THE MAGAZINE OF THE NATIONAL ASSOCIATION FOR INTERPRETATION

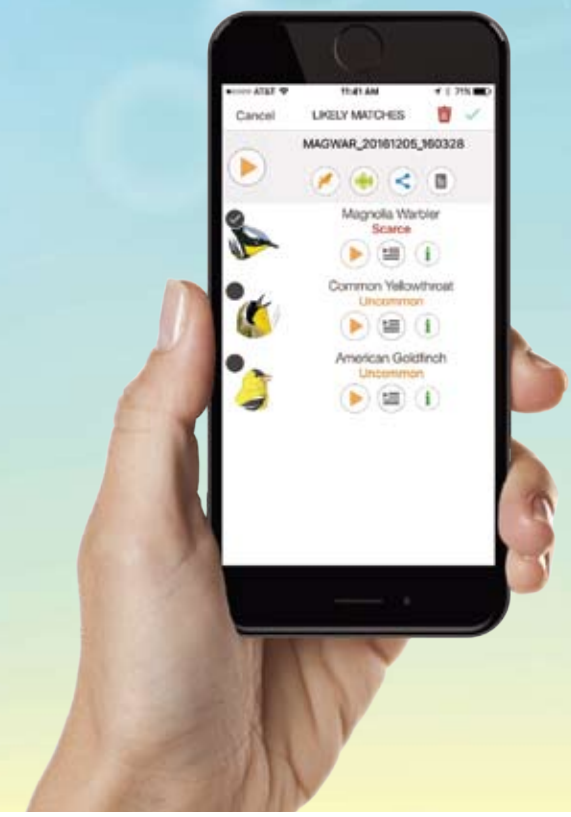
Legacy

JULY/AUGUST 2017
VOLUME 28, NUMBER 4

Communicating SCIENCE

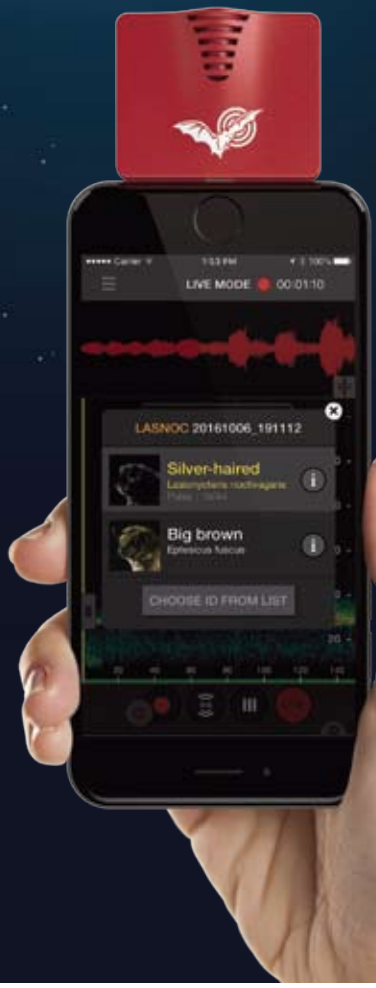
BIRDS BY DAY

Song Sleuth



BATS BY NIGHT

Echo Meter Touch 2



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wildlife ACOUSTICS
BIOACOUSTICS MONITORING SYSTEMS

Chiro, a non-releasable (due to a wing injury) big brown bat that worked as an animal ambassador at Chewonki, in Maine. Photo by Sarah Daniels. See the story on page 18.

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An interpretive approach to communicating scientific information at Tirimbina Biological Reserve in Costa Rica has yielded positive results. Photo by Emmanuel Rojas. See page 15.

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First Impressions

Acadia National Park's Bubble Pond.
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Minor Problems

I have a weird, almost encyclopedic knowledge of minor league baseball team nicknames and logos, and it's something of a problem for me. There are 160 affiliated minor league baseball teams—those that are officially aligned with Major League Baseball parent clubs. There are countless other unaffiliated teams that play in independent leagues around North America. This means there's a good chance that when I meet someone for the first time, when they tell me where they're from, I'm going to ask them about the local minor league ballclub. *Oh, you're from Binghamton, New York? Ever been to a Rumble Ponies game?*

PAUL CAPUTO

And it's not just that I know the name of the team closest to my new friend's hometown (usually along with the classification and parent club), I know *why* the team is called what it's called. In the case of the Binghamton Rumble Ponies, their name comes from the fact Binghamton is the carousel capital of the world. The Lehigh Valley IronPigs are named for the pig iron forged in the steel mills of eastern Pennsylvania. The Hartford Yard Goats are named for a certain kind of hard-working locomotive in train yards. The Columbia Fireflies are named for their proximity to Congaree National Park, which is one of a handful of locations worldwide that play host every spring to a lovely display of synchronous lightning bugs. And so on. *For 160 teams.*

It's not something I'm proud of. In fact, it's something of a curse.

So, this issue of *Legacy* is especially pertinent to me, because the overriding theme when it comes to interpreters communicating science is that it's possible to overdo it when you're super enthusiastic about a subject and you want everyone to know what you know. When a new friend asks me about my hobbies and 45 minutes later I haven't stopped to take a breath and I'm explaining how the New Orleans Baby Cakes are named for a plastic toy found in Mardi Gras king cakes, I may not have that friend for long.

This issue of *Legacy*—which had a record number of submissions from interpreters wanting to write on the subject—deals with the challenges of making science accessible, engaging, and relevant to visitors to interpretive sites. How do we take information and ideas that can be highly technical or specific to a certain field of study and make it pertinent to visitors whose expertise lies elsewhere? The articles that follow tackle that subject.

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Interpretation at the California State Railroad Museum

To the Editor:
I very much enjoyed Phil Sexton's insights into the role of interpretation in the California State Railroad Museum.

As the interpretive designer for the museum, in collaboration with Spencer, Lee and Busse, the project architects, I can verify that interpretation was the driving force behind the multi-structure museum design from the inception of planning and design in 1972 to the opening of the History Building in 1980. It is gratifying to know that interpretive programming continues to be a primary museum mission.

While the collection of rolling stock and related archival material is in itself a rich historical treasure and the restoration of the original locomotives and cars an achievement without peer, it is the entire history of western railroading from the formation of the Central Pacific Railroad in Sacramento to the driving of the Gold Spike at Promontory Flats, Utah, on May 10, 1869, that is the core foundation of the CSRM experience.

Barry Howard, President
Barry Howard Limited
Santa Barbara, CA

Channeling Scientists

D. RAMEY LOGAN

Interpreters channel information about the natural world to the public in a way that is both understandable and relevant. We spend much of our time discussing the outlet of this flow of knowledge by asking ourselves again and again, *who is our audience?* Whoever our respective audiences are, they lie at the mouth of this river of cleverly themed programming. If we are the furrowed beds that move information in a clear and interesting way to our audience, where are the headwaters of these conclusions that have carved our path?

HILLARY HOLT

Research journals exist in the hundreds that contain peer-reviewed literature that pours forth from universities and other academic institutions. To the clear majority of the public this world of scientific research is beyond their scope and interest. These academic papers are admittedly overwhelming to process as a layperson. The flood of minutia in the detail of data and methods can easily cause the levees of someone's interest to burst. Interpretive programs are the spillways, giving dense information to the public in manageable doses. Spillways operate when a dam or levee is in danger of giving way; however, often interpreters do not have the brute force and power of current and relevant research threatening the integrity of their audiences' understanding. We want to operate on that brink, challenging audiences to think critically and become involved by realizing that the scientific process is on-going.

To do this we must take up the information where the scientists left off by remembering what science is at its fundamental core: questioning everything. This begins for us as interpreters by questioning the information that we are disseminating and the way in which we are framing our subjects. One of the ways that I present the history of the indigenous people of my area is to quote one of the archeologists, "We are figuring out who these

people were by digging through their trash piles. One new finding can completely change the story we thought we were telling." We must remember that gravity is still a theory. There is no black and white. By introducing the reality that what people are learning today could be refuted in the future could free them from a sense that everything in the world is understood. Inject awareness into people's reality that the state of current knowledge ebbs and flows, crashing into the boundaries of the unknown and receding to regroup.

If you are interpreting natural history, as opposed to the physical sciences, you need to be turned on to how messy ecological systems are to study. Unlike chemistry and physics laboratories, it is completely impossible to isolate individual variables. What we know about certain species has only been studied, for example, in a drought, after a fire, in a year when lice numbers were up, or the pH of the water is lower than "normal." There is much to learn.

The dynamics of an ecological system are immensely complex. It is very easy to attempt to draw conclusions based on casual observation. Many longtime locals of Catalina Island come into our nature center concerned that there aren't as many quail, or the non-native bison on the island are acting differently than they used to, among many other speculations. We as teachers can find ourselves operating on intuitive inference, and not stop ourselves from explaining away phenomena because it is easier to have a quick answer than to do the research. We may need to realize we have a question on our hands that might not have a well-researched "answer." There can also be bias or prejudice in the delivery of our information that even we are unaware of.

Just recently, while perusing the website of one of the camps on the island, I found the statement, "One of the greatest threats to the Catalina Island Quail is the removal of non-native goats and boar." But wait! How can that be? I am dedicated to delivering the message that removing the non-native herbivores was good for the overall health of the island. And this is true, but there are unseen shifts and consequences when altering the assemblage of organisms in any given ecosystem. That statement came out of the California Fish and Game Species Account, but perhaps it could have read, "The greatest threat to the Catalina Island Quail is non-native grasses," for the quail's habitat is being affected directly by the overgrowth of these grasses upon the removal of the goats and pigs. Again, we must be critical but open to taking in new information as it becomes available. Interpreters are the condensers and translators that process concepts for consumption by our visitors. We must have an understanding of the systems we are discussing.

