Talking Visuals in a Digital Age

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Many visitors of U.S. national parks have to make a concerted effort to visit these iconic settings. With all there is to take in, why does the iSWOOP project advocate that interpreters direct visitors' eyes to a 2D image or a digital screen? This question came from some interpreters at Carlsbad Caverns in 2014 when asked why they weren't keen to take an iPad into the cave for use while roving. It's a reasonable question. Our answer is best conveyed with an anecdote. Take a moment to reflect on a moment from the past week or two. Did you pull out your phone to show something to a friend or family member? Why? If you did so (or someone did it to you), the purpose was probably not about effectively educating visual learners. The impulse to share a novel sight is emotional rather than educational. Vision, according to some researchers, is one of our strongest senses, mediating 80 percent of what we experience. The iSWOOP project contends that the same impulse that leads to a shared visual experience (of cat videos or boxing kangaroos) can be leveraged to make messages about conservation, science process, and the environment more memorable. Tison-Povis and Crowley showed how a tool like a flashlight could make a difference in conversation. When visitors to a museum exhibit with dioramas could establish a shared focus, their substantive conversations about the exhibit lasted longer than if they didn't have a tool to establish a shared point of focus.

Technology in the form of phones and tablets is seductive in its portability, not to mention easy striking color (if you aren't interpreting in the bright sunshine). Obviously technology has advantages beyond the digital display. With well-crafted visual material, interpreters can augment the impact of a resource by zooming in on its features or showing its form in a different part of its life cycle. With such possibility comes a responsibility to make certain that trade-off is worthwhile. If one draws attention away from the resource to a screen, when visitors return their gaze to their immediate surroundings, they should be able to discern more, appreciate more, question more, enjoy more. How can we insure that will be the case?

The iSWOOP team developed collections of visualizations for interpretive interactions and a style we call ViA for visually augmented interpretation. Two overarching ideas distinguish iSWOOP visualizations from the signs and photos commonly seen in parks, in scientific publications, and on posters for conferences. First, ViA imagery does not stand alone. By design, imagery added to iSWOOP visual libraries is often intentionally incomplete so that interpreters can add their voice and customize the questions they pose. As Hristov, Strohecker, Allen, and Merson wrote: "The goal of ViA is not solely to inform, but rather to engage. Such material does not contain all information needed for interpretation; instead, it provides a visual point of departure and relies on the facilitator or storyteller to craft a story or learning experience that is further enriched by visitors' questions, past experiences, and reactions."

ViA is in sync with the approach to science communication that moves away from information transmission to an exchange that values dialogue, participation, and mutual learning between science experts and the public. To be as inclusive as possible, imagery

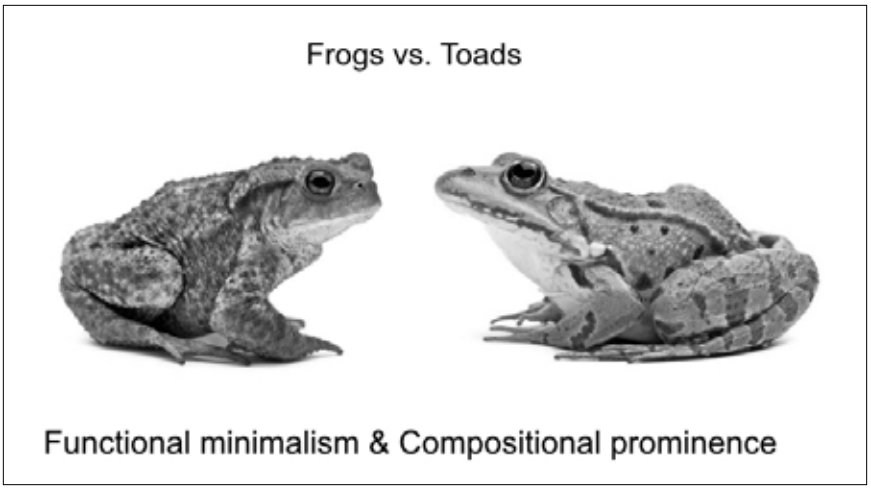
is artistic, rendered, with attention to line, negative space, and color, so that people who are science-avoiders are attracted rather than repelled.

