Goethe's Way of Science as a Phenomenology of Nature

David Seamon
Kansas State University

In this article, I argue that Goethe's way of science, understood as a phenomenology of nature, might be one valuable means for fostering a deeper sense of responsibility and care for the natural world. By providing a conceptual and lived means to allow the natural world to present itself in a way by which it might speak if it were able, Goethe's method offers one conceptual and applied means to bypass the reductive accounts of nature typically produced by standard scientific and humanist perspectives. I illustrate this possibility largely through examples from Goethe's Theory of Color *(1810).*

In a recent article, naturalist and wildlife writer Charles Bergman argues that our current intellectual understanding of animals is too often dismissive or reductive (Bergman, 2002, 142).[1] For scientists, he says, the danger is to treat animals, not as autonomous creatures with their own lived constellations of experience, but as Cartesian automatons whose behaviors can be explained by instincts, stimulus-response mechanisms, evolutionary concepts, genetic programming, or some other imposed system of explanation.

On the other hand, Bergman also questions many humanists', writers', and artists' understanding of animals, which too often, he says, become little more than "allegories of human fear and desire" or are given up entirely as "radically unknowable beneath human representation" (ibid., 143). He concludes that "Animals are not only texts that we produce. We need an ethos more favorable to animals, more open to the creature as a living presence" (ibid., 146).

In this article, I argue that Goethe's way of science, understood as a phenomenology of nature, might be one valuable means for fostering this openness toward the living presence of the natural world, including its animals but also its plants, its terrestrial forms, its ecological regions, its formations of earth, sky and water, its sensual presence as expressed, for example, through light, darkness, and color.

The Goethe here to whom I refer is, of course, the eminent German poet and playwright Johann Wolfgang von Goethe (1749—1832), who also produced a considerable body of scientific work that focused on such aspects of the natural world as light, color, plants, clouds, weather, and geology. In its time, Goethe's way of science was highly unusual because it

Janus Head, 8(1), 86-101. *Copyright © 2005 by David Seamon*
All rights reserved.
Printed in the United States of America

moved away from a quantitative, analytic approach to the natural world and emphasized, instead, an intimate firsthand encounter between the student and thing studied. Direct experiential contact coupled with prolonged, attentive efforts to look and see became the basis for descriptive generalization and synthetic understanding.

In arguing that Goethe' way of science offers one means to foster a deeper openness toward nature, I want to highlight three interrelated topics:

- First, considering the particular method by which Goethe explored the natural world and indicating its value phenomenologically;
- Second, arguing, after physicist Henri Bortoft (1996), that the results of Goethe's approach help one to understand the thing as it is understandable both in itself and also as it has a necessary relationship to other things of which it is a part;
- Third, suggesting that Goethe's way of science may offer a powerful vehicle for engendering a stronger environmental ethic grounded in both perception and thought but also activating feeling.

In this article, I argue that Goethe's way of science offers one hopeful path to bypass the reductive scientific and humanist accounts of nature that Bergman criticizes and to find a means to allow the natural world to present itself in a way by which it could speak if it were able. In short, Goethe's way of science contributes much to an environmental phenomenology (Seamon & Zajonc, 1998).

Goethean Science as Doing Phenomenology

Introducing students to phenomenological method is always a considerable challenge because, typically, there are no certain means to know if we are really seeing and understanding the phenomenon we are claiming to (Seamon, 2000). It is easy to read too much or too little into the thing because our only guides for trustworthiness are our intensity of awareness of the phenomenon and our ability to continually return to the phenomenon as the means and ends of descriptive and interpretive accuracy.

One need for beginners is a phenomenon that everyone can readily experience and return to when discrepancies arise as to what the phenomenon really is. In this sense, I have found Goethe's *Theory of Color* a godsend because it provides a phenomenon—the appearance of color—and a set of

ordered exercises to probe and better see what color is and how colors are in relationship.

Skeptical of Newton's color theory (which claimed that colors are contained in colorless light and arise, for example, through refraction in a prism), Goethe began his studies of color in the late 1780s and published *Theory of Color* (*Zur Farbenlehre*) in 1810 (Goethe, 1970, 1988). The crux of his color theory is its experiential source: rather than impose theoretical statements (as he felt Newton had), Goethe sought a means to allow light and color to reveal themselves in their own terms directly through our own human experience of them.

To understand Goethe's style of looking and seeing, I want to focus on the prism experiments in part two of *Theory of Color*. These easy-to-do exercises are a helpful way to introduce students to phenomenological looking because a phenomenon is present—the appearance of color in a prism—which, on one hand, most people are unfamiliar with yet which, on the other hand, can be readily examined, described, and verified through sustained work with the prisms. Table 1 indicates the kind of questions one should keep in mind in doing these experiments and, for that matter, all Goethean science.

