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There is more to a blur than meets the eye!

Andrew Davidhazy

There is more to a BLUR than meets the EYE!

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This is a little project that has quite significant ramifications for encouraging the awareness of photography and other students to technical uses of the photographic process.

It is a project that I include as an introduction to basic concepts in technical photography in my own high speed photography course that eventually also deals with more sophisticated applications. I use this project as a sort of "ice breaker" to the field. You may find it interesting as well.

Helicopters, or the whirligig seeds of several species of trees, are so much a part of our daily experience in this part of the country that almost everyone has noticed and played with them at some time or another. I bring several seeds that I pick up from the street on my way to school to my classroom and set up a problem to the students based on their behavior in flight. Namely, I pose the question of what kind of photographic equipment they might use and how they might go about figuring out the rate of fall and the rate of rotation of one of these things.... as I drop one from my hand.

Several suggestions usually surface quite naturally. Most involve the use of video cameras, high speed motion picture cameras or stroboscopes. The students quite often realize that these devices exist and that they indeed would be able to provide crucial data needed for the analysis of this seemingly very simple event.

It is usually obvious even to them that what one needs to determine is the time that it takes the seed to fall a given distance. What is not so obvious is how to determine rotation rate. It turns out that the principle essentially is the same. One needs to determine the number of revolutions that the seed makes in a given amount of time.

Anyway, after a brief discussion of basic requirements I get back to the "tools" that are usually suggested and flatly state that all the equipment mentioned above is too sophisticated and expensive and that in "real world" situations sometimes they have to deal with a very low budget yet be able to solve seemingly very difficult problems. Such as the one I posed by dropping the seed. Botanists would be very interested in the solution of this problem.

Eventually we agree that the most important item that we really need is an accurate stop watch and an automatic monitor of the seed's location and position in space at two different times. It turns out that a simple camera neatly provides both of these capacities.

If a seed is dropped from some height it acquires a "terminal" velocity. Once this is achieved the shutter of the camera is opened.

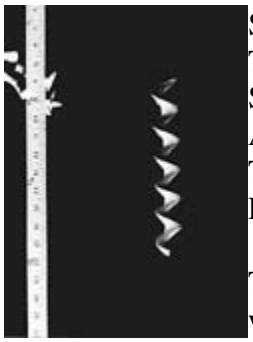
When this happens the seed is located at a particular location in space. When the shutter closes it is at a different, lower, location in space. The elapsed time is the exposure time that was set on the shutter. By including a yardstick next to the falling seed the location of the seed from the start of the exposure to the end can be determined quite accurately. Dividing the distance traveled by the exposure time set gives the average velocity of the seed.

What is more, by examining the blurred image produced by the falling, twisting, seed it is possible to determine rotation rate as well. Note that the image consists of a wavy line caused by the blades of the "propeller" being at right angles to the camera at certain times. Two consecutive edges of the "corkscrew" that the seed describes while falling stand for one whole revolution. With a little ingenuity is is possible to determine rotations of even less than a complete revolution.

To determine the seed's rotation rate count the number of edges or ridges visible between the top location of the seed and the bottom and divide by the exposure time. This will give the rotation rate in revolutions per second. Multiply by 60 and you get RPM. Pretty good, eh?

Any kind of film can be used but to make sure that this works well make sure you use as black a background for the falling seed as possible. Use an exposure time of 1/8 to 1/4 second and overexpose the film by about 2, 3 or even 4 stops. The overexposure is necessary because the seed will not be occupying the same spot in space during the exposure. Throw plenty of light on the flight path of the seed and keep the light off the black background. Possibly use a spotlight pointing straight up from below the seed.

Place the camera on a tripod, keep the back vertical and place a yardstick next to the flight path of the seed to give you the scale needed to determine how far it has fallen during the shutter open time. You may have to experiment a bit to make sure the camera is not too close to the seed or you will not get the whole blur into one frame. If either end of the blur is missing you can not make a measurement because you can't tell where time started or ended.



SPINNING SEED IS PHOTOGRAPHED WHILE FALLING NEXT TO A YARDSTICK WITH THE CAMERA SHUTTER SET TO 1/4 SECOND. IN THAT TIME THE SEED FALLS 11 INCHES FOR AN AVERAGE VELOCITY OF 44 INCHES PER SECOND. IN THE SAME TIME IT TURNS ABOUT 5.5 TIMES FOR A ROTATION RATE OF 22 RPS OR 1320 RPM

The idea is to have some fun, learn a bit about making measurements with a standard camera and possibly explore other applications of

blurred photographs.

If you would like to discuss this project with me I would be happy to provide whatever assistance is needed. Contact me at RIT, PO box 9887, Rochester, NY 14623. Phone 716-475-2592, fax 716-475-5804.

Original title of this article was: SEEDS KEEP FALLING ON MY HEAD