The importance of understanding where "facts" come from hit home for me while describing the behavior of the Southern Pacific Rattlesnake that resides on Catalina Island Conservancy's land. It has been said by many an educator and entertainer on Catalina that the snakes on Catalina rattle less, strike more, and have stronger venom than their mainland counterparts. Upon investigating the studies where these conclusions were supposedly gleaned, I found that the paper on the frequency of strikes by Catalina snakes had never been published. The study on the snake's venom discussed the varying components between populations of Southern Pacific Rattlesnakes, but never in the complicated verbiage could one insinuate the wildly undescriptive label of "stronger." Could the story about the rattlesnakes on Catalina have been merely lore and a tactic to infuse a healthy fear into visitors of the island, with just a glimpse of scientific backing to perpetuate it?

The concept of a paper not being published goes back to the idea of what the academic process is, not to be confused with the scientific method (Observation > background research > hypothesis > experiment > re-access > analyze and draw conclusion). In the academic process research goes through a rigorous peer review, where other scientists with expertise in the same field review a paper to make sure that it is suitable for publication. If the study has only been done once, and a board of scientific peers did not deem it worthy to publish, how can I present this information without pausing to question it? Not that the conclusions drawn from the study are necessarily

LAURA CAMP

incorrect. The study isn't repeatable or the statistics that the scientists used are in question are among the reasons a paper may not be accepted by a journal. It should just give a curious and objective interpreter pause.

It is true that interpreters have the tricky task of simplifying information down to the point where it's true but likely not totally accurate. Getting an audience, especially children, to grasp what a gray world it is when they are looking for black-and-white answers is a very tall order. However, we need to have integrity about the information we are presenting and not rest on the summaries of information given to us. We must be consummately curious ourselves. A deeper understanding of the topic at hand enriches our ability to convey that information to others, because it is not rote, but gushing forth from a spring of our own wonder.

The accuracy of what you are teaching is not the only reason why it is important to go back to the source. Scientists are unable to advocate for their own work. In the scientific world if you demonstrate an opinion on the results of your research it creates a bias that could potentially discredit your findings and reputation as a researcher. When I was in graduate school, my original advisor got stuck in a biased quagmire. He desperately wanted to prove that a non-native species of bird in Hawai'i was causing the decline of a native species. There were accusations that he re-analyzed his data set multiple times looking for the statistics to point toward what he hoped to prove. On top of that, whenever I would speak to him he would rant about the newspapers he had talked to and the press he wanted to obtain. This does not instill confidence that this man's findings were objective. Scientists are rarely allowed to be advocates for their cause.

Interpreters must bridge research and the audience. Conservancies, zoos, and other facilities doing internal research and receiving visitors need to work closely with an interpretation team. We are the people on the ground, and usually we are the faces of the organization, placing emotional emphasis on the conclusions that scientists render to color the perceptions of our audience in a way that leads to opinions of their own.

There is said to be a shifting baseline in the awareness that new generations have about what the natural world should look like. We are in the middle of the next great extinction. My second advisor in graduate school saw six different species of Hawaiian bird before they went extinct. Papers from the early 1900s described mixed flocks of native Hawaiian birds moving between elevations based on the season. Now the 10 percent of native birds left in Hawai'i are mostly relegated to the highest peaks. As species' ranges contract, due to urbanization and deforestation, and migration schedules shift as spring comes earlier each year, the guide books that we are carrying into the field are quickly becoming outdated.

Getting an audience, especially children, to grasp what a gray world it is when they are looking for black-and-white answers is a very tall order.

The public needs to be aware that change is occurring and feel inspired to get involved. Citizen science has become a movement. Websites like iNaturalist have come onto the scene with gusto and are making data collection of species' presence or absence possible on a huge scale. We as citizen scientists are like raindrops covering the landscape, dropping on private lands and backyards, having eyes where the remote lake of research cannot reach. Combined, we are an ocean of information; channeled properly, we ourselves are a foaming torrent of knowledge. But we must first stand on the shoulders of giants to understand the bathymetry of our programming content, while keeping our heads above water.

For More Information

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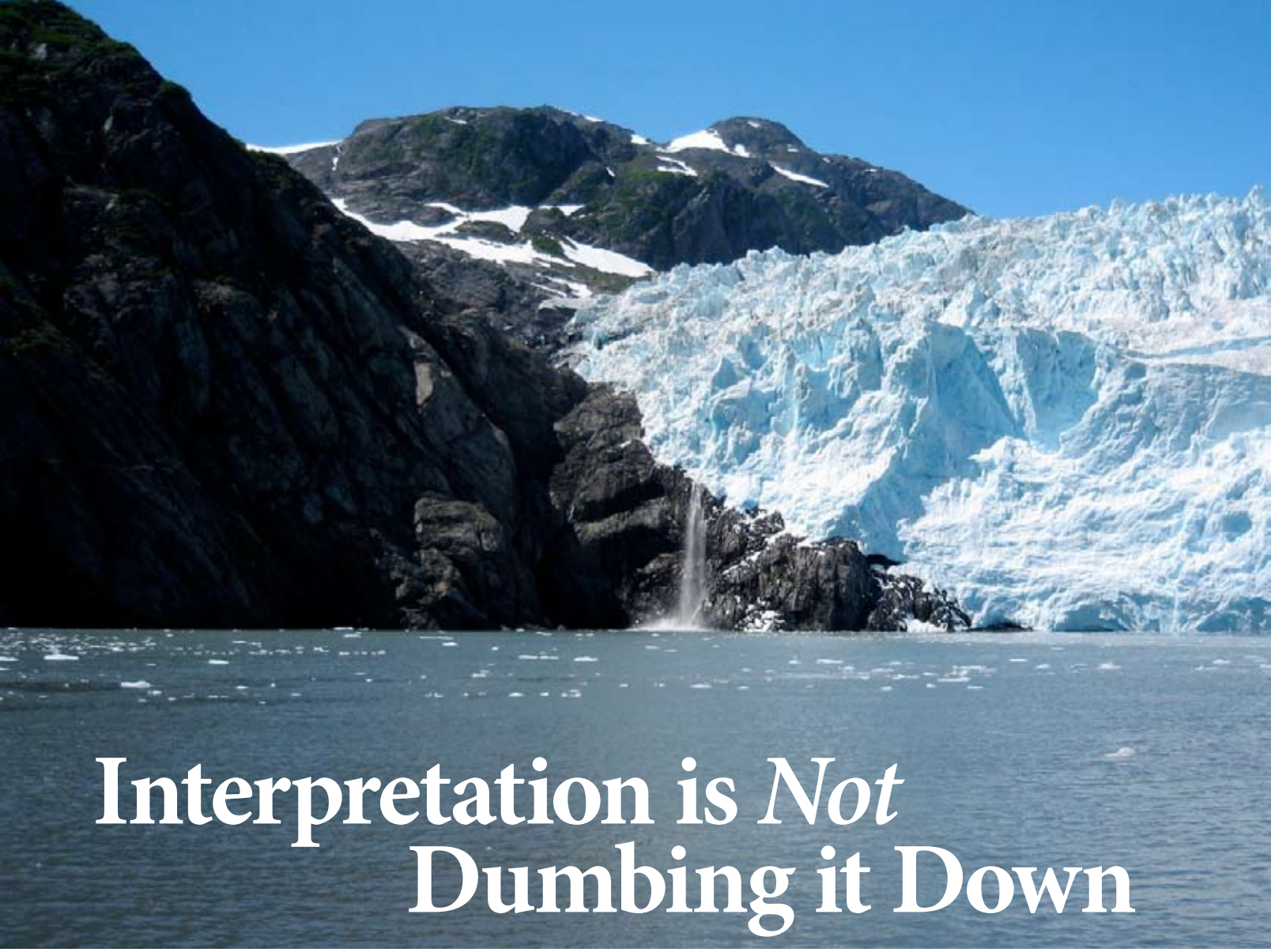

Interpretation is *Not* Dumbing it Down

At ScienceTalk Northwest, a new conference held in Portland in January this year, there was a palpable sense of urgency throbbing throughout the room. Recent news carried stories of newly seated President Trump's history of climate change denial, a gag order for the Environmental Protection Agency and other departments, and the removal of scientific data and information from public websites. Many people in the room felt that their work, that science itself, was under attack. They were looking for help.

JULIA PINNIX

The conference was meant to help scientists learn techniques for communication. Yet even as they sought help, many were resistant to what they were hearing. To them, the demonstrations were "dumbing down" their research. There was too big a gap between what they wanted to say and how others were saying it.

The number one rule of interpretation is "know your audience." For interpreters working with scientists to bring their work to the public, you must work in two directions: translate the work for the audience you're delivering it to and persuade the scientist that your methods are effective.

Researchers are extremely sensitive to how their work is portrayed. They envision their colleagues reading and critiquing it. They tend to use highly specific language to describe what they are doing. They can be resistant to anything less precise.

Scientists also have a special worldview. They speak in terms of probabilities and percentages, not absolutes. They alter conclusions based on further evidence. They credit their teams and colleagues for collaborative work. This kind of nuance can be lost in translation.

Interpreting science for the general public can be tricky. Words have different meanings—like "theory," for instance. A theory, to a scientist, is an explanation that has survived a rigorous process of testing.

To a lay person, the word may mean just a guess or an idea. Worldviews, language, and education levels differ widely. But it should not be assumed that the public can't comprehend the work of science.