Participants are asked to begin by simply looking through the prism, seeking to become more and more familiar with what is seen. They record their observations in words and colored drawings. Ideally, the experiments are done by a group of four or five, so that participants can share descriptive claims that other participants can then confirm or reject, drawing on their own looking and seeing. Gradually, the group moves toward a consensus as to exactly how, where, and in what manner colors appear.

GOETHEAN LOOKING AND SEEING:
Questions to Keep in Mind

- What do I see?
- What is happening?
- What is this saying?
- How is this coming to be?
- What belongs together?
- What remains apart?
- How does this belong together with itself?
- Is it itself?
- Can I read this in itself?

Table 1. Questions to keep in mind for Goethean looking and seeing.

LOOKING THROUGH A PRISM:
Exemplary Descriptions

- Black, white, and unformly pure surfaces show no color through the prism; rather, colors only appear at edges, which can be defined as places of contrast made by darkness and lightness.
- Colors, howeveer, do not appear along all edges; rather they appear only along edges that are more or less parallel to the axis of the prism.
- The more marked and strong the edge of darkness and light, the brighter and more lively the colors.
- Usually, the colors at the edges arrange themselves in two different groups: a yellow-ornage-red edge; and a blue-indigo-violet edge.
- Less frequently, the colors green and magenta appear.

Table 2. Some examples of accurate descriptive statements arising from looking through a prism.

Let me emphasize that this process of seeing accurately is not easy or fast. Many participants first beginning the exercise expect to see color everywhere or, with vague memories of high school physics in mind, expect a full-color rainbow to appear, which in fact does not readily happen. Once participants bracket their expectations and begin to really look at the color appearance, they often present observations that are vague or incorrect: for example, "I see a halo of color around all objects" or "colors only appear where there is light." Neither of these observations are correct, but they indicate the misreading and imprecision into which beginners can fall.

Typically, too, some participants at first are tempted to use scientific language in their descriptions—for example, *refraction, light particles, light waves, wave frequency*, and so forth. These expressions may be legitimate concepts in physics but must not be used phenomenologically, since we cannot know these concepts directly in our experience of light and color. Any language that the group develops for experiencing the colors must be verifiable in human experience, thus, "colors appear at edges of dark-light contrast" is a legitimate phenomenological statement, since observation can immediately verify or disprove the statement. On the other hand, saying that "The prism refracts white light into colors" is not possible phenomenologically, since we cannot see refraction directly nor can we see through our sensual experience that, because of the prism, colorless light is somehow becoming colored.

This process of looking is slow and requires continual presentation, corroboration, recognition of error, and correction. Eventually, group members can establish a thorough picture of what their experience of color through the prism is and end with a set of descriptive generalizations like those in table 2.

Seeing and Understanding Broader Patterns

The exercise of looking through the prism just described is excellent for introducing students to the effort, care, and persistence required to produce accurate phenomenological description, but Goethe's aim is considerably larger: to discover a theory of color that arises from the colors themselves through our growing awareness and understanding of them.

Here, we move into a stage of looking and seeing that explores the wholeness of color by describing in what ways the colors arrange themselves in relationship to each other and to the edge of light and darkness that, as discovered in the experiment just described, seems to be a prerequisite for any color to arise at all.

To identify such patterns and relationships, Goethe presents a series of experiments using a set of cards with black and white patterns that are to be viewed carefully through the prism and results accurately recorded. The cards to be discussed here are illustrated in figure 1, and instructions for their use is provided in table 3.

The value of the cards in these experiments is that they provide a simple way to direct the appearance of color and, thereby, provide a more manageable and dependable context for looking and describing. Rather than seeing color along any edge, participants are now all looking at the same edge displaced in the same way so they can be certain that they will see the same appearance of colors.

In regard to card A, for example, we begin with the white area above the black and, through the prism, look at the white-black horizontal edge in the middle of the card. If the image we see is displaced by the prism below the actual card, then at the edge we see the darker colors of blue above violet. If we turn the card upside down so that black is above white, we now see something quite different—a set of lighter edge colors that, from top down, are red-orange and yellow.

