



Can the Collaboration of Science and Art Broaden Our Understanding of Nature?

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Humans transform, filter, break down, and reassemble seemingly endless amounts of information as we make sense of the world we live in. For an ecologist observing a natural ecosystem, this process may produce a graphical figure summarizing a targeted property of the system to understand the consequences of environmental change; for an artist observing the same phenomenon, this may result in the formal use of abstraction, form, and color as an inquiry into the ways humans interface with “Nature.” If viewed only in this way, the two disciplines emerge as a simple dichotomy; yet in reality, the two have many approaches in common, both of which help us understand the world we live in. Since 2014, the two of us (a scientist who studies the ecological interactions among of plants and animals, and a visual artist utilizing video and digital media) have been collaborating at the intellectual confluence of the sciences and arts with the goal of generating novel perspectives on the world that surrounds us and our relationships to it. In this paper, we

discuss our long-term, ongoing collaborations at the intersection of science and art, how it can influence our individual perspectives by building trust and exchange between scientists and artists, and how such collaborations have the potential to create new ways of knowing and understanding. To explore these ideas, together we created Figure 1: a creative appropriation of video stills taken from Dorf’s (2021) film, *A New Nature*, that was predominantly produced and conceptualized during the 2021 field season at the Rocky Mountain Biological Laboratory. Throughout the film, the viewer is provoked to consider not only the future of what Western culture commonly refers to as “Nature” in the face of a changing planet, but also what the term itself means in contemporary life and language. Figure 1 functions as an illustration of the work produced from our long-standing collaboration, as well as a visual tool and metaphor to better understand the ways in which we collaborate.

Ways of Seeing Nature

Taking influence from John Berger’s *Ways of Seeing* (1972), we begin by asking the question: when observing nature, what is it that we see and why do we see it in that way? This question sits at the center of our collaboration as scientist and artist and is one that we are continually investigating. Figure 1A presents an image that can feel both familiar and foreign. Recognizable elements of a spruce forest can be identified on a localized scale: needle-like leaves, tree trunks, color palette, and variation in light. But when zooming out to see

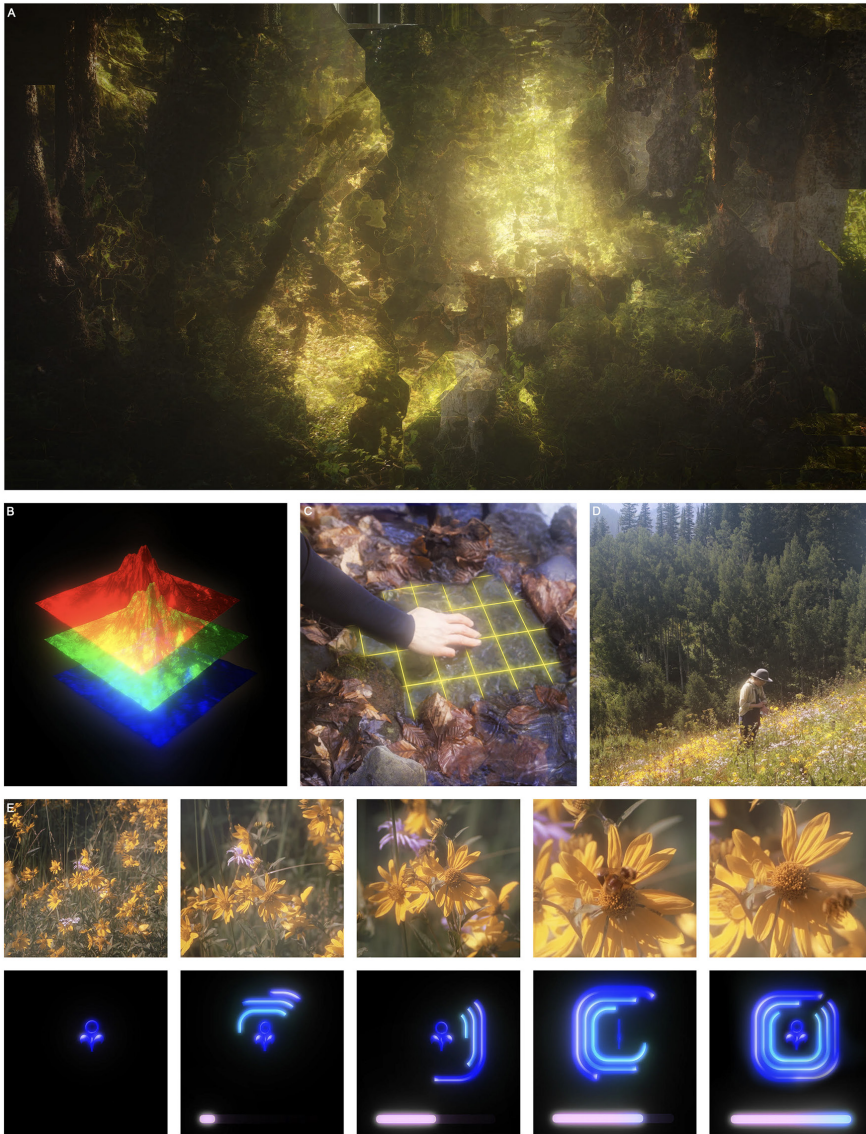


Figure 1. An illustration of the work produced from the bidirectional collaboration between science and art as a visual tool and metaphor of the collaboration and how we understand nature. We created this figure together in Dorf's art studio in New York City and then later at CaraDonna's lab at a remote biological field station in Colorado (The Rocky Mountain Biological Laboratory). (A) Digital collage image of subalpine spruce forests. (B) Digital image of three identical 3D-rendered mountains split into the additive color channels of red, green, and blue. (C) Digital image of a hand reaching into a small pool of water that has a grid atop its surface. (D) A scientist in a subalpine meadow noting the timing of an observation of a pollinator visiting a plant. (E) Two series of five images illustrating the passing of time building up to a discrete event. All still images are from the film, *A New Nature* (Dorf, 2021).

the entire image, these familiar elements and the logic of the image and the forest itself fall apart. We have something that appears and feels like a forest, while simultaneously approaching nonsense. In other words, Figure 1A asks us to ponder: how can we recognize this image of a forest when there is

in fact no forest represented; or, put another way, how do we understand something as it changes rapidly in real time? This idea is analogous to how, as we begin to understand many dimensions of ecological systems for the first time, they are simultaneously shifting in response to global change.

Conduits for Collaborative Seeing

As we consider this tension in our observation and perception of nature, we turn to Figure 1B, which investigates how we filter, transform, split, and rearrange our observations as we try and make sense of them. In Dorf's (2021) film, *A New Nature*, the form featured in Figure 1B rotates, undulates, and slowly separates as the voiceover asks: "Tell me what you see. Can you tell me what I see? What is there in front of you?" The voice over and rotating landscape are directly inspired by Piaget's (1954) experiments with early childhood development and object permanence in which Piaget would present a model landscape to a child, ask them to describe the scene, turn the landscape, and continue to ask probing questions to see if the child recognized the landscape as the same form. The constant state of fluctuation renders Piaget's request to describe the subject's state nearly impossible. In the case of *A New Nature* (Dorf, 2021), the viewer is presented with an impermanent moving target that is not only in constant rotation, but also changing form from one moment to the next. Eventually the rotating landscape divides into three identical 3D-rendered mountains split into the additive color channels of red, green, and blue. When separated they are independent entities, but when combined they compose an image that represents the fully realized spectrum of color and light. Functionally, digital images are presented with all their color channels combined together so that the image is more or less a reflection of a sensory experience or an observation; similarly, scientific ideas are presented as cohesive and generalized frameworks that otherwise emerge from many disparate sources of empirical information. When an image is broken apart, as in Figure 1B, the viewer is challenged to consider how even the most basic ideas, observations, and environments can be infinitely split or combined, revealing something foreign and strange in a new and unexpected manner. This is a process that both scientists and artists are constantly enacting.

The question of asking what one sees and how one sees it is a more complicated inquiry than it might seem. In the case of the 3D-rendered mountain splitting apart (Figure 1B), the challenge presented is that if everything is in constant flux, how do we interpret what we are observing? Despite their different approaches, scientists and artists both run up against this problem, whether considering, for example, plants adapting to rapidly changing climate conditions, or the ever-shifting relationship among humans, technology, and nature. Figure 1C and 1D illustrate two different moments of interfacing with the world. Figure 1C shows the hand of an artist reaching into a small pool of water only to be met with a graphic grid that lays atop the water itself; Figure 1D shows a scientist in the field noting the timing of an observation of an interaction between plant and pollinator. What both images help to reveal is that the human observer is the conduit for seeing, observing, and understanding. The scientist and the artist bring with them different histories and toolsets for interfacing with the world, but they both share the common feature of the human acting as the filter for translating the sensory experience of the world—the observation—into knowledge.

The methods of observation of the scientist and artist can be very different, but something that is not so obvious is that the goals of the scientist and artist are often shared. Figure 1E investigates this idea with two series of images that illustrate a narrative arc of the passing of time building up to a discrete event. The top row illustrates a slow zoom sequence of the formation and dissolution of an interaction between a flower and a bumble bee; the bottom row illustrates the sequence of a graphic-loading interface of a unicode flower, which spins in the center as the sequence progresses. From one perspective, they represent two divergent narrative arcs as seen from their

deeply contrasting aesthetic representations. But from another perspective, they both center on the passage of time and the temporal sequence of the completion of a natural event (e.g., CaraDonna et al., 2014, 2017, 2021; Post, 2019). What Figure 1E seeks to interrogate with the juxtaposition of these two sequences is the question of seeing, observing, and interpretation. As with the other elements of Figure 1, we continually ask: what are we seeing, who is doing the seeing, what is the mode of observation, and how is it all interpreted? Critically, it is not so much that one way of seeing or knowing is better or more accurate—instead, we argue that together, we have a fuller understanding of the world that reaches beyond that of the quantitative, qualitative, logical, and emotional.

Novel Ways of Knowing Nature

The scientist and the artist can begin with the same source of influence and the same set of information (plants, animals, and their interactions); use different means of analyzing, observing, and understanding (population dynamics, ecological networks; color, light, sound); and naturally resolve on quite different results (e.g., CaraDonna et al., 2017; Dorf, 2021). If the collaboration between the two is simply art in service to science, or science in service to art, then new ways of knowing do not easily emerge. What we have learned over nearly 10 years of bidirectional sharing at the confluence of science and art is that there is much to be gained through trustful and open collaboration. Such collaboration has helped to reveal to us that there is no one result that is greater than the other. Instead, we find that knowing and knowledge production is constantly in flux like the surroundings that seed our inquiries. If we allow it, each approach informs the other, helps to challenge their mutual assumptions, and shifts perspectives.

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