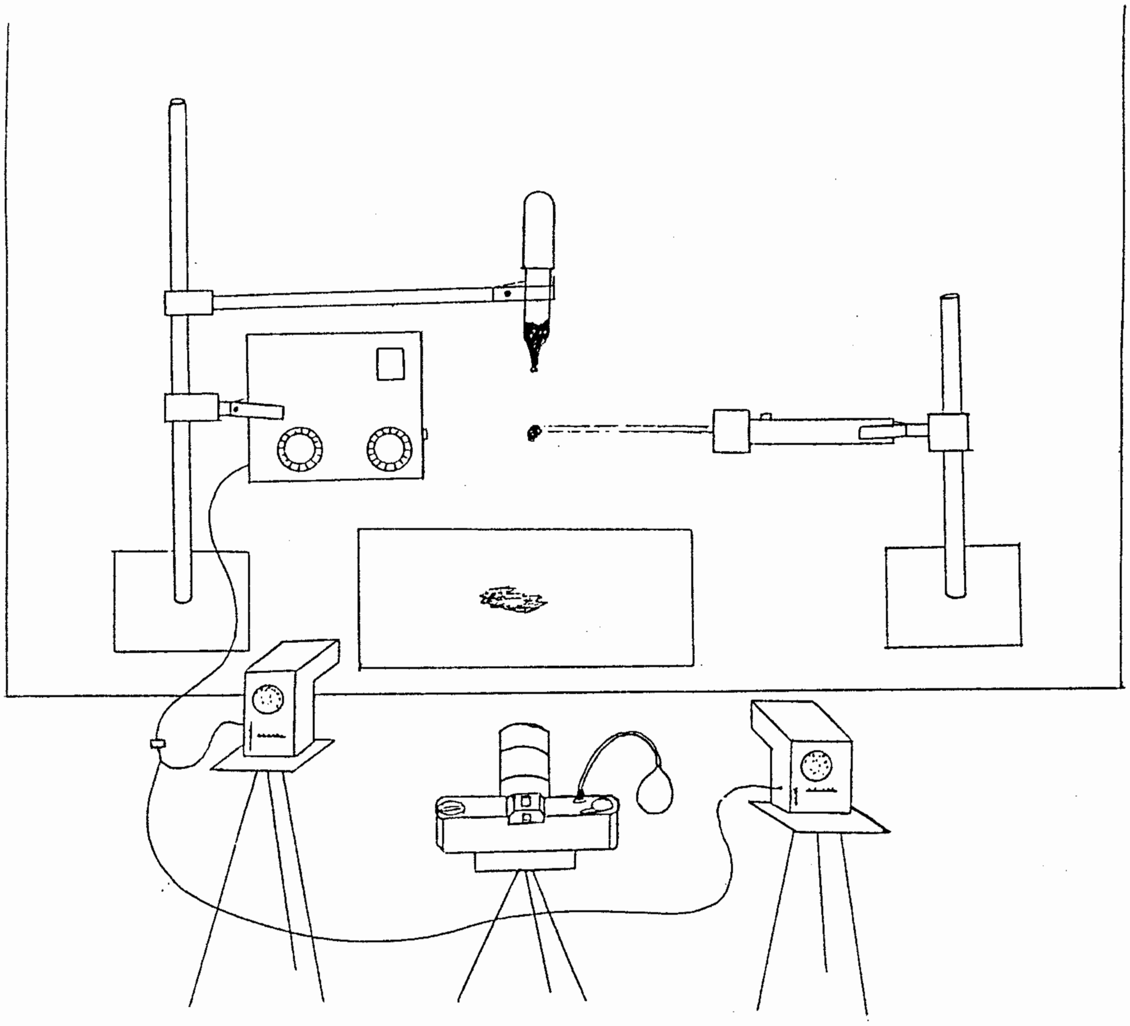
PARTS LIST

| | |
|---|---|
| | 3" X 2" X 1.5" Box |
| | 3" x 2" perf. board |
| Q1 | Phototransistor RS #276-145 |
| IC1 | 4093BCN IC SK 4093B (RCA) |
| SCR1 | ~~C106D2~~ SCR SK 3598 (RCA) |
| R1 | 1K ohm resistor |
| R2 | 3.3K ohm resistor |
| R3 | 10K ohm resistor |
| R4 | 330K ohm resistor |
| R5 | 680K ohm resistor |
| R6 | 500K ohm potentiometer |
| R7 | 50K ohm potentiometer |
| C1, C2 | 1 mfd / 35 volt capacitors |
| | male PC sync cord |

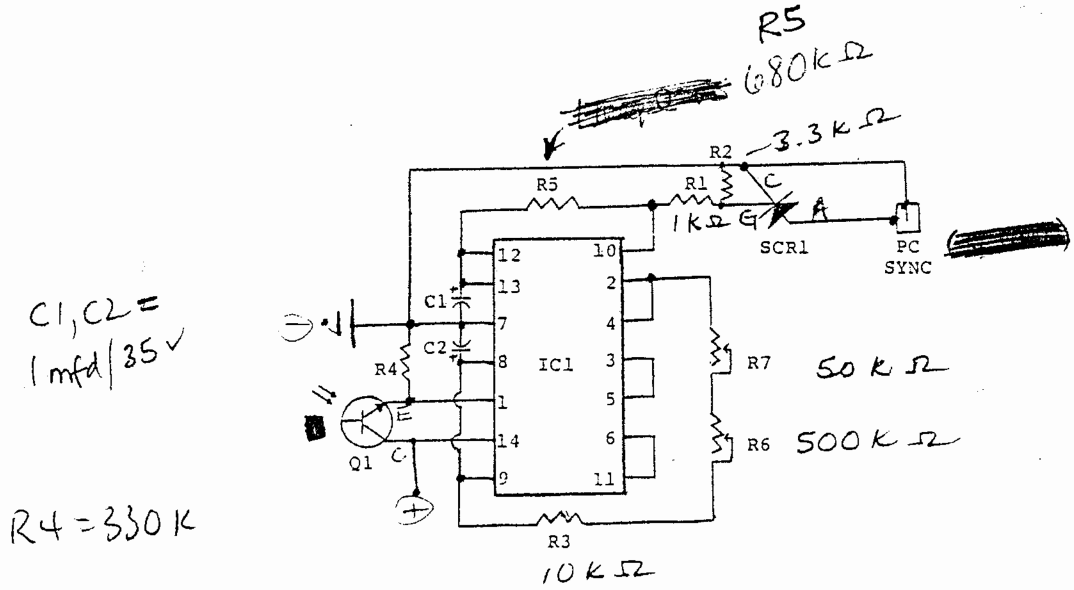
These photographs are very basic to anyone who has been using Bloodstain Interpretation, but they have proved invaluable in teaching lay people what is taking place as blood falls and strikes an object.

The next project is the stop motion of the coning effect of forward and backward spatter from a gun-shot and from a beating type action.





EQUIPMENT SETUP




CIRCUIT DIAGRAM