As figures 2 and 3 indicate, the experiments with cards B and C are perhaps the most intriguing because they generate two colors not as regularly

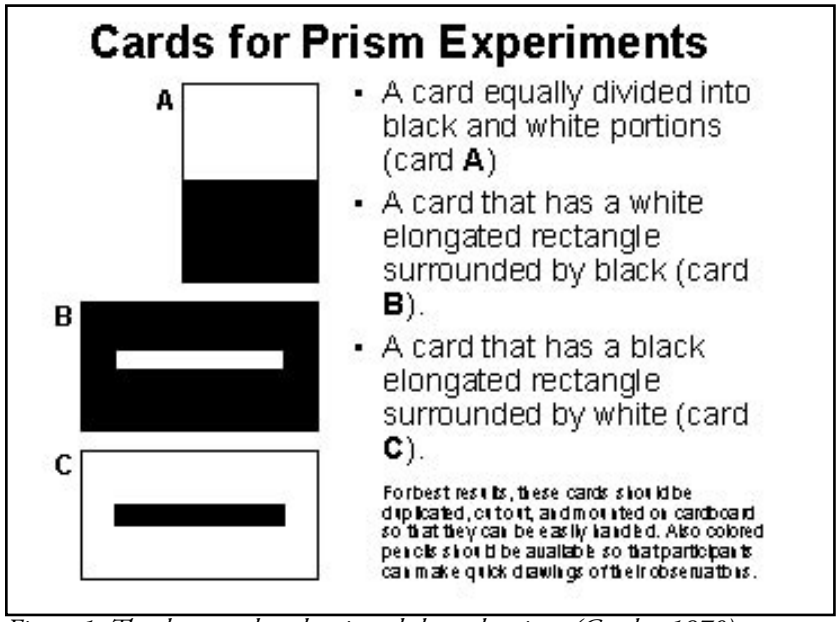

Figure 1. The three cards to be viewed through prism. (Goethe, 1970).

seen as in the dominant spectra of yellow-orange-red and blue-indigo-violet. As one moves card B farther away toward arm's length, there is a point at which the yellow and blue edges merge, and a vivid green appears horizontally so that the original white rectangle is now a band of rainbow (figure 4). For card C, a similar point is reached where the red and violet edges merge to create a brilliant magenta (figure 5).

Allowing the Parts to Belong

I have discussed a portion of the procedure that Goethe used to introduce participants to colors' prismatic appearance, and now I want to highlight the style of looking and seeing more precisely. In working in the way that Goethe required, it is important to emphasize that participants must be active in their seeing. They must not just observe what they see but plunge into the looking—they must, literally, "pay attention" so that they see *with intention* rather than just have a visual impression.

For Goethe, however, these efforts of active looking and seeing are not enough. Once the participant gains familiarity with the particular patterns seen (for example, black above white generating red-orange-yellow), then the next

FIVE PRISM EXPERIMENTS
• *Experiment 1*. Hold card *A* with the white area above and black below. Making sure that all participants' images are displaced by the prism in the same direction (i.e., either above or below), locate the card's black-white edge in the prism. What colors appear along the edge? Draw and identify the colors, using colored pencils. • *Experiment 2*. Invert card *A* so that the black area is now at the top and white at the bottom. What colors now appear along the edge? Draw and identify. • *Experiments 3a & 3b*. Repeat situations 1 and 2, but this time assure that the image of the card's edge is displaced in the opposite way (if down before, now up and vice versa). • *Experiment 4*. Look at card *B* so that the long axis of the white rectangle is parallel to the prism axis. Observe and describe the colors that appear on the upper and lower edges of the white rectangle. Slowly move card *B* away until it is at an arm's length. As you move the card, observe and describe any color changes. What *new* color appears? • *Experiment 5*. Using card *C*, carry through the same procedure as with card *B*. What *new* color appears?

Table 3. Five prism experiments from *Theory of Color* (Goethe, 1970).

step is what Goethe called *exact sensorial imagination*—in other words, visualizing and thinking the phenomenon concretely in imagination. For example, I picture myself holding the black-above-white card, picture the displacement of the prism, picture the red-yellow-edge, then picture myself turning the card upside down and seeing the new edge of blue-indigo-violet.

Notice here that there is now an action that is simultaneously outer and inner as well as perceptual and cognitive—I re-experience my perceptual seeing but do it in my mind's eye. As Bortoft explains, the result gives "thinking more the quality of perception and sensory observation more the quality of thinking" (Bortoft, 1996, 42). What I have just encountered in perception is transcribed into an intellectual picture, but that intellectual picture is held to accurate transcription by the original reality of my perceptual looking and seeing.