Also dangerous is the belief that you're part of a special group. Multiple times at the Portland conference, I heard people talk about how smart the attendees were, how special. I got an early lesson in the dangers of that kind of thinking. I was labeled *gifted and talented* (GT) in elementary school and put in a special group of classes separate from "normal" students. We were often told, and told each other, how smart we were. But when we visited the "normal" classes at science fair time, those kids did far better experiments and presentations than any of the GT kids. Smart wasn't enough—and it wasn't so special, either.

Labels like that are, however, powerful—and divisive. A better place to start is on common ground: enthusiasm. Most of the biologists I know were kids who couldn't keep their hands off the world. They caught lizards and turtles, raised fish and tadpoles and gardens. Their enthusiasm fueled their pursuit of education and careers in science. Their passionate interest drives them to work hard and make discoveries. Enthusiasm is catching.

What is the central idea in a scientist's research that is exciting? That's what interpreters ferret out: the "wow" moments. "Wow" moments are great bridges, especially when phrased in ways that connect to a person's life.

As a ranger for Kenai Fjords National Park, I rode boats all day with visitors excited to see wildlife, glaciers, and beautiful scenery. I talked a lot about climate change, the impacts of which are plainly visible there. I was chatting with a farmer one day on the back deck of a ship. He said, "If the earth is warming, then won't you be able to farm in Alaska? Isn't that a good thing?"

I explained that there's been little time for soil development, compared to where he lived. The temperatures might be good for farming, but the soil wasn't there. He understood soil, so he immediately grasped the problem of rapid change.

Finding common ground with your audience is critical. "Experts" aren't always the trusted sources they think they ought to be. I roved the trails at Exit Glacier, another part of Kenai Fjords NP, carrying a folder stuffed with illustrations, charts, maps, and pictures to help me explain climate change. One afternoon, I spoke with two couples on the subject. They listened politely, and prepared to move on. One of the men, as he turned away, paused, and pointed to the bear repellent spray on my hip. "Do you ever carry a shotgun instead?" he asked.

It should not be assumed that the public can't comprehend the work of science.

"When I'm out hunting," I began, "I still carry this." I explained why bear spray is a more reliable choice. We talked about hunting for a moment; and I knew that because of that conversation, what I'd said about climate change was more likely to be heard. I wasn't just a talking uniform; I was a person who had interests in common with him. I wasn't an authority; I was a trusted source.

The difference between an authority and a trusted source is huge. And it drives scientists crazy. They want to talk about their work; but the public wants to hear about *them*. Who are they? What do they care about? Do they have kids? People have their own lenses of personal experience through which they look for a way to connect, to gauge the integrity of the speaker.

An interpreter can help scientists find humanizing stories about themselves that make them accessible. The high school dropout who found his passion and earned a master's degree. The girl who carried salamanders home and learned to raise a threatened species, and now works for the US Fish and Wildlife Service. The biologist who, as a kid, loved fish so much, he spent all of his allowance on aquariums until more than 20 lined his bedroom walls. It's the humanity we share, not just the data, that helps people decide whether or not to trust what the scientist (or the interpreter) has to say.

In interpretation, concepts count more than words. When I worked for Alaska Peninsula and Becharof National Wildlife Refuges, I reported regularly on the work of our biologists. If they didn't like what I wrote, I'd sure hear about it. So I developed a method for getting articles done.

I'd either interview them and write an article, or ask them to write one and edit it myself. The critical part was to hand the article back to them for review. Editing together took a long time. One frustrated biologist asked, "Why can't we just say *demography?"* Because, I reminded him, your audience doesn't know that word. Find another way to say it. What's important here: the word or the message?

We don't all speak the same language, even when we all speak English. Our assumptions, our experiences, our feelings are factors in how we hear what others say. An interpreter's task is to look for meaning, to seek connections, to provide context for trust. That goes for our sources (scientists) as well as our audiences. Building trust with a scientist means taking the time to thoroughly understand their work, and to rephrase it in ways they can live with, checking back with them as many times as it takes to get a version

that works for them as well as the intended audience.

I've worked for many years with multiple public agencies, and I'm used to my work being public property. But for many scientists, ownership of their work is part of the landscape. Their names are on it in ways ours are not. So expect it to take a lot more time when you're helping to bring their work to the public.

An interpreter's job is to convey the vital importance of these concepts: know your audience, find common ground, share enthusiasm, use accessible language, be a trusted source. This isn't "dumbing down"; it's connecting.

Ultimately, great work goes nowhere unless the story is told. As a backcountry kayak guide in Alaska, I stopped at a beach a geomorphologist had shown me, and took a group in to have a look. "Hundreds of years ago," I told them, "the ground you're standing on was wet bog and scattered trees, called *muskeg*. When the vast glacier that filled nearby Glacier Bay extended nearly to this spot, its immense weight pressed down this part of the continental plate, and the muskeg lowered and became beach. Now the glaciers have melted, and the land is rebounding an inch and a half a year. Let's look now for the clues that reveal this story."

Plate tectonics, glaciology, soil study, ecology, botany, carbon dating—all were compressed into a single paragraph. That brief story is a starting point, a doorway inviting the listeners to walk in and learn more. No scientific paper can fire the imagination like a story; but we need both, the content and the context. Working hand in hand with scientists, we can bring stories to the wider world that inspire curiosity, action, and wonder.

ABOUT THE AUTHOR

Julia Pinnix has been working as an interpreter since 1988. She is currently information and education manager for Leavenworth Fisheries Complex.

The Interpreter's Ethical Responsibility

IN COMMUNICATING SCIENCE

LARRY BECK

DAN DUSTIN

"What the naturalist-as-emissary intuits, I think, is that if he or she doesn't speak out, the political debate will be left instead to those seeking to benefit their various constituencies."

—Barry Lopez

The thematic focus of this issue of *Legacy,* communicating science, is particularly timely given the current political situation in the United States. On January 29, 2017, Jonathan Jarvis, the former director of the National Park Service (NPS), posted the following statement on the Association of National Park Rangers Facebook page (www.facebook.com/parkrangers):

> I have been watching the Trump administration trying unsuccessfully to suppress the National Park Service…. The NPS is the steward of America's most important places and the narrator of our most powerful stories, told authentically, accurately, and built upon scientific and scholarly research. The Park Ranger is a trusted interpreter of our complex natural and cultural history and a voice that cannot be suppressed.

Our national parks are indeed an encyclopedia of places set aside to protect our most treasured landscapes and our most important historic sites. As Jarvis continued, "Edicts from on-high have directed the NPS to not talk about 'national policy,' but permission is granted to use social media for visitor center hours and safety."

Jarvis went on to question if interpreters at the Martin Luther King, Jr. National Historic Site should avoid talking about issues such as racism, the civil rights of African Americans, or Dr. King's efforts to speak up and out about other social injustices across the land. And what should interpreters do with the lessons learned from Manzanar, a Japanese American internment camp administered by the NPS, where 10,000 U. S. citizens were wrongly imprisoned during World War II? And what should interpreters do with the lessons learned from climate change science,

Jonathan Jarvis, former director of the National Park Service

ASSOCIATION OF NATIONAL PARK RANGERS

portending warmer temperatures, melting glaciers, rising sea levels, and potentially massive relocations of human and non-human populations alike? Clearly, we are at a point in American history when the interpretive profession's voices must ring loud and clear. Now more than ever, interpreters must understand their ethical responsibility to speak up and out. Interpreters are in the truth-telling business, and it is incumbent upon curators, naturalists, and historians alike to present the facts as they understand them, and to reveal the truth of the sites they are interpreting. This is the purpose and power of such places. And to the extent these interpretive stories touch on "national policy," it makes them all the more relevant and all the more important to the citizenry they are duty bound to educate.

The Importance of Truth-Telling

In 1982, Michael Frome penned an essay titled "To Sin by Silence," inspired by Abraham Lincoln's words, "To sin by silence when they should cry out makes cowards out of men." Frome asked, "What should interpreters really be interpreting?" We suggest the following:

- History and Culture: The lives of leaders, good and bad, and the lives of everyday people, good and bad, and how this may inspire the better angels of our nature. This approach necessarily engages social justice issues such as prejudice, inequality, and oppression.
- The Natural World: Ecological systems and natural processes; pollution of the air, water, and land; habitat destruction; climate change. This approach, of course, relies heavily on what science has to teach us.

Our answer to Frome's question, then, is that interpreters are obliged to interpret to the best of their ability what science teaches us about the state of humanity and the state of the natural world upon which all life depends. Anything less does an injustice to what interpretation can offer the world. If interpreters do not address facts, if interpreters sideline or ignore the truth, if interpreters do not embrace reality, then there is nothing much left for interpreters to say. From our perspective, communicating science is at the heart of what interpreters do.

We cannot overemphasize the interpretive profession's responsibility to truth-telling, however inconvenient or unwelcome the truth may be. And science, despite its imperfections, is the best method we have to uncover truths. At the most basic level, interpreters provide visitors with scientifically based answers regarding important cultural, historical, and ecological questions. Through interpretation at museums, historic sites, zoos, aquariums, and parks, a visitor learns first-hand about human and natural processes at work, thus extending a visitor's education, which in turn contributes to a stronger democracy, populated by an increasingly informed citizenry. And if interpreters employ their gift creatively, educated citizens will be inspired to action in a manner that will make the world a better place.

