

The Dandelion Puzzle

In my ninth and last semester at UMass, I finally had an opportunity to take electives. One of them was Optics with Prof. Alderman. The course included both geometric and physical optics. I wasn't sure how it might ever come in useful, but then, the same could be said of most of my other courses also. But twenty-five years later, it actually did come in handy, more or less.

After my father died in 1976, I had set up a darkroom in one corner of my woodworking shop in order to print some of his negatives of nature photography. Then, thanks to his old view camera and other equipment, I developed a renewed interest in photography and joined the Concord Print Club.

One problem that especially intrigued me was how to obtain the sharpest possible photo of a small object requiring depth of field, such as a dandelion seed head. The usual advice is to use the smallest possible lens aperture. But I knew from my optics course that diffraction works just the opposite way and increases as the aperture decreases. I reasoned that there ought to be an optimum setting whereby those two effects balanced each other. Being at that time a designer of puzzles, I attacked this problem as a mathematical puzzle. The result, after many hours of calculations, was a mathematical solution to the problem that struck me as quite surprising and interesting.

Armed with this solution, I queried some of my photographer friends to see if they knew about it. Problem: Your assignment is to photograph a (spherical) dandelion seed head so that every tiny hair from front to back is as sharp as it can possibly be. This is strictly a puzzle in photographic optics, so no tricks like immersion in a fluid, scanning devices, electron beams, etc.

The answers I got were interesting. Regarding format, some said use 35 mm while others thought that 4 x 5 or even larger would be best. Correct answer: It doesn't matter. As for type of lens, some said wide angle, while others chose just the opposite—telephoto. Correct answer: It doesn't matter. The bizarre answer I got from one person was, use the most expensive lens, and he was a bit miffed when I told him that didn't matter either. My surprising discovery was that none of these things matter. They all cancel out in the calculations. All that matters is the optimum aperture, which can be calculated fairly easily.

I may still have those calculations somewhere in my files in case anyone is ever interested, which I doubt. I once mailed them to Ansel

Adams, and even he was not interested, but he sent a nice thank you note in return anyway.

I never did get around to verifying my calculations experimentally. One complication was that my calculations for optimum aperture gave settings that were too small for any of my shutters. My plan was to use an ordinary five dollar reading glass for a lens and cardboard with a small hole punched in it for a diaphragm. Unfortunately this was just another of those many projects that never got finished before I shut down my darkroom and quit black and white photography.

One more note added in 2021. This was strictly an exercise in optics. I realize that there might be more artistic merit in letting the back of the seed head be out of focus.