An important result in Goethe's color experiments is that we begin to realize various necessary connections among the colors—for example,

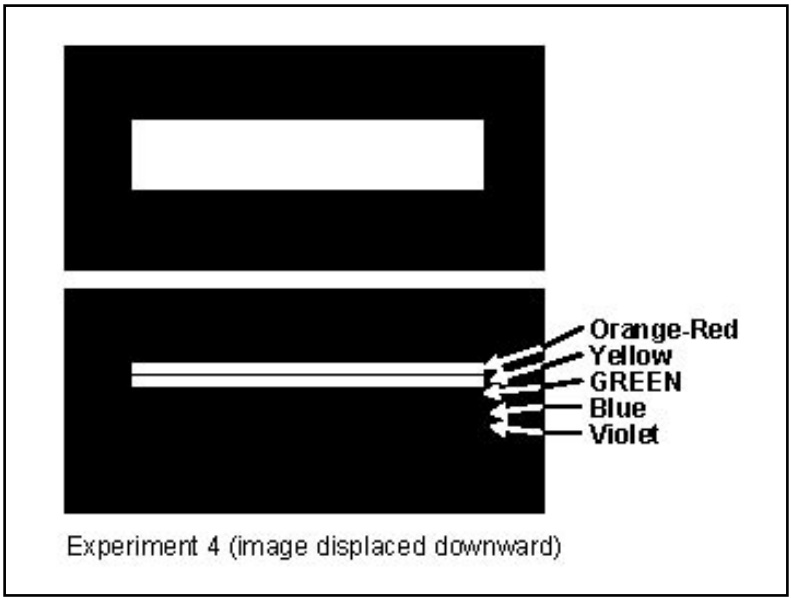

Figure 2, illustrating card experiment 4.

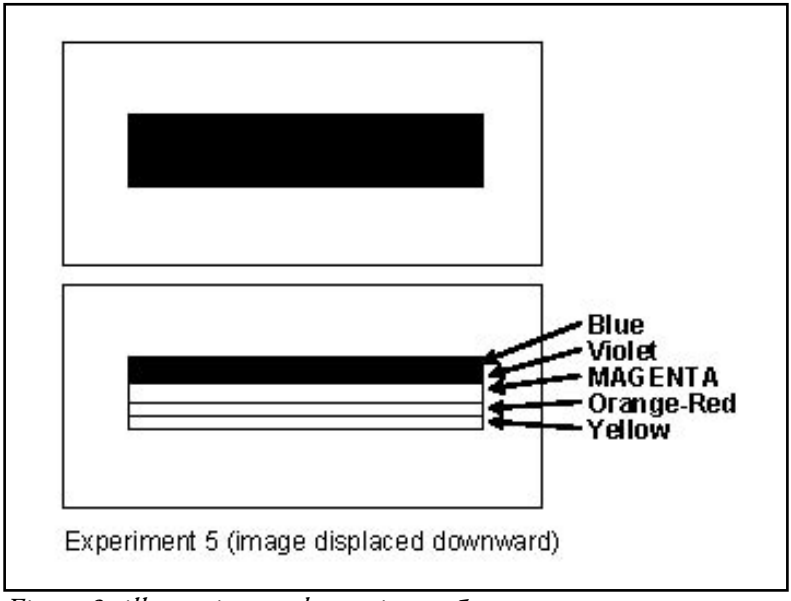

Figure 3, illustrating card experiment 5.

we recognize that black, blue, indigo, and violet always appear together, as do white, yellow, orange, and red. In this sense, says Bortoft, we see colors "belonging" in a non-contingent "togetherness" that is not determinable from just looking alone. The perception here of necessary connection "is the perception of a relationship as a *real* factor in the phenomenon, instead of being only a mental abstraction added on to what is experienced with the senses" (Bortoft, 1996, 99).

Moving Out Into Nature

In conducting his prism experiments, Goethe realized that light and darkness were integral to the appearance of the colors. He saw the prism however as a complicating factor in that it was required for the colors to appear. If, instead, he could find some situation in nature where colors arose *all by themselves* from light and darkness, then he would be able to locate the source of color in nature itself. He called such a foundational situation the *ur-phenomenon* (*Urphänomen)*–the deep-down or primal phenomenon that marks out a necessary pattern of relationship.

In time, Goethe concluded that the ur-phenomenon of color is the reciprocity of darkness and light or, more precisely, that color is the resolution of the tension between darkness and light. Thus, darkness lightened by light leads to the darker colors of blue, indigo, and violet, while light dimmed by darkness creates the lighter colors of yellow, orange, and red. As Goethe poetically summarized the situation, colors are the "deeds and sufferings of light."

