How To See It

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Joseph Wood Krutch was a professor of literature and a theater critic, who after years of living in the East, discovered the Southwest and eventually moved there. In *The Desert Year* (1952) he enthusiastically describes why he finds the natural history of the Southwest so fascinating. Though he had long enjoyed observing nature near his country home in Connecticut, the organisms and environment in the Southwest were so different that he found himself looking at a totally new world as if with new and more observant eyes. In an essay titled "How to See It," he writes:

> *Perhaps I shall never again see any of these things quite as completely as I do now at this moment when I have grown just sufficiently accustomed to my new environment to be able to take it in but by no means accustomed enough to take it for granted (p. 46).*

The naturalist John Burroughs (1992), in an essay called "The Art of Seeing Things," takes an opposite tack: The better you know an area, the more you will see there. While Burroughs did do some traveling, many of his essays describe what he discovered about the natural world close to his rural home in New York State. For him, the better one knows an area and its plants and animals, the more likely the eye is to pick up interesting details. In another essay, "A Sharp Outlook," Burroughs (1981) quotes Gilbert White, the author of *The Natural History of Selborne* and one of the founders of the nature writing tradition, as holding that "the locality would be found the richest in zoological or botanical specimens which was most thoroughly examined" (p. 22).

Burroughs and Krutch seem to be at odds about the conditions under which one is likely to be most observant. Krutch thinks that the eye gets sated, dulled, by looking at the same thing again and again; one sees less because the eye takes things for granted. Burroughs, on the other hand, thinks that with knowledge of an area, it's easier for the eye to look beyond the basics for the minute details. But notwithstanding these differences, I think Burroughs and Krutch would agree that what is most obvious to the eye is the unusual, that which sticks out against the background of the usual; the difference is in how they define the unusual. Krutch sees it in a totally different environment, where everything is unusual relative to the environment from which he came. For Burroughs, however, the unusual means something more subtle, the small variations that occur from day to day, and that only someone very familiar with an area would notice.

It is interesting that despite their differences, both Burroughs and Krutch wrote essays on seeing. And they are hardly the only nature writers to do so. In her *Pilgrim at Tinker Creek*, Annie Dillard (1974) has an essay called "Seeing" in which she writes of looking at everything from microorganisms to meteor showers. In *Round River* (1953), Aldo Leopold describes the responses of four of his friends when he pointed out a new deer swath to them. He notes that:

> *There are four categories of outdoors men: deer hunters, duck hunters, bird hunters, and non-hunters. These categories have nothing to do with sex or age, or accouterments; they represent four diverse habits of the human eye. The deer hunter habitually watches the next bend; the duck hunter watches the skyline; the bird hunter watches the dog; the non-hunter does not watch (p. 126).*

This passage stuck with me because it reminds me of something I read a long time ago, something written by Rudolf Arnheim (1974), who is interested in the psychology of art. He argues that seeing is much more than a passive intake of images by the brain, that it involves great mental activity and is dependent upon prior experience, what the mind has already learned. This is really what Leopold, Dillard, Burroughs and Krutch are all writing about: how our interests and our knowledge influence what we see. It makes sense that naturalists would write about seeing because it is so central to most experiences of nature. Yet seeing seems such a simple thing, so easy to do, that we tend to take it for granted. Even though biology is a science in which observation has always played a pivotal role, we tend to see observation as something anyone can do, a lower-order thinking skill that even a first-grader can master. While this may be the case, seeing does deserve more attention; we should not discount a skill just because it can be learned by a small child. Douglas Burton-Christie (1996) describes how his three-year-old daughter has taught him to see; she was so observant that he found himself noticing a lot more. He quotes Krutch to the effect that seeing is the faculty of wonder that requires time, patience,

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and attention; we get better at seeing the more we attend to it.