Communicating science in a way that strengthens visitors' emotional and intellectual bonds with the people and land that sustain them is essential to the mission of the interpretive profession. It is a mission that simply cannot be accomplished if part of the story—the science part—is missing. Lisa Brochu and Tim Merriman, former associate and executive director of the National Association for Interpretation, respectively, remind us in their book *Personal Interpretation* that the mandate of a profession includes "public service with social responsibility." This mandate is timelier than ever.

Interpreters frequently know things that are relevant to public life, and when this is so, they are entitled, and sometimes obligated, to say what they know. In this regard, interpretive services can serve as a portal unto something deeper, more meaningful, and more important

in the big picture—something that beckons visitors toward more ethical and responsible outlooks and choices. This more important component of an interpretive experience, richer and longer lasting, is often driven by what science has taught us. Interpreters should never lose sight of that fundamental association.

Conclusion

We understand circumstances vary for those offering interpretive services. We also understand that interpreters must be judicious in their choice of words, especially when representing a governmental agency whose leaders are subject to political pressures of one kind or another. Consequently, interpreters should guard against making controversial pronouncements in public unless they are confident about the factual basis of what they are saying. Expressing opinions not substantiated by facts may reflect poorly on interpreters' supervisors, their agency, or both. In a deeply divided nation, interpreters should not go out of their way to initiate arguments or provoke heated political debate. Neither should they skew or oversimplify facts, or ignore or disparage other points of view. They should strive to be accurate at all times, exercise appropriate restraint, and show respect for other opinions and those who hold them. Ultimately, interpreters need to be true to their science, and they need to be true to themselves. By doing their best to present a complete and balanced story, interpreters can empower visitors to compose their own stories and take responsibility for their own actions in working for the common good.

ABOUT THE AUTHORS

Larry Beck, Ph.D., and Dan Dustin, Ph.D., are professors at San Diego State University and The University of Utah, respectively. Both have contributed considerably to the literature of interpretation, environmental ethics, and outdoor recreation policy.

How Do Rainforests Talk?

Moving Science from Journals to Communities

MICHAEL SEVILLA

Even though communicating science to different audiences has always been a goal at Tirimbina Biological Reserve in Costa Rica, like many other research-based sites, the reserve did not always achieve that goal. Eventually, visitors became a "selective pressure," influencing the evolution of interpretation in Tirimbina over time. A few years ago, participation in the reserve's bat program started to decline; visitors, especially those from younger audiences, said that it was "too technical."

It became clear for researchers that they had to use new techniques to fulfill these visitors' needs and desires, and they learned their lesson. They improved the bat program, adding interpretive elements and techniques. Even more, when the opportunity came to create a new tour about birds, Tirimbina's two recently hired interpreters knew exactly what they had to do. They used 365 species of birds, 1,216 species of plants, five scientists, 15 staff, a dozen interviews and working sessions, and the support of two organizations to extract and transform valuable scientific data into digestible and engaging content for the public. Funded by the American Bird Conservancy, the new bird interpretive trail (the "Bird Garden") is the first product at Tirimbina Biological Reserve designed with Tilden's and Beck & Cable's principles, Ham's "TORE" (Thematic, Organized, Relevant, Enjoyable) framework, and a participatory approach from the PUP Global Heritage Consortium to create interpretive themes.

MARISOL MAYORGA

MARIELA GARCÍA-SÁNCHEZ

Understanding Science and Scientists

Costa Rica has been on the map of environmental conservation for a long time, not only because of its many ecotourism opportunities, but also for the opportunities it provides to visit and work in well-known tropical research stations.

In 2016 the country received almost three million visitors, 40 percent of them from the USA. For most, the primary purpose was "sun and surf," but also thousands of scientists and students came in the name of science. These researchers can offer important contributions to science and the world. For instance, like other private reserves in Costa Rica, Tirimbina Biological Reserve (a.k.a. Tirimbina Rainforest Center) was created thanks to one of these researchers. Robert Hunter, an American agronomist, bought the land in the 1960s where he experimented with different crops such as cacao and vanilla. He also protected an extensive area of rainforest. He later sold the property to the Milwaukee Public Museum and Riveredge Nature Center, which created and managed Tirimbina for several years until it earned independence in 2005.

Despite their importance, scientific contributions are often underutilized in programming because of the technical language and obscurity in scientific journals. Also projects are often developed with research and preservation in mind, with no outreach or promotion to make the work visible to communities and tourists who live around or visit protected areas.

This situation described the early Tirimbina. Over time its purpose and audiences have broadened, with more actors involved in research projects. Currently, the reserve receives close to 35,000 visitors per year, including foreigners and local residents, who visit in search of inspiration, entertainment, and learning, and can influence the site's direction through their financial or volunteer support.

EMMANUEL ROJAS

Based on Tirimbina's research on migratory birds and native plants, the Bird Garden Trail assists educators and interpreters alike in making sense of natural phenomena such as migrations and the relevance of native plants for bird conservation.

Interpretation Flies Its Way to the Rainforest

Currently, as part of its tourist offerings, Tirimbina leads several tours and programs, based on research in the reserve. For instance, during the chocolate tour, visitors learn traditional agricultural production processes in a cacao plot used for research decades ago. They also learn how this plant was cultivated intercropped with other forest trees, and was one of the most important products for the Mayans and Aztecs, like the Aztec emperor Moctezuma, as well as for other Central American cultures.

Another product based on Tirimbina's research is the above mentioned bat program, in which visitors learn about different species that live in the reserve and their relevance to the place and visitors' lives. It discusses famous myths (Dracula and the Chupacabra "goat-sucker") and shares recent discoveries by scientists at the site.

Although these eventually became very popular programs, their design passed through several iterations as interpretive planning has not been commonly used in the development of touristic or educational programs in Tirimbina, and more generally, in Costa Rica. To create the newest product, the Bird Garden, however, a new paradigm came into place. In this case, interpretive planning was the driver. For this, the team carried out the following steps:

1. *Read, read, read.* Interpreters reviewed scientific papers and other published research related to birds and plants (inventories and conservation) in Costa Rica and especially in Tirimbina, as well as public use management and interpretation literature.
2. *Talk with experts.* Interviews with researchers helped to broaden interpretive staff's understanding of the meanings scientists ascribe to local and migratory birds as well as their habitats.
3. *Talk to non-experts.* Interviews with staff and community provided additional perspectives about bird conservation issues and opportunities.

4. *Create a conceptual model*. Based on the interviews, staff created a conceptual model to visualize threats to bird diversity in Tirimbina and environmental education that could help to reduce these threats.
5. *Apply TORE to programs*. Even though Tirimbina still lacks an interpretive framework of themes for the entire reserve, staff adapted a participatory methodology from the PUP Consortium to identify interpretive themes for this trail, focusing on native plants for birds. Then, based on the new themes and Tirimbina's goals, interpreters designed an outline with objectives and activities for families and school kids, their primary audiences.
6. *Design the trail*. Staff built a universal access trail with interpretive stations sporting interactive exhibits and signs.

Bridging Science and Community

The staff at Tirimbina also believes in sharing with local communities the value of natural heritage to improve people's quality of life. For this reason, every year Tirimbina offers an open house with guided walks, exhibits, and environmental education activities free to the community.

A more permanent way of sharing rainforest science with the community is through a school program, completely funded by the reserve's tourism. This program offers free transportation, meals, learning materials, and entry to the reserve for students of seven schools from surrounding neighborhoods. Once students arrive at the reserve, science becomes a practical experience to complement formal school curricula. For instance, Tirimbina began Costa Rica's first butterfly sampling in 2003, and this inspired educational activities about pollinators and their importance for the ecosystem and people.

It is Tirimbina's expectation that by improving this kind of experience and sharing the language of the rainforest more tourists and residents will support Tirimbina´s conservation mission.

"We cannot win this battle to save species and environments without forging an emotional bond between ourselves and nature as well—for we will not fight to save what we do not love." —Stephen Jay Gould

ABOUT THE AUTHORS

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Wild at Night

The Secret Lives of Bats

When answering questions about what is killing off a large percentage of bats, the answer could be: There is a disease called White Nose Syndrome that affects hibernating bats and is severely damaging their population. It is spread like we spread the flu, and researchers are trying to learn more about it and the surviving bat populations to try to figure out how to prevent the spread of this fatal disease. They are doing this through use of acoustic monitoring, telemetry, mist-netting, and radio transmitters.

JESSICA WOODEND

But what are those things? And how do we help the public reach a better understanding of how they can support and become part of helping bats? The public should be part of a whole experience in order to get them involved.

Communicating science isn't just about sharing information, it is helping people to become a part of it. What if, instead of going to a science presentation and hearing all of the latest up-to-date information, you actually were able to be a part of collecting that information? Being part of the science could help create a stronger connection to the issue, helping to raise awareness and creating important allies to the cause of helping the bat population. After all, these animals do so much for us, it's the least we can do for them.

Traveling the state of Maine to educate about wildlife, frequently with wild animals in tow, I get a lot of different reactions to different types of animals. There has been a very obvious theme in my career: I love being a champion for those that are misunderstood. What animal comes to mind when thinking of one that may be misunderstood? Snakes and spiders are high on that list, sharks and wolves are up there as well (the plight of the predators), and I'm sure after pondering this question for a few moments bats will fly onto that list. Bats are one of the most misunderstood, underrated, yet extremely beneficial animals we are lucky to share this planet with. They bring us so much, including helping

to control insect populations, which helps prevent the spread of disease and protect crops that give us things like coffee, bananas, tomatoes, nuts, chocolate, tequila (thank you bats), and hundreds of other food items that pass through our stomachs on a daily basis. Yet right now they are disappearing at an alarming rate, due to a disease caused by a fungus. Currently, there is a lot happening in the world of bat research, but not unlike the bats themselves, the general public isn't hearing much about it. If they aren't hearing about it, how can we get them involved?