As figure 4 indicates, Goethe believed that he had discovered color's ur-phenomenon in his observations of the sun, sky, and landscape. On clear days he noticed that the sun directly overhead at midday is a yellow-white, whereas the same sun setting is orange or red. He also saw that the sky overhead is a brilliant, darker blue, whereas toward the horizon its blue shade grows lighter. In a similar way, he noticed that, when looking at a series of receding mountain ridges, the nearer mountains are shades of indigo and violet, while the ridges farther in the distance are blue.

In all these instances, Goethe interpreted the layer of atmosphere between him and the thing seen as a semi-transparent medium that, depending on the situation, works as a layer of light or darkness and thereby generates lighter or darker colors. In front of the white brilliance of the sun, this atmosphere is turbid and thus darker. Depending on its thickness, this translucent medium makes the sun's color appear yellow at midday or red at dusk and dawn.

On the other hand, this same turbid atmosphere in front of the blackness of space or the dark green of distant mountain slopes works as a lightness, thus the sky at the horizon, with more atmosphere between me than the sky directly above, is a lighter shade of blue that the sky above. Similarly, the dark mountain ridges farther from me have more atmosphere in between than the ridges nearer, so the distant ridges appear blue while those nearer are indigo and violet.

Unlike Newton, who theorized that colors are entities that have merely arisen out of light (as, for example, through refraction in a prism), Goethe came to believe that colors are *new* formations that develop through the dialectical action between darkness and light. Darkness is not the passive absence of light as Newton suggested but, rather, an active presence opposing itself to light and interacting with it. Goethe's central aim in *Theory of Color* was to provide a way to demonstrate firsthand this dialectical relationship and color as its result.

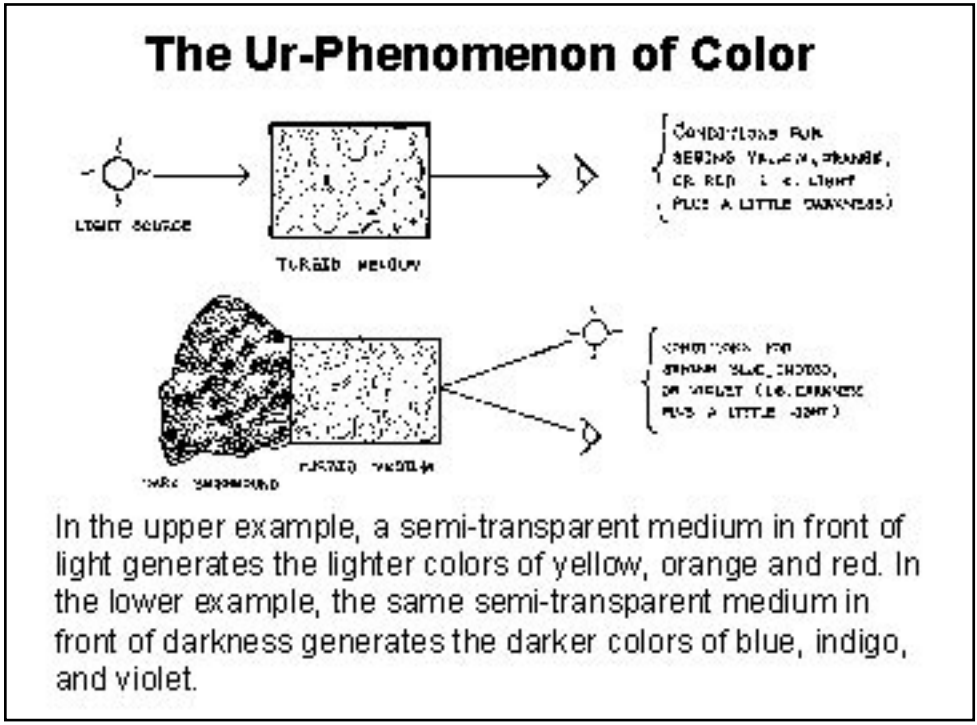

Figure 4. Goethe's ur-phenomenon of color as evoked by a semi-transparent medium.

Engendering Reverence for Nature

Until recently, the preponderance of scientific opinion concluded that Goethe' theory is subjectivist and without the foundations of the "wave length" theory of light that dominates color research today. On the other hand, there has been some experimental work, especially the color experiments of Edwin Land (inventor of instant photography), which cannot adequately be explained by "wave length" and, in fact, makes more sense in terms of Goethe's theory, particularly the importance of a light-dark edge for generating colors and the active role of the eye in contributing to the color experience (Land, 1959; Zajonc, 1993).[2]

Rather than discussing whether Goethe's color theory is correct or erroneous, it is perhaps more useful to say that, whereas conventional analytical science emphasizes a knowledge of primary qualities—i.e., features of quantity like number, size, and position that can be measured and thereby transformed into a mathematical model—Goethe sought a science of *qualities*—a method whereby color becomes visible as intelligible *within itself*—i.e., without some external explanatory agency like "angle of refraction" or "wave length" which lies outside color as color appears as itself.