Cleaning Up a Visual

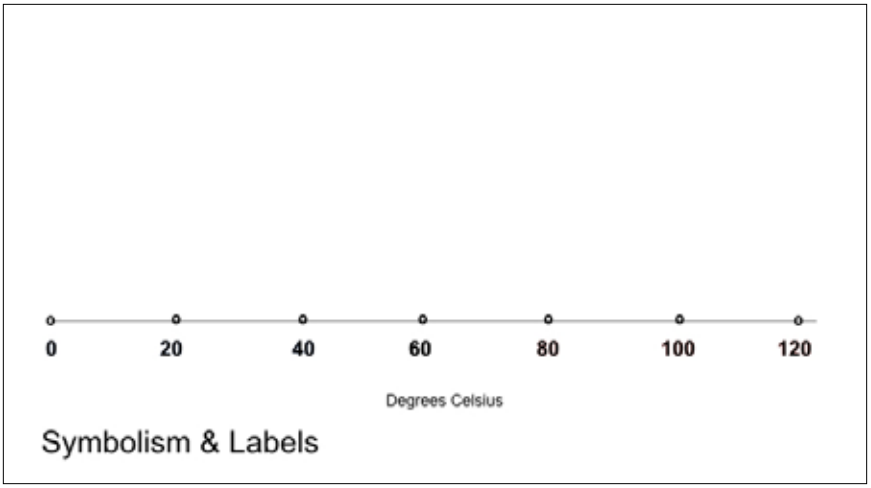
Interpreters who are keen to provide video, animations, still images, or other visuals to supplement their interactions don't need to be Photoshop wizards. But grabbing high-resolution photos in an effort to have some visual at hand might not spark a rich conversation either. iSWOOP has strived to design minimal, "clean" visual translations that prompt curiosity and facilitate thoughtful conversations, creating space for guided interpretation or the viewer's own discovery and construction of meaning. Below we describe some of the principles that have guided the development of collections of iSWOOP visualizations.

Functional Minimalism

In our experience, images will be most impactful if the compositions are minimal rather than complex. iSWOOP staff have asked interpreters to think about their visualizations as if they were sound. Would they try to interpret over a radio playing the news and a TV blaring sports? Interpretive interactions benefit from an uncluttered soundscape. Posters and slides that scientists develop for their peers attending conferences are usually jam-packed with information. While it may be useful to have all of the data representations within close proximity, we suggest prioritizing functional minimalism and compositional prominence. For example, if a visual element is used, then it should have its own canvas or slide. Elements like color have a purpose and meaning (e.g., if there are red and blue elements in the composition, they indicate hotspots or temperature difference). Decorative use of color or line is not advisable because such additions risk distraction, at best, and misinterpretation, at worst. At Indiana Dunes, interpreters let the public know about Dr. Bob Brodman and his research on amphibians. When highlighting the differences between toads and frogs, the first image was in grayscale, to keep the focus on structure and function. The juxtaposition was not accidental. If two images, graphs, or other visual features are presented simultaneously in the same composition, that is an invitation for viewers to compare and contrast or to make a prediction based on their observations.



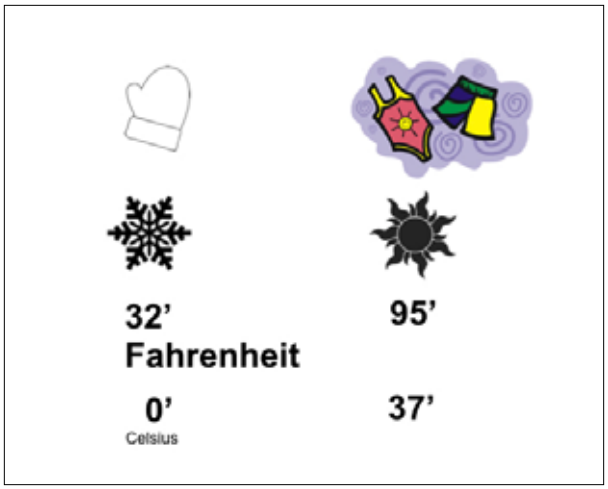
Without distracting text, background, and color, viewers can focus on observing similarities and differences. To achieve a minimalist composition, crop, select, paste on a new slide. Juxtapose with care. In this example, gray-scale images of two amphibians enable viewers to concentrate on structure and function.