The Intelligent Eye

This brings me back to a book I mentioned in last month's column: David Perkins' *The Intelligent Eye* (1994). As I noted then, Perkins argues that by learning to look at art and think about it, we can develop thinking skills useful in many disciplines. Having tried his approach, I have to agree with him, and I think his method can just as well be used for looking at cells or the internal anatomy of a frog. Perkins gives a four-step method of how to look at a work of art. The first step is to give time to looking, 10 minutes or so. Ten minutes is a long time to stare at a picture, and I'll admit that I rarely do it. But even a couple of minutes is longer than we ordinarily attend to any image, and such attention bears rich fruit. The longer we look at an image or at a living organism, the more we see; small details or slight differences in shading that at first weren't noticeable become quite obvious, and the mind begins to work, asking questions about why the elements are situated the way they are, why the artist chose to include this and exclude that. As Perkins notes, "if giving looking time is important for art, giving thinking time is important in general" (p. 42). I find that in our culture taking time to think is not encouraged. We are doers not thinkers. Taking time to sit and quietly ponder a problem—or simply to look and think about what we are seeing—is not something we allow ourselves to do often enough, but as Perkins points out, it is useful, no matter what discipline is involved.

After taking time to look, we can move on to Perkins' second step: making looking broad and adventurous. Here, too, the starting point is looking, but the tie to thinking is closer, and the viewer is encouraged to expand perceptions by looking and asking questions of the painting that force the mind to think more daringly about the image. Perkins suggests looking for symbolism, surprises, cultural and historical connections, virtuosity, etc. In other words, he wants the viewer to think of the image in many different ways, on many different levels. This exercise could easily be done with a photograph of a cell or by looking at a cell through a microscope and asking "what kind of cell is this; is it a unicellular organism or a cell from a larger organism; what makes it distinctive; how does it differ from a textbook illustration of a cell; what seems to have been done to the cell to make it visible, etc. No matter what the subject, the aim here is to ask a lot of different questions, to look at the image from many different viewpoints, even viewpoints that may, at first, seem odd; we are not to censure our minds but to let them be adventurous because it's hard to predict where a fruitful idea will come from.

After this broad-ranging approach, Perkins suggests switching gears a bit for step three which is making looking clear and deep. He notes that:

> *If you give looking time and look broadly and adventurously, you will certainly discover much... But it is all too easy not to. Time and broad thinking can still just skim the surface... We reach easy conclusions that may not stand up to more careful scrutiny (p. 59).*

The antidote to this is thinking more deeply; questioning the observations we've made, following them further to see if they hold up and are perhaps even more fruitful if they are given more careful consideration. Again, such sober deliberation is something that our culture doesn't encourage; we

are too impatient, too anxious to get on with it, to produce results. Yet any endeavor, whether it be art or biology or economics, benefits from careful thought. Problem solving has been a buzzword in education for years and learning problem solving skills can be very useful for students. But Perkins is arguing that there are other ways to encourage thinking, and analyzing an image is one of them. While he focuses on artworks, I think looking clear and deep, going back to what we've already considered and questioning conclusions, is a valuable technique to use with any image.

The fourth step in Perkins' scheme is a summing-up step, a tying together of loose ends, by reviewing the three steps already taken. Again, this is something we tend to neglect in our efforts to be done with a task, but it is good to take stock, to review what we've accomplished in our looking. Perkins suggests that it is useful to organize the process of looking, to do it in some order, such as the one he recommends so that the process is systematic and nothing is slipped over. He also suggests that the process outlined here can, with variations, be used in a variety of different contexts aside from the examination of artworks. As I mentioned, I find it works well with specimens, biological illustrations, and photographs of specimens. Asking these questions forces the observer to think beyond simply identifying the specimen or figuring out the diagram and to ask questions such as, Why is this illustration colored the way it is? Why did the photographer choose this angle for the photo? What assumptions underlie this representation of the living world?, etc. Since biology is such a visual science it behooves us to look more closely at the images we use in teaching and also at how we help our students to view the living world.