Rather, in Goethe's way of science, colors in everyday experience—e.g., the color edges made by the prism or the changing colors of sun and sky—are now understood to have an intrinsic necessity and therefore are understandable *in themselves*. One is reminded of Heidegger's definition of phenomenology: "to let that which shows itself be seen from itself in the very way in which it shows itself from itself" (Heidegger, 1962, 58).

There is nothing wrong with a quantitative science that gives attention to the progressive appearance of the natural world in its mathematical aspect, but this analytical interpretation is only partial, thus the natural world may be capable of appearing in other ways if approached accordingly. This is Goethe's great contribution: he pointed the way toward a complementary science that allows our thinking to enter into the coming into being of the phenomenon instead of analyzing in secondhand fashion what has already become (Bortoft, 1996, 214).

For me personally, what is most inspiring about Goethe's *Theory of Color* is its facilitating a kind of "folding over" of natural phenomena so that things unjoined before now connect in relationship. Phenomenological geographer Edward Relph says that the best phenomenology is the "gathering together of what already belongs together even while apart" (Relph, 1983, 201). *Theory*

of Color offers such a gathering admirably.

To see, for example, reddish-tinged clouds in front of the full moon, to be walking at night and see a colored shadow projected by street lamps, to see a blue afterimage after looking from a room window in the evening darkness to a lighted window beyond and then turning away—these are the moments that come to attention after studying *Theory of Color*, along with a recognition that each of these moments represent an aspect of Goethe's major principle that color arises from the tension of darkness and light. These moments are small and perhaps insignificant in themselves, yet they regularly reappear and incrementally add up. One feels a certain pleasure and gladness and admiration for a natural world in which seemingly inconsequential events belong and have a place.

It also must be said that Goethe offered considerable insight for applying his method of seeing to other phenomena like weather, climate, clouds, plants, and animals. Currently, there is some fine Goethean science being conducted—e.g., sculptor John Wilkes' efforts at a Goethean study of water and the crafting of fountainlike vessels that allow water to move in the spiral-like way it appears best to prefer (Riegner & Wilkes, 1998); or ecologist Mark Riegner's innovative efforts to use plants and animals as a means to "read" the unique sense of place of particular ecological regions (Riegner, 1993, 1998).

One particularly effective example is the research of biologist Wolfgang Schad (1977) and naturalist Craig Holdrege (1998), whose efforts to render a Goethean phenomenology of animals through qualities of animal form, appearance, and behavior offer stunning insights into the experiences and the worlds of creatures other than ourselves. In the holistic biology that these researchers are attempting to establish, each feature of an animal is seen as significant because the whole is reflected in each part. The aim is to recognize the inner organic order in an animal in such a way that its individual features can be understood by the basic organization of the animal itself. (Bortoft, 1996, 92-93).

One finds that one result of a Goethean approach to animals is our returning to questions we asked as children but for which we never received satisfactory answers: e.g., What exactly is a cat? What exactly is a dog? How are cats and dogs different and how are they alike? Why are leopards spotted but zebras stripped? Why are giraffes' necks long? Why do cows have horns but deer antlers? Why do beavers, otters, seals, and hippopotami live in water? How can such different animals as shown in figure 5 have a similar

black-and-white pattern? These are one kind of question that Schad and Holdrege attempt answers for in their work.

For the matter at hand, a Goethean approach to animals is important because it provides an organized, accessible way for us as human beings to move closer to the worlds of other creatures. In this growing intimacy, we not only deepen our intellectual understanding of animals but also strengthen our empathy and emotional sense. We better realize the profound moral implications of Goethe's claim that each animal is "a small world, existing for its own sake, by its own means. Every creature is its own reason to be" (Goethe, 1988, 121).[3]

Goethean research demonstrates that each living creature has a unique manner of presence in the world. This presence is what the animal is, how it appears, how it behaves and lives, how it experiences its world. Any efforts to alter this presence—as with the piecemeal manipulations of genetic engineering—can radically change the whole animal and its lived relationship with its wider world. One example that Holdrege (1998, p. 230) provides is the rat-sized transgenic mouse made so heavy that it can no longer climb