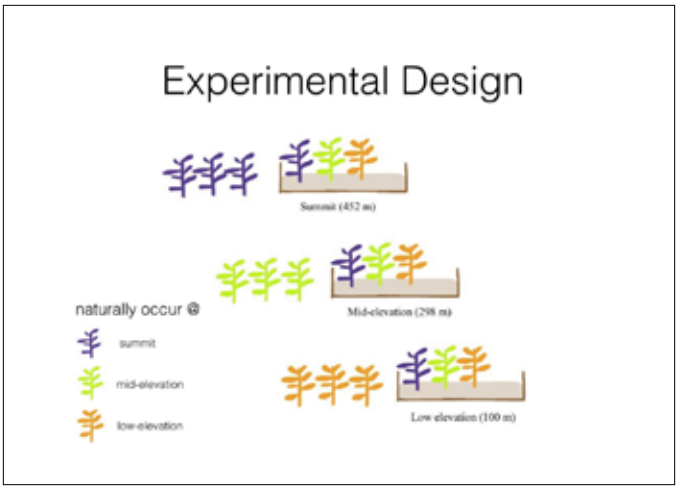
Celsius on the x-axis

Symbolism and Labels

Because it is difficult to show one-time visitors the impact of changes in precipitation or temperature, graphs can be useful alongside before and after photos. In an interpretive setting, a graph can be a turn-off, a signal that some boring talk about data and trends is about to happen. Scientists' graphs often use unfamiliar units. Temperature conveyed in degrees Celsius is not intuitive for many in the U.S.



Alternatives to a Celsius scale. As an example, we show alternatives to representing temperature ranges with numbered increments in Celsius. Though symbols are not culturally neutral, they can be interpreted without mathematical conversions.



Experimental Design: Caitlin McDonough MacKenzie illustrated her experimental design for raising plants in an experimental garden using symbols for plants from different elevations. The composition of the images of the experimental gardens on her slide echoed a slope.

Yet iSWOOP interpreters and leaders who believe parks can be a setting for informal STEM learning based on cutting-edge science have experimented with inviting visitors to engage with data representations and found visitors are willing to think about the stories that are emerging, to make their own meaning from the data. Changes accomplished by cropping and deleting text boxes make graphs more appropriate for showing groups in an interpretive interaction. Stripping figures of titles with technical terms and replacing labels in metric units with something more intuitive (and playful), can draw visitors in and help focus them on meaning-making.

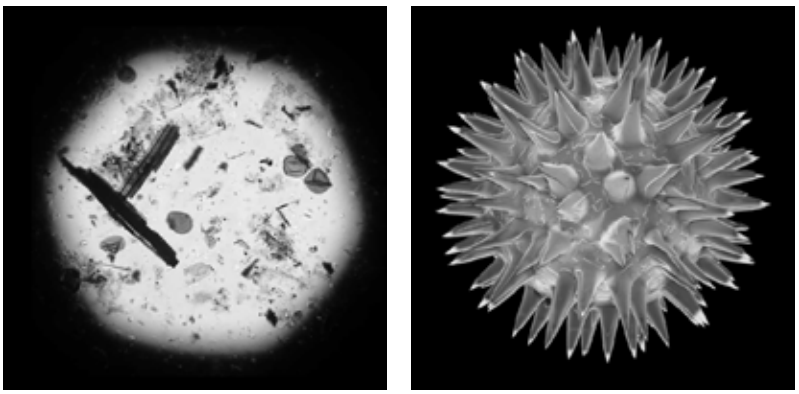
Zooming in (and out)

Seeing what scientists see under a microscope or with high-speed photography makes the familiar unfamiliar. The novelty can be arresting, a hook, but also lead to new observations. Louw and Crowley wrote extensively about the promise of gigapixel imagery for natural history museums. Louw (along with others) continues to explore the beauty of natural forms and structures while also making it easier for citizen scientists identifying macroinvertebrates (see macroinvertebrates.org, made possible with funding from the National Science Foundation, Grant No. 1516149).