One of the programs I often teach is called "Bats of the World." It is very informative, but only slightly scratches the surface of threats to bats and how we can help to alleviate their struggles. It does not touch on the big picture that is the statewide (and national) effort to learn more about the once abundant population of bats. With our traveling programs we reach over 20,000 people a year just in rural Maine, but we need to be spreading the message to even more people. After nearly every presentation I give, I have adults come up to me to ask why they never see bats flying around in their backyards any more, or how they could attract them back (as if the bats just got tired of that yard and needed new scenery). The absence of this animal is felt but some have gone without hearing the explanation as to why it is happening in the first place. Seeing bats flying around at night cannot become a mere memory. This has inspired an update to our bat program to encourage conservation.

The goal is to bring the secret lives of bats to light. Since bats are nocturnal, we are not always aware of the benefits they bring us while we are fast asleep. It's the same for the scientists that are studying these animals. They are out in the field while we are putting on our pajamas and climbing into bed. We are not aware of the work that goes into learning about these nocturnal animals and their silent disappearance. The researchers have enough work to do; that's where

CARRABASSETT VALLEY PUBLIC LIBRARY

Audience members seek bat information through interpretive displays and props.

the interpreters step in. We are the bridge between the science and the public, we are the messengers of the data biologists are working hard to collect. It is up to us to wake everyone up to the world that exists while we are all dreaming. It's not just the secret lives of bats that is being brought to light, but also the little-known world of wildlife biologists as well. Giving them credit for the vital work they do, trying to draw more support and funding for their efforts, while making sense of the complex terminology that may pass over some of our heads. We gathered bat biologists and educators around the state to share current information about ongoing projects and technology being used. All of this has been woven into the bat program through interactive demonstrations.

The audience will see pictures of all different adorable bat faces while highlighting the benefits of these animals (pollination, seed dispersal, insect control). Some of them will even get to become a bat! Trying on a bat costume demonstrates how their wings are comparable to our arms, putting on big bat ears will give them a to-scale visual of how big our ears would have to be to hear like a Northern long-eared bat, and a long pink tube illustrates how long their tongue would be if they were a tube-lipped nectar bat (1.5 times the body

length). Next is a basic overview of current threats.

Since they have experienced what it is like to be a bat, it is time for a crash course in becoming a bat biologist-in-training. Using Wildlife Acoustic's Echo Meter Touch, audience members are transformed into biologists and tasked with finding the "bat" hiding in the room. The Echo Meter plugs into an Apple product and lowers the ultrasonic echolocation sounds to a frequency our ears can pick up. It even identifies the species of bat we are listening to! (I'm having a nerd moment just thinking about how impressive this technology is.) There is a small device hidden, a bat chirp, that makes the same frequency noise a real bat would make. This gets hidden in the room with a stuffed toy bat. Once they find it, the bat biologist (an audience member) comes over to the model mist-net that is set up and tosses the toy bat into the net. Another "biologist" puts on some gloves (safety first, even with the toys) and removes the bat from the net. We get a weight on the bat, look it over for any noticeable issues, and put a radio transmitter on it. This completes the typical cycle that biologists are completing multiple times every summer night. They use acoustics to locate bats and mist-nets to catch them for a full status work up, and then send these small mammals off with a transmitter so their usual hangouts can be mapped. After the "in-the-field" demonstration, a discussion is held regarding why researchers need to do this, and what they are learning from it.

The community leaves the presentation with information on a range of "to do's" that will help the bats. Starting simple with helping to spread the word about how vital bats are to our ecosystem, putting up a bat box, and how to safely remove a bat from your house. Then comes the call to action steps that require some commitment: Citizen Science Projects.

There is a project in Maine called BatME, which is coordinated by the Wildlife Demographics Lab at the University of Maine in cooperation with Maine Audubon. It is supported by the Maine Outdoor Heritage Fund and the Maine Department of Inland Fisheries and Wildlife. Unfortunately, it is not happening this year, but we hope spreading awareness through interpretive techniques can help to bring it back for next summer. The public is encouraged to help monitor bats around the state. There is a training on how to use the Echo Meter Touch to gather information about how many bats and what species they are "listening" to. It is something that all ages can really get into, because it is fun to go out at night and explore and to see the display light up at the sound of a bat. What a great way to bring science home to your own backyard. Doing this really helps biologists to cover as much area as possible, since there are only so many biologists and so many nights during the summer to be out. It's the perfect way to round off the whole bat experience.

Now the focus can be on raising awareness and sharing ways that others can help protect these animals and prevent them from becoming a distant memory. Who knows, maybe someone will be inspired to make this their career. Communicating science means involving people directly in the whole experience, and creating a deep connection to the animals to encourage conservation. How can we, as interpreters, use these science demonstrations more often to help people connect to more challenging topics?

A fifth-grader at Chewonki Elementary School helps to build bat boxes to put up around campus.

JESSICA WOODEND

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Putting Humanities Minds *in Science Jobs*

NATIONAL PARK SERVICE

On an average day at work, I might be teaching classes on geology, bird biology, or conservation efforts regarding predator-prey relationships. It would be easy to think that I might have gone into interpretation with a background in earth sciences. However, this is not the case. In fact, absolutely none of my studies have been in the hard sciences—at least officially.

CHLOE DONALDSON

The idea of separating studies by discipline is reinforced by the way classes are organized in schools, the way subjects are shelved in libraries. While organization is necessary to make sense of information, it often translates into the idea that different subjects never actually touch. This is reinforced by social media jokes that stereotype STEM minds, quirky art students, English students with Jane Austen, and so forth. You may be a STEM person if you do this; you may be an English person if you do that. Because of this mindset, it may be surprising to know that this former English and art student spent many lecture hours learning about songbird behavior, sustainable agriculture, and climate change, or that the focus of my work was on the intersect of ecology and humanities. Welcome to the world of interdisciplinary studies.

Eco-criticism is one of many interdisciplinary subjects that are becoming increasingly popular in the academic world. It pulls from theories of post-war place and displacement, as well as rising awareness about climate and environmentalism throughout the 1900s. Researchers ask how the way we talk about the world around us changes our behavior, how word selection affects conservation, how culture affects the perception of place. For example, how do America's lone cowboy myths affect the way we think about resources? How are descriptions of forests different between peoples? When the Puritan pilgrims arrived in America, they saw the wilderness as demon-haunted, frightful, and dangerous. However, the Native American peoples had very different views.

The underappreciated Flint Hills in eastern Kansas

EDWIN OLSON

In children's literature, wilderness often includes havens of the domestic: the homes of Toad and Rat and Mole, Mr. and Mrs. Beaver's cottage in Narnia, Mrs. Tittlemouse's fastidiously clean house, and Christopher Robin playing in the Hundred Acre Wood. How does this forest differ from Jack London's wildernesses, where people freeze in the uncaring Yukon winter, and dogs feel a call of the wild to return to their primal roots? How does this differ from Merry and Pippin encountering a sentient forest of Ents in Middle Earth, then proceeding to avenge the cleared forests against the armies of darkness?

These questions may even move beyond the depictions of wild places themselves. How does the term *virgin land* play into both ideas of conquest and colonization, but also gendered power constructs? Why is the word *desert* synonymous with times of depression for some cultures, and inspiring for others?

Even environmental terms, like *going green*, carry with them cultural connotations. Green, lush places, especially those that allow people to go skiing or enjoy other forms of recreation, are more likely to be protected than a yellow field in Kansas, a red desert in New Mexico, or the patchy, scruffy boreal forest of the far north, whose sparse and small trees often cause people to forget they are forests at all. However, Kansas fields may be home to considerable wildlife, including a wide variety of birds, which use the prairie mammals and insects for food. The deserts of the Southwest contain endemic and endangered species, whose habitats extend beyond Taos or Grand Canyon. The boreals alone provide a great deal of the oxygen on earth, but have often been clear cut because their small, sparse trees do not match the traditional view of a forest.

There are many fields of similar interdisciplinary studies, which an increasing number of schools are starting to provide. Bath Spa University in the UK has an Environmental Humanities program, which allows students of literature, sociology, and ecology to work together with researchers in these subjects. Carnegie Mellon offers courses in environmental and scientific rhetoric. UCLA's English

PhD program allows eco-critical focuses. Furthermore, science departments are increasingly more open to candidates with a humanities background. This provides a diversity of perspectives and thoughts, making both the humanities and the sciences more dynamic, creative, and relevant.

Interdisciplinary study may seem like simply a new trend in cooperation in academia, but it has many real-world applications, especially for interpreters. We learn from the beginning of our training that interpretation is not merely the relation of facts. A guide should not simply share a list of the biological features of a specimen, or the principles of radiometric dating in geological time. Knowing the resource is only half the battle. The second part is communicating it.

Students of language, sociology, creative studies, history, and literature are steeped in communication and cultural awareness. The tools that the humanities may provide are immense. Creative arts can improve interpretive techniques and storytelling capabilities. Writing students can translate dense, scientific subjects into comprehensible materials. Sociologists may help interpretation connect with underrepresented or marginalized groups, and assist in communicating across cultures and nations. Historians can provide essential perspective in heritage interpretation, avoiding potential pitfalls, and assisting in telling stories that many lay people may not know.