Thinking about Perkins' recommendations reminded me of an old book that is one of my favorites, May Theilgaard Watts' (1975) *Reading the Landscape of America*. Watts was a botanist who traveled widely in the United States and describes the various areas she visited, not only in terms of what they look like now, but how they got to be that way. She reads the landscape, very much as Perkins reads a picture: bringing to bear a wealth of knowledge and perceptual skill that allow her to understand what she sees much better than most people would. The shape of a sand dune in Indiana along the shore of Lake Michigan tells her a great deal about how they developed over time and about the different plants that have been involved in this development. In another chapter, she "reads" the record of a quaking bog as it evolved from a lake that slowly filled in. Though some of her material is dated, almost any of Watts' chapters is a wonderful way to introduce the concept of change over time in an ecosystem and also a great example of what thoughtful seeing is all about.

Seeing & Art

Someone who reads seemingly more mundane landscapes than Watts is Mary Anne McLean, who has created a book filled with drawings of the plants in her garden. This hardly sounds revolutionary, but what makes *Mary Anne's Garden* unique is that McLean (1987) draws the same plant day after day or in some cases hour after hour, creating what amount to time-lapse sketches of flowers and vegetables. But she thinks calling them time-lapse drawings "sounds like a bit of a yawn," and instead she considers these drawings as "the surprises and excitements of things growing" (p. 8). What a beautiful way to put it; what

a wonderful way to express the joy of seeing.

The joy of seeing—and of recording what's seen in art—are also the subjects of two other beautiful books: *Bird Egg Feather Nest* by Maryjo Koch (1992) and *A Trail Through Leaves: The Journal as a Path to Place* by Hannah Hinchman (1997). Koch's book includes striking watercolors of everything from birds' eggs to birds' feet. Unlike McLean, she has traveled far from her backyard and includes birds as diverse as owls, flamingos and penguins. What makes the book so striking is the interesting way text and drawings are combined and woven seamlessly together. Hannah Hinchman's book combines some of the aspects of McLean's and Koch's, but has a very different flavor. Hers is more of a how-to book, in the best sense of the term. The book is the story of how she came to find it so rewarding to keep a visual journal of her observations on nature; interspersed throughout the book are sections on how the reader can also develop such a journal. This is both an inspiring book and a beautiful one. It is liberally illustrated with sketches from Hinchman's journals of everything from rocks and deer to lichen and beetles. While I enjoyed McLean's and Koch's books, it was only when I read Hinchman that I became interested in drawing from nature. She made me want to force myself to see more carefully, to really savor what I was looking at, and drawing is the best way to do this.

Drawing to See

I know that on more than one occasion in these columns, I've used the quote from Goethe to the effect that you really haven't looked at an object until you have drawn it, but I think this bears repeating here. I discovered this anew when I started to put Hinchman's ideas into practice. But even well before I read her book, I've tried to get my students to do some drawing. I reasoned that if I am going to help students to observe more carefully, then I should be putting more emphasis on drawing, something that is seen as appropriate for three-year-olds, but beneath the dignity of the "mature" high school or college student. When I ask my students to draw, often their first response is to look at me in disbelief. But then I sense a nervousness, a feeling that this is something they simply can't do. They can't do it because they don't see themselves as artists. Also, they are out of practice—it has been a long time since a teacher has asked them to draw. Lest you think that I'm asking them to reproduce Da Vinci's anatomical sketches or to draw a bird's-eye view of the campus, I should note that what I usually ask them to draw first is an unshelled peanut. But even this simple exercise does get Goethe's point across; they do "know" that peanut a lot better after they have completed their drawings.

Robert McKim (1980) argues that drawing invigorates seeing. In his book, *Experiences in Visual Thinking*, he describes how seeing, imagining and drawing are related to each other. He considers visual thinking a powerful mental ability that is usually not well developed because our educational system, after the primary grades, ignores visual education and concentrates instead on language and reasoning skills. McKim provides exercises designed to train the mind to imagine more effectively. Drawing is an important part of his program, as are exercises in how to observe more carefully and to imagine more richly.

Seeing & Microscopy

Because biologists do not just see with the naked eye, but with a variety of instruments, most notably the microscope, emphasis on the education of vision is especially important. I can remember the first time I wrestled with a microscope as a high school freshman. It was a frustrating rather than an exciting experience; I hardly felt the kind of breathless awe that van Leeuwenhoek describes (Ruestow, 1996). I finally saw the cells in the onion root tip, but not before I had cracked a few cover slips and gotten completely frustrated. It would have helped if someone had pointed out to me that my problems were hardly unique, that they were in part the result of the fact that, as Ian Hacking (1981) puts it: the first lesson of microscopy is that we learn to see through a microscope by doing, not just by looking. We have to learn to move around in the microscopic world, and just as we often fall as we learn to walk around in the macroscopic world, it's not surprising that we might break a few cover slips in our wanderings in the microscopic world.