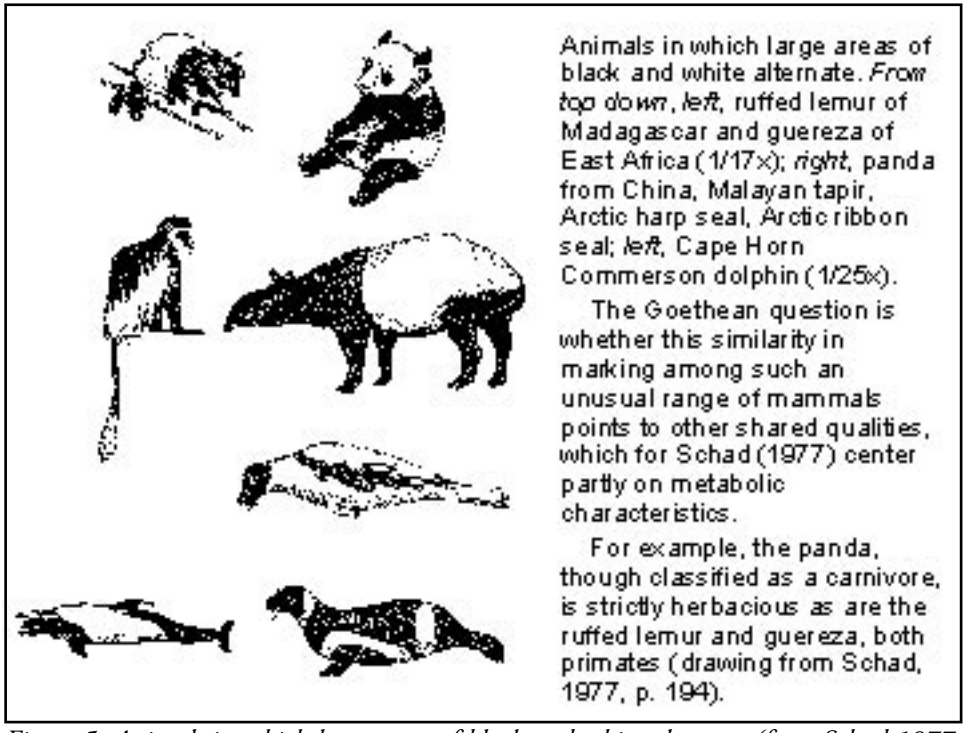

Figure 5. Animals in which large areas of black and white alternate (from Schad 1977, 194).

a plant stem to gather the seeds it needs for food.

As the natural world is more and more threatened, the biggest need is that we must learn again to love nature, and I have come to believe strongly that Goethe's method offers much in this regard. The African-British novelist Doris Lessing (1969, 10) writes that love is "the delicate but total acknowledgement of what is," and her idea crystallizes the heart of Goethean seeing: that the mundane, little things of our world can house a miraculous wholeness that we can encounter, understand, and come to care for.

In his article mentioned earlier, naturalist Charles Bergman emphasizes that we must "care as much for the worlds of being as we do for the worlds of meaning…." (2002, 146). Goethe's way of science is one means to engender such caring—a method of encountering qualities by which the natural world remains alive, dynamic, undivided—itself. In short, a science of the wholeness of nature (Bortoft 1996). Said differently, a phenomenology of the natural world.

Notes

1. An earlier version of this article was original presented as a keynote address at the annual meeting of IAEP—International Association for Environmental Philosophy—Chicago, October 12, 2002. The address was published in IAEP's newsletter, *Back to Earth*, March 2003, 4 (1): 3-11.

2. In his central experiment using two light projectors, Land (1959, Zajonc, 1993, 190-95) projected on a screen a synchronized image produced by two colored lights—one yellow, the other orange—passing through two black-and-white transparencies shot of a still life. One black-and-white transparency was taken through a red filter, the other through a green filter (the fact that the filters were red and green is immaterial to the experiment).

One would expect that the resulting still life on the screen would appear in gradations of yellow-orange but, amazingly, what one really sees is a full-colored reproduction of the original still life, and this done with two colored lights and black-and-white images! Land writes that "we are forced to the astonishing conclusion that the rays are not in themselves color-making. Rather they are bearers of information that the eye uses to assign appropriate colors to various objects in the image" (Land, 1959, 2).

From Goethe's perspective, the first provocative component of Land's experiment is the black-and-white transparencies, which could be interpreted to provide a great number of varying darkness-light "edges" that the two separate projector lights then pass along and through. One could infer a great number of black-white edges, each accommodating a particular color edge.

Though I haven't emphasized the point here, Goethe also believed strongly in the eye's *active* role in seeing. Goethe spoke of "the law of required change"—the idea that "the eye is compelled to a form of opposition, quickly merging opposites and striving to achieve a whole." Part I of *Theory of Color*, dealing with physiological colors—i.e., colors in the eye—describes colored after images and color shadows as everyday examples of this law.

Colored shadows arise when there are two light sources (one that is colorless) casting shadows thrown by an object. If the colored light is green, for example, the object's shadow cast by the green light and illuminated by the colorless light will be *red*, even thought there is no red light anywhere. This appearance of red, says Goethe, is the instantaneous tendency of the eye to supplement the dominant green lightness of the scene with a red in the darker shadow.

Colored shadows are especially relevant in regard to Land's experiments because all colored shadows, like Land's complete color rendition of the still life, occur instantaneously and must require an immediate response of the eye, which in Land's case might be interpreted as an immediate rendition of all the colors of the still life, perhaps because of the "infinite" number of gradations of black-white edges offered by the two superimposed black-and-white transparences.

3. This approach to animal morphology is considerably different from the usual Dawinian approach, which explains the particular features of an organism in terms of random mutations and a long-term statistical effect of the environment acting mechanically on the results of chance. The creature as a whole is not involved, since the small random variations are only in the organism's individual features, which are considered separately without any correlation among them (see Bortoft, 1996, 89-107).

As Goethe wrote in his 1820 "Introduction to Comparative Anatomy," "All [an animal's] parts have a direct effect on one another, a relationship to one another, thereby constantly renewing the circle of life; thus we are justified in considering every animal physiologically perfect. Viewed from within, no part of the animal is a useless or arbitrary product of the formative impulse (as so often thought). Externally, some parts may seem useless because the inner coherence of animal nature has given them this form without regard to outer circumstance" (Goethe, 1988, 121).

References

Bergman, C. (2002). Academic animals: Making nonhuman creatures matter in universities. *Isle, 9(*1), 141-47.

Bortoft, H. (1996). *The wholeness of nature: Goethe's science of conscious participation in Nature.* Hudson, NY: Lindesfarne Press.

Goethe, J.W. von (1970). *Theory of colours.* (C. L. Eastlake, trans.). Cambridge: MIT Press [originally 1810].

Goethe, J.W. von (1988). *Goethe: Scientific studies.* (D. Miller, ed. and trans.). NY-Suhrkamp.

Heidegger, M. (1962). *Being and time*. NY: Harper & Row.

Holdrege, C. (1998). Seeing the animal whole: The example of the horse and lion. In D. Seamon & A. Zajonc (Eds.), *Goethe's way of science* (pp. 213-32). Albany, NY: SUNY Press.

Holdrege, C. (2003). *The flexible giant: Seeing the elephant whole*. Ghent, NY: The Nature Institute.

Land, E. (1959). Experiments in color vision. *Scientific American*, May, 2-14.

Lessing, D. (1969). *The four-gated city*. NY: Bantam.

Relph, E. (1983). Response. *Journal of Environmental Psychology*, *2*, 201.

Riegner, M. (1993). Toward a holistic understanding of place: Reading a landscape through its flora and fauna. In D. Seamon (Ed.), *Dwelling, seeing, and designing: Toward a phenomenological ecology* (pp. 181-215). Albany, NY: SUNY Press.

Riegner, M. (1998). Horns, hooves, spots, and stripes: Form and pattern in mammals. In D. Seamon & A. Zajonc (Eds.), *Goethe's way of science* (pp. 177-212). Albany, NY: SUNY Press.

Riegner, Mark and John Wilkes, 1998. Flowforms and the Language of Water. In *Goethe's Way of Science* (D. Seamon & A. Zajonc, eds.). Albany, NY: SUNY Press, pp. 233-52.

Schad, W. (1977). *Man and mammals: Toward a biology of form.* Garden City, NY: Waldorf Press.

Seamon, D. (2000). A way of seeing people and place: Phenomenology in environment-behavior research. In S. Wapner, J. Demick, T. Yamamoto, & H. Minami (Eds.), *Theoretical perspectives in environment-behavior research* (pp. 157-178). NY: Plenum.

Seamon, D., & Zajonc, A. (Eds.) (1998). *Goethe's way of science: A phenomenology of nature.* Albany, NY: SUNY Press.

Zajonc, A. (1993). *Catching the light: The entwined history of light and mind*. NY: Bantum.

Author's note: Correspondence concerning this article should be addressed to David Seamon, Architecture Department, Kansas State University, 211 Seaton Hall, Manhattan, KS 66506-2901. E-mail: triad@ksu. Website: www.arch.ksu.edu/seamon.