If interpretation is an art, and meant to inspire and provoke an audience, we should draw from the arts and humanities. These subjects help us understand the perspectives that people bring to a resource, and help us connect the information from a resource to the individuals we serve. While studying a scientific resource is clearly important, an interpreter may also benefit from reading literature, looking at art, and studying sociological issues that may relate to guests. This can create a shared study experience, one which can bring in guests from wider backgrounds, and interpret information in new and creative ways.

I don't know if I will always pursue arts and humanities, but I do know that the skills I have learned in my academic career have helped me be a better interpreter, trainer, and also researcher in scientific subjects. Whether it is finding a creative way to explain the habitat concerns of the endangered southwest willow flycatcher or the forces of erosion on the Grand Canyon, understanding culture, communications, and even how different peoples understand a sense of place, have been the best tools in my mental toolbox.

And that's called a metaphor.

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What Don't We Know?

Messages about Science

TIM WATKINS

MARTHA MERSON

Science has so much to offer a curious mind: everything from revelations about how the tiniest life on our planet contributes to whole systems to the mysteries of black holes. The questions and puzzles are frequently more compelling than the answers. In 2013, Stuart Firestein, Chair of the Department of Biological Sciences at Columbia University, said, "So every fact really that we get just spawns 10 new questions. And those are the things that ought to be interesting to us." His point was that the more we know, the more we realize how much we don't know. Questions push the field forward and are points of entry for those of us communicating science.

After a semester of assigning chapters from a chunky text, Firestein realized that he had given his Columbia students the idea that the field of neurology is quite advanced. He hadn't conveyed his true assessment of the field: that what is known is dwarfed by what is not known; that the questions are more interesting than the facts. Troubled by the messages he was inadvertently conveying, he set about to design a course with a far different message. His class on ignorance featured scientists who talked about what they didn't know, how those questions drove their work, and how they anticipated findings would shape their next questions.

In park settings, questions that highlight what scientists don't know can enrich visitors' learning. Unanswered questions present an opportunity to invite visitors to think through how scientists approach their work—in short, how they create new knowledge. The questions can lead to true dialogue about the implications for new discoveries.

The idea of asking scientists to talk about what they don't know may be relevant, especially to staff who plan panels and special events featuring scientists. But beyond that, the idea that unexamined actions and comments could detract from science communication goals is worth considering. Therefore, we began to record and interpret some off-hand statements made during ranger-visitor interactions. Of course, any statement is open to interpretation. In the table

STATEMENT	IMPLIED	ALTERNATIVE	IMPLIED
Everyone knows …	*There's no room for disagreement.*	I used to be skeptical about…until I heard (or read, or saw)…	*Skepticism is permitted or even welcome, and is not a permanent condition, but rather can precede a newly formed conclusion based on evidence or discovery.*
(In answer to how many, how fast, how far) The data show that…	*There is an answer based on research.*	Want to hear a really good story about how researchers figured it out? I worked with them last summer…	*Stories of how we know what we know are interesting, especially when framed by the human ingenuity it took to figure it out.*
(In answer to a question about a resource) Good question. I don't know.	*This is a dead end conversation, not worth discussing more.*	I don't know. What do you think it would take to figure that out? What else are you wondering?	*Questions drive research. All of us are equipped to think scientifically about a question.*
The rule is [no food in the cave, no collecting on protected lands].	*Rules are park prerogative.*	Visitors and park staff realized that XYZ was causing problems such as … or XYZ traditional practice could be sustainable if…	*Observation and experience from a broad group inform policy. Science serves US.*
Scientists know these things.	*Knowledge is created by professionals through sophisticated methods you don't need to know about.*	Researchers have experimented to find out… Researchers Named Thus and So collected data on…	*You don't have to be gifted; with effort one can figure something out.*

above, we examine several statements and offer possible interpretations of their implied meaning. We propose a re-framing that invites exploration of what we don't yet know about the world, and that entices visitors to learn and wonder in new ways.

In those interpretive opportunities, wherein interpreters translate science, act as conduits for content, and reveal the process of how scientists know what they know, there is often a sub-text that carries messages about who does science and how it happens. It is worth reflecting on those messages to ensure they do not suggest science is a static body of knowledge for a select few with little relevance to decisions. Consistently portraying the reality of science as an ongoing, question-centered, question-driven enterprise requires awareness and possibly a willingness to think through and reframe responses that used to be good enough. The payoff is a public that better understands, relates to, and is excited by science and scientists.

For More Information

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ABOUT THE AUTHORS

Martha Merson is the Project Director for Interpreters and Scientists Working on Our Parks. Tim Watkins is the Science Access & Engagement Coordinator for the National Park Service.

Appreciating Acadia

Unlike Yellowstone National Park, with its iconic bison or Joshua Tree National Park, with its Dr. Seuss-like trees, Acadia National Park doesn't offer visitors one charismatic attraction. Instead, Acadia's visitors drink in views of sparkling water and its rough-cut coast.

PATRICK KARK

I wanted to tell a story with a longer time span than Acadia's founding 100 years ago. I wanted to help visitors appreciate the glacial forces that shaped the landscape. To interpret the landscape of Acadia I needed a way to support visitors' imagination because the last Ice Age was 12,000 years ago and the period of deglaciation that led to today's scenery so vastly exceeds any living human's memory.

In summer 2015 I developed a "Hike with a Ranger" program during which I covered primary plant succession along the coast of Maine. While hiking on Mount Desert Island, one of the most visited areas of Acadia, I would build the story of how what we see around us got here. To add detail and scientific accuracy, I researched many internet sources on tree and plant dispersal in the Northeast. I read through documents on glacial activity in Maine. I consulted Barton, White, and Cogbill's book *The Changing Nature of the Maine Woods*, which describes how plant succession occurs during periods of deglaciation, and the NPS publication *Geology Fieldnotes* (available at https://www.nature.nps.gov/GEOLOGY/parks/acad) for a geologists' view of the formation of Mount Desert Island.

I looked forward to giving the program each week. Every time my hike would come to an end I heard exclamations of wonder about the diversity of terrain in Acadia National Park. Looking back, the program was highly relevant to the visitor experience, but not as place-based as I wanted, mainly because I wasn't able to find information that was specific to Mount Desert Island. I was making intellectual connections with facts, but not supplying a lot of

story about how we know what we know, especially in the area in and around Acadia National Park. At the same time, I knew the geological forces had dramatic potential, but I didn't have a personal story to add.

Fast forward to May 2016. On a sunny morning I was traipsing across what was once a Navy base, now land on Schoodic Peninsula, managed by Acadia National Park, just across Frenchman's Bay from the Mount Desert Island's Cadillac Mountain. A group of rangers, scientists, educators, design, and film students gathered on the edge of the bog. Minutes later, I was holding a coring device for the first time, feeling excitement at learning how to obtain core samples. With guidance from our local scientists, Jacquelyn Gill and Kit Hamley, I took a core sample, driving the device into the bog, letting its cylindrical form fill, sucking up sediment the way a straw in soda fills when you cover the exposed end with your finger. Then the others and I held our breath as we extracted mud likely 5,000 years old.

The coring experience was part of the iSWOOP project's gathering at Acadia. Interpreters and Scientists Working on Our Parks (iSWOOP), aims to make park-based research a visible and interactive part of visitors' experiences. Acadia, like many of the nation's parks, has 60 or more active permits in any given year, but the public generally hears little about the research while it is underway. Typically, scientists publish findings after the research has wrapped up, but the stories of how they came to their research focus, the innovations needed to answer their questions, and how it all might influence parks' management decisions can be told anytime. Those stories remind the public of the role parks play in research as well as conservation.

The author's first experience with a coring device.

From paleo-ecologist Jacquelyn Gill, I learned how scientists can analyze pollen found in layers of sediment cores like the one we extracted from Schoodic's bog. Wind-blown pollen can stay intact through thousands of years. From the pollen records, researchers can piece together a picture of plant and animal communities from different eras. The pollen record reveals which types of plants were dominant. The sediment record also includes remains of charcoal, indicating widespread fire, and fungal matter that are the tell-tale signs of mammalian digestion (Gill, 2013).

I was inspired to revise my Hike with a Ranger program based on actual plant pollen data acquired from Sargent Pond in Acadia. This research gave me the place-specific information I was looking for to explain exactly how plant succession occurred in Acadia National Park after the last deglaciation event. The hike's new form and shape were influenced by iSWOOP and what I learned from Jacquelyn Gill, but also by my commitment to raising difficult issues like climate change and to using facilitated dialogue techniques to make a space for visitors to express their questions and values. The following paragraphs convey the high points of the program.

Once my group had gathered and I had introduced myself, I liked to mention how many active permits there are at Acadia and how during your visit you could be walking through someone's science experiment.

Grain pollen, enlarged

In the revised program (Summer 2016), I passed around an enlarged image of a grain of pollen. It's beautiful and not very recognizable. Most people picture pollen as green dust. I asked, "Anyone have an idea what this image is depicting?" If no one spoke up, I'd answer my own question:

This is a picture of a piece of pollen taken through a microscope. Smaller than what we can see with our own eyes. But what is amazing about pollen is that, because of this, we know the story about how this landscape came to be here. An amazing story that we will be exploring today along our hike! But not only will we be exploring the past, in the end we might find out how this piece of pollen will continue to help us in the future.

The hike began in a wet area very similar to a bog. I showed a picture of me coring while I described the experience, the steps in the process, and explained what pollen can tell us. I built up the story that the rest of the hike would tie together. As the hike progressed, we made stops so I could point out the story of deglaciation and build the story of how plants began spreading on the island. Starting with a giant glacier erratic and working our way through a forest floor covered in lichen and moss, we then entered

a clearing showing glimpses of natural grasses growing at the foot of the mountain. Each plant and rock gave us a clue to what the landscape once looked like.

As we ascended the trail, the diversity of flowering plants and trees became apparent. The diversity of plant life was a stark contrast to the moss and lichen where we began, symbolizing the change in vegetation over time and terrain. At the summit of Beech Mountain, visitors and I caught our breath. Acadia is the perfect place to gain some perspective. Beech Mountain summit is particularly so. On a clear day you can see the mainland, the Cranberry Islands five miles from shore, the entrance to the fjard that almost cuts Mount Desert Island in half, and the ever present expanse of the Gulf of Maine.

At that point I shifted from past to future. In my notes I wrote:

- Climate change has been/will occur
- Must understand what is going to happen
- What change will be acceptable, what change will not be acceptable?
- How to change behavior in response?

I framed the dilemma for my hikers like so: "With much change in the past and most certainly changes to come, how do we prepare and position ourselves?" I wondered aloud, "How will you feel about changes to the landscape?"

Discussions were lively, reflective. Visitors expressed:

- Concern over the environment
- Questions about how Acadia would change
- Observations of change from their own homes
- Ideas on how to help species that might struggle to survive warming.

All of these topics and even more were brought up and discussed among visitors as we took in the remarkable summit view. We resumed hiking, stopping at one more point, taking in a stunning sunset. My notes to myself read, "Enjoy sunset (If foggy—continue hiking, finish hike earlier)." To allow all that had been discussed to settle in, the hike would then move quietly down the mountain.

Looking back, my program evolved a lot between 2015 and 2016. It became more personal and more specific. Without confronting the controversial question about how old the planet is and how long humans have been around, I focused on how we know what we know and what it means for us today. Throughout this entire process I have learned a lot. But it was not just the scientific information that I learned. I put techniques into practice that iSWOOP introduced to help visitors connect with that information.

Using techniques such as open-ended questions, visuals to spark conversation, and my own personal story of being a part of the research in the park, I was able to present data in a variety of ways that had actually been gathered by researchers in Acadia National Park. This makes all of it, even information from 12,000 years ago, more real. This closeness to the information is what really seemed to make quite the difference when it came to understanding and appreciating Acadia, but also allowing people to imagine how Acadia will change. Once they know how it changes, they will be able to start helping and implementing ideas—not just how to help Acadia, but how to help their own towns as well.

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Martha Merson, project director for iSWOOP, contributed to this article. For further information on iSWOOP, see www.iswoopparks.com or email Martha_merson@terc.edu.

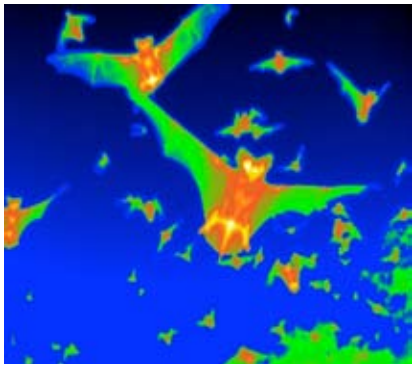
Inspiring Visitors' Scientific Inquiry

by Transforming an Interpreter's Science Communication

Science is wicked cool! So why has my enthusiasm for it dwindled significantly over six years in the role of National Park Service interpretation/education ranger? Whether in Carlsbad Caverns or Rocky Mountain National Parks, why do I feel like a walking encyclopedia when I talk to visitors? Why am I struggling so when I seek to provoke visitors' scientific interest? Do I have the correct tools to provoke visitors to increase their scientific literacy?

ALYSSA PARKER-GEISMAN

In my experience, during the typical two- to four-week seasonal training, scientific research is usually presented in "sound bites," resulting in my superficial understanding of park science. Combined with assuming that visitors prefer quick answers rather than scientific details, I found myself didactically regurgitating simplified scientific results to visitors. Despite my best attempts to provoke visitors' wonderment, I increasingly felt like a walking encyclopedia and my scientific curiosity dwindled. I lacked the necessary tools to spark visitors' scientific inquiry and wonder.



NIKOLAY HRISTOV

Thermal camera shot of bats against a night sky.

However, a new model has enabled me to ignite visitors' scientific curiosity and understanding: Interpreters and Scientists Working on Our Parks (iSWOOP). iSWOOP empowers interpreters to communicate science in an engaging fashion that fosters visitors' scientific inquiry. Re-connecting with my own curiosity has enabled me to adopt this new model successfully.

The iPhone with an attached thermal camera captivated me while I was attending iSWOOP training at Carlsbad Caverns National Park. "Cool! How much does this cost? I want one!" I asked out loud. The facilitator did not give me the answer, so I discovered the answer myself using my iPhone: $250. We were learning how to use thermal camera technology to engage visitors and discuss how it enabled researchers to obtain an accurate bat population count. My excitement for science communication was being re-kindled.

In the table I compare iSWOOP's approach to the traditional style of communicating science:

To successfully develop an iSWOOP program, one needs a researcher, stories about the research process, intriguing visuals or props, and interactive techniques to start relevant conversations that raise visitors' awareness about National Park-based research. Where can interpreters get briefed on current park research if iSWOOP isn't scheduling scientists to come spend time with interpreters at your park? Most times, the shared drive is a rabbit hole, inefficient for accessing an overview of recent cutting edge studies. The internet is usually too broad, unless one has a researcher's name and access to repositories for science papers. If you're interested in integrating park research into your formal and nonformal programming, check out the vast store of research briefs available on the Inventory and Monitoring (I&M) Networks, Research and Learning Centers (RLCs), and the Integrated Resource Management Application (IRMA) websites.

Between jobs, I recently worked on the iSWOOP project, collecting and analyzing over 100 research briefs generated by RLCs and I&M. These are intended for interpreters' use, and so project director Martha Merson and I characterized the sample, paying attention to various attributes such as readability, type of visuals, subheads, story potential and more.

RLC and I&M briefs reveal the vast array of scientific research and extent

of inventory/monitoring efforts across national parks: wildlife, endangered plants, species relationships, and abiotic topics such as water quality. The brief two-page summaries lend themselves to interpreters quickly understanding the essence of the project.

Half of the briefs contained relevance to park management, but only a handful included relevance from the visitors' perspective. Most of the briefs contained a project introduction, methods, data findings, and discussion identified by subheads. Only a couple of briefs had a narrative layout. I particularly enjoyed the brief that narrated inventory efforts in Haleakalā National Park, a "true expedition into wilderness" to inventory at high-elevation streams. The description of the helicopter transport to a remote research hut where researchers would stay for five days helped me appreciate the extent of work that goes into the result-oriented science "sound bite" I share with visitors. I imagined sharing this story with visitors to help them appreciate the labors that go into scientists' research. This was the only brief of the 66 I&M briefs analyzed that told a story.

Briefs aren't one-stop shops; if an interpreter wants to share a research story with visitors, they first will need to contact the brief's researcher. Most briefs contain contact information to pursue this.

Intriguing visuals that enhance visitors' curiosity are a hallmark of a successful iSWOOP program and can be used to examine researchers' results, discover new information, or ask further questions about the research. When I was at Carlsbad Caverns, I showed visitors slow-motion videos and graphs showing emergence patterns to help elicit visitor questions. Images or a graph engage interpreters' and visitors' critical thinking skills while both parties decipher it. Out of 66 I&M briefs, 97 percent contained resource images, and about 35 percent contained graphs. Interpreters may consider pursuing the researcher for high-resolution or additional visuals that enable interpreters and visitors to engage with the scientific results or ongoing efforts.

iSWOOP is	iSWOOP is not
Personal and interactive: an approach to personal interpretation that makes science in parks an interactive and visible part of the public's park experience	Primarily using waysides, social media, exhibits, or print media to showcase park-based science
Audience-centered, two-way conversations that allow time for visitors to engage with each others' ideas	Information out
A way to talk about science as a process that starts from questions, involves revision, and has the potential to matter to all of us	A way to remind visitors that science is largely a collection of facts about how the world works
Based on the idea that science in parks is inherently interesting and full of good stories—both first person from interpreters' experiences and about the researchers and what they are studying	Facts strung together and offered in an engaging way
Technology and innovative methods key to understanding how we know what we know	Facts shared without attention to who figured it out and how
Sequenced images are to reveal something about the resource, but also as a starting point for inquiry and discussions of relevance	Images shown primarily to illustrate a place
Programs, formal and nonformal, that invite visitors to predict, observe, and speculate	A replacement for the strategies and know-how interpreters possess already
Comfortable with silence and reflection	Pre-scripted and pre-determined
Possible because interpreters and scientists spend time together in the field and in the classroom	Minimal or limited direct contact between interpreters and scientists, such as a one-hour bag-lunch or field work encounter without follow-up

Working together, scientists and interpreters have the opportunity to raise park science awareness among visitors. Between iSWOOP's interactive strategies and this trove of research, I am eager to start new conversations with visitors about park science, to combine my reawakened enthusiasm for park research with the iSWOOP approach to transform my science communication with visitors. How will my techniques for science communication change as I learn researchers' stories and share those with park visitors? How will park visitors' scientific literacy make itself felt and possibly grow in my presence once I let go of "knowing it all" and start to question and learn alongside visitors? I anticipate positive results during my summer season.

ABOUT THE AUTHOR

Alyssa Parker-Geisman graduated with a degree in Marine Geology from University of Miami, before beginning to work for the National Park Service. For further information on iSWOOP, please visit www.iswoopparks.com or contact Martha Merson at martha_merson@terc.edu or Alyssa Parker-Geisman at alyssa_parker-geisman@nps.gov.

Tiny Tots and Big Ideas

Exploring Hands-On Early Childhood STEM Programming

SARAH KINARD

LUCIEN MEADOWS

The following conversation between employees at the Fort Collins Museum of Discovery in Colorado highlights the challenges and benefits of STEM programming for children.

LUCIEN: You've been at Fort Collins Museum of Discovery since 2012, with a short break to work with the local school district. As Early Childhood and Accessibility Coordinator, you oversee programs for FCMoD's littlest visitors. What programs does the museum offer for early childhood?

SARAH: We have a very unique program—Storytime in the Dome—where we project a book onto the Digital Dome Theater screen and read it aloud. Storytime is followed by a craft that correlates with the book's theme. Craft time is a great way to practice those fine motor skills!

We also have Tot Time, which is a STEM-based program for preschoolers.

LUCIEN: At the 2016 Association of Science-Technology Centers Conference, museum staff realized STEM for early childhood was just starting to appear across the nation. Soon after, Tot Time launched. Can you say more about the start of this program?

SARAH: We opened The Tot Spot exhibit in Spring 2016 and realized a need for programming for this audience. After the conference in the Fall, Tot Time felt like the perfect fit.

People wonder, "How could you have a three-year-old engineer?" But preschoolers are natural scientists! Asking questions, testing ideas—they're already practicing the scientific method! This age is all about absorbing and using new information. It's all in the way you present it.

LUCIEN: Each Tot Time session has a specific theme. In "Space Explorers," kids gathered for story-time, learned about the planets, built a space explorer designed to go to the planet of their choice, and shared their creation. Why have a theme?

SARAH: Mostly for my sake! A theme helps me organize and focus the session, and know what I'd like the kids to walk away with.

It also gives visitors an idea of what to expect. If a child is interested in planets and astronauts, their caregiver might see "Space Explorers" and make sure to attend.

LUCIEN: What do you hope happens after each session?

SARAH: I try to have some aspect they can continue at home. For "Which Nest is Best?" the kids predicted and counted how many scoops of birdseed it takes to fill up a snack

ROBERT PARROTT

ROBERT PARROTT

baggie. They took these baggies home, and my hope is that the adults and kids would scatter the birdseed and watch for birds together. The adult can ask the child what color each bird is, what each bird might eat—exploring together, not just homework.

LUCIEN: On that note, how is Tot Time different from science class at an elementary school?

SARAH: Nonformal educators have more freedom in how they can present a topic or lesson. We don't have a curriculum to follow or standards to meet. Here, there are no tests so there's a lot less pressure. Kids haven't failed that science test yet. They still believe they can be astronauts. I love that, and I want to keep that confidence going.

LUCIEN: What is one of the most satisfying moments you have had in leading Tot Time?

SARAH: As I was reading aloud during a recent session, one boy was so interested—he was just a few inches away from the book and my face! I thought about asking him to scoot back with the rest of the kids, but I didn't want to squash that enthusiasm. He was so excited to see what was on each page!

At whatever point you can connect, it is great! Tot Time is geared for preschoolers, but we often get two-year-olds. It can be a challenge to adapt for younger kids in the moment, but watching them make connections and get excited about the topic is well worth it.

LUCIEN: Have you ever had a session go just not at all as you expected?

SARAH: The first session! A group came in over halfway through—after we already set the tone and started the activities. I had them jump right in, without the context of story-time and discussion. They were confused, but I had them stick around after so I could catch them up on what they missed.

You can have as much of a plan as you want, but you have to be able to go with the flow! Some kids may not be able to sit and pay attention during storytime, but they might be very into the activity that follows—or vice versa!

LUCIEN: Why should nonformal educators, from museum staff to park rangers and beyond, consider STEM programming for their littlest visitors?

SARAH: For preschoolers, their whole world is a giant science experiment. Education is moving away from memorization and toward transferable skills. As nonformal educators, we can find creative and engaging ways to get kids thinking about the world around them.

LUCIEN: Yes! The Institute of Museum and Library Services released a list of "21st-Century Skills" essential for today's students—problem solving, flexibility, innovation, and more.

SARAH: These skills are easy to build in the sciences. Problem solving to find out whether your hypothesis is right. Flexibility to bounce back after your first guess doesn't work out. Innovation to try a new idea. These skills are useful no matter what your future career is.

If we can build these skills and confidence through STEM at an early age, all the better!

LUCIEN: What suggestions would you give for interpreters interested in starting an early childhood STEM program of their own?

SARAH: Teaching STEM isn't as intimidating as it sounds! These kids are eager to experiment and get their hands dirty. Make the class about the process—the result is just one step in a series of important steps.

Start with a theme, then do research to find ideas. I use Pinterest to get ideas for activities, and then figure out FCMoD's own unique twist. I've even used Sesame Street for advice on how to present the scientific method to preschoolers!

And relax! These are little kids—things will go differently than you planned! Breaking the session into sections helps keep the kids engaged and avoids wandering attention spans. Do your best to give them the spark and confidence, and they'll keep exploring long after!

ABOUT THE AUTHORS

Sarah Kinard is the Early Childhood and Accessibility Coordinator and Lucien Meadows, CIG, is the Grants Coordinator at Fort Collins Museum of Discovery, northern Colorado's only ASTC-affiliated museum (Association of Science-Technology Centers). Learn more at www.fcmod.org.

Oases in a Book Desert

Little Free Libraries and Environmental Literacy

I was a budding naturalist exploring the Chicago lakefront with essential tools in my "Hello Kitty" backpack: binoculars, a notebook, a pencil, and a field guide about North American birds. In first grade, my mother helped me identify any unfamiliar species. I was fortunate to have access to a shelf full of field guides when I was young, but many children in Chicago and other large cities struggle to find appropriate reading material of any kind. Similar to food deserts, where residents have insufficient access to fresh produce and healthy foods, a book desert is a neighborhood where insufficient reading materials are available. Susan Neuman, professor of Childhood Literacy and Education at New York University, published a study in *Reading Research Quarterly* comparing high-income and low-income neighborhoods in Los Angeles, Washington, D.C., and Detroit. Neuman found that books for purchase are significantly less common in low-income neighborhoods.

EMMA MARTELL

Little Free Libraries

The Little Free Library (LFL) movement offers one potential solution to the book desert problem. Maintained by stewards who live near the LFL, the dollhouse-like structures have a "take a book, leave a book" policy. First founded in 2009, today there are over 40,000 LFLs worldwide. Stewards enjoy many benefits to overseeing a book exchange, including neighborhood socializing, improving public spaces, sharing information, and promoting early reading.

Some LFLs are located in front of private residences while others can be found at museums, parks, or cultural sites. The number and type of books present in the LFL depends on the size of the structure. These structures offer opportunities for providing information even when interpreters are not present, especially if they are filled with texts related to the mission of a nearby institution.

Field Guide Study

I saw LFLs as an opportunity to increase literacy and access to scientific texts at the same time. There are 72 registered LFLs located around Chicago, spanning 227 square miles. With the support of Lincoln Park Zoo, I began a study of 17 randomly selected LFL locations. I distributed 34 field guides to each LFL and returned to the sites over four weeks to track how many had been picked up. Field guides distributed included Golden Guide titles *Birds, Insects,* and *Butterflies and Moths,* and a National Geographic book for early readers called *Seed to Plant*. Finally, color-printed and spiral-bound copies of the Field Museum rapid color guide to *Common Species of Chicago Park District Natural Areas* were also distributed. All field guides contained information about species native to North America, including Illinois.

Pick-up rates were calculated by dividing the number of guides removed from the LFL by the number of guides distributed throughout the study. Overall, nearly 70 percent of the field guides were picked up. The most popular title was *Butterflies and Moths* with a pick-up rate of 83 percent, followed by *Insects* at 79 percent and *Birds* at 76 percent. These three Golden Guides were more popular than the *National Geographic Reader* or the rapid color guide. *Seed to Plant* had a pick-up rate of 59 percent, and 53 percent of the *Common Species of Chicago Park District Natural Areas* were picked up.

The results demonstrate that LFLs can be an effective distribution point for information about native species. While there were many diverse titles in the LFLs I visited, there were no other field guides available at the study sites other than the ones I distributed. The field guides were thus a unique resource within the selected LFLs. As I visited the sites, I had a chance to talk to two LFL stewards. One commented, "Did you drop off a field guide that had pictures of grasses on the front? My son likes to open it up and point at all the things he's seen." Another steward commented, "We took two of the field guides and we plan to take them out to a farm when we go to Michigan next week." These comments reveal two promising uses for the guides.

Using Little Free Libraries for Interpretation

What can you do to connect literacy development to interpretive practice?

1) Host a book drive to collect scientific texts. These can be donated to a local LFL steward.
2) Look for Little Free Libraries in your neighborhood and fill them with texts related to your site. Your neighbors will benefit from the information and perhaps be motivated to visit your institution.
3) Establish an LFL of your own. LFLs are a natural fit for any museum or park with a cozy "nook" for reading, or any site located near a busy public transportation stop.
4) Invite families to help decorate a LFL. Costs can be kept to a minimum by reusing materials to create the library structure.

I urge interpreters to consider LFLs as an extension of their work to inform and inspire visitors.

For More Information

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ABOUT THE AUTHOR

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The Sum of Our Beliefs

The Judgment Factor in Interpretation

Editor's note: Will LaPage passed away in March 2017. Legacy *is publishing six articles in this series posthumously.*

"Children begin by loving their parents; as they grow older they judge them; sometimes they forgive them."
—Oscar Wilde