James Elkins (1996) writes that all seeing is difficult, that it is not just when using a microscope that we encounter problems:

> *No matter how hard I try, there will be things I do not see. No seeing sees everything, and no skill or practice can alter that. Every field of vision is clotted with sexuality, desire, convention, anxiety, and boredom, and nothing is available for full, leisurely inspection. Seeing is also inconstant seeing, partial seeing, poor seeing, and not seeing: seeing is also blindness (p. 95).*

This is a discouraging comment, but it highlights the point Arnheim makes: that seeing involves the mind as much as it involves the eye, and so the mind's prior knowledge—to say nothing of the emotions—influence what we see. In an article on early microscopy, Elkins (1992) gives an example of how mind and eye interact. He notes that it was difficult for people like van Leeuwenhoek to make sense of what they saw under the microscope because it was so totally foreign; the mind could not grasp what the eye saw because it had no context in which to put these images.

In a book on 17th-century Dutch art, Svetlana Alpers (1983) writes of the relationship between this art and the use of the microscope by such Dutchmen as van Leeuwenhoek and Christian Huygens. She is not arguing that the art of the time influenced the microscopy or vice versa, though there was definitely communication between artists and microscopists with, for example, van Leeuwenhoek serving as executor of Vermeer's estate. Instead, she sees both the art and the interest in microscopy as stemming from the same cultural source: a basic interest in what things look like. This was a culture in which images played a prominent role. Constantijn Huygens, the father of Christian, wrote that the eye is the source of new knowledge about the world, that we learn by seeing. He and other Dutch thinkers of the time were influenced by the writings of Francis Bacon, or at least by those portions of Bacon's writings in which he argues for the importance of careful observation: "All depends on keeping the eye steadily fixed upon

the facts of nature and so receiving their images simply as they are" (Bacon quoted in Alpers, p. 82).

Alpers argues that this interest in the visual in Dutch culture led the artist and microscopist to perceive the world in a similar way, with emphasis on what she calls multiplying, dividing and opening. By multiplying, she means interest in the innumerable small elements within a larger body or the differences between individuals of a single species; dividing means seeing an enlargement of a small part of a larger body; and opening means revealing the inside of objects or organisms. The exquisite detail in the Dutch art of this time and the interest in texture and minute detail are all manifestations of these processes, which were obviously also important to a microscopist like van Leeuwenhoek. I should note that the drawings of sperm and bacteria and protozoa that van Leeuwenhoek is famous for were done by a "visual scribe" whom he employed to record his observations, so he did not trust Hinchman's approach to the visual world.

Conclusion

In *On Seeing Nature*, a very environmentally conscious book on looking at the living world, Steven Meyers (1987) argues that "consciously selecting specific problems, and finding pleasure in the process of learning to see, constitute a large part of aesthetic vision and help to keep both seeing and wonder alive" (p. 104). He thinks that learning to find pleasure in the process of seeing is part of developing the ability to see nature. I think it's important for us to keep this idea in mind as we introduce students to the visual richness of biology. It is easy to become sated by the vast number of beautiful organisms and wonderful views of nature. It is also easy to get so bogged down in helping students to understand the sometimes difficult concepts of biology, the concepts that lie beneath the visual richness, that this richness is forgotten. It might be a good idea to have students simply look at a peanut or a leaf or a flower. Georgia O'Keeffe said that she first became interested in drawing flowers when a grade school teacher passed out flowers to her students and asked them just to look at them. For O'Keeffe this opened up a whole new world of wonder, one she never tired of exploring during the almost hundred years of her life. While few of us can hope to produce future O'Keeffes, I think encouraging our students to explore the pleasures of seeing may add something to their lives and may also make them better biologists.

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