At Acadia iSWOOP showed off pollen grains (both 3D models at thousands of times their size and in digital 3D form). Then interpreters could weave a story and show other types of images to connect the intricate, beautiful pollen grains to landscape change.

Discussion

We know from experiments like the one where people watch a video of basketball players and they *miss* the gorilla, that there is a lot to say about looking and seeing besides putting imagery in front of people. Engaging and supporting powerful forms of visual observation is tricky, with a potentially steep learning curve. It's not just seeing, it's noticing. It is not just noticing, it is bringing in background knowledge to make more nuanced observations. Then there's interpreting and extrapolating. All of us, especially digital natives,



Pollen and charcoal under a microscope. Pollen, common as dust particles in the spring, a familiar cause of allergies, and yet striking in its form

have become accustomed to very sophisticated graphics and yet few of us have explicitly adopted an equally sophisticated set of strategies for deconstructing them and interpreting them. Interpreters have a role to play enabling everyday observers to move toward seeing (and coming to know) with the eyes of science. Parents may need additional support to scaffold their children's transition from everyday to scientific observation.

Technology makes it easier to fulfill that role. Scientists can share visualizations. Interpreters can deconstruct crowded slides or posters to isolate elements. They can leave the data on graphs intact, but remove jargon-laden titles and replace labels in unfamiliar units with symbols. They can highlight unfamiliar aspects of the natural world: a magnified pollen grain, the inside of a bird's mouth, the skin of an amphibian, the fungi at the root of a Joshua tree.

All with the purpose of inviting visitors to look with new eyes at the natural and cultural resources available for them to behold.

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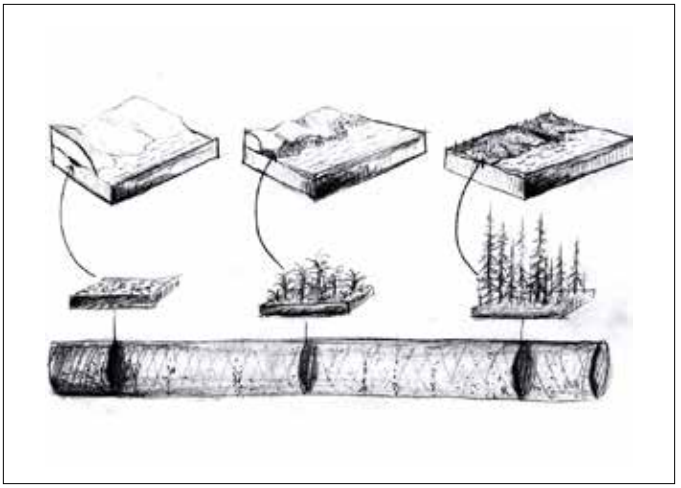

Zooming in on a grain of pollen opens up the possibility of stories about a particular landscape, the process or coring to extract pollen, researchers' experiences coring, and the larger story of landscape change.

ABOUT THE AUTHORS

Louise Allen, Nickolay Hristov, Martha Merson, and Carol Strohecker combined efforts to launch iSWOOP. Allen, Hristov, and Merson have worked intensively with park rangers at Jean Lafitte National Historic Park and Preserve, Carlsbad Caverns, Indiana Dunes, Joshua Tree, and Acadia National Parks to fine-tune an approach to making park-based and park-relevant science an interactive and memorable part of the public's visit to national parks. This has been challenging and rewarding beyond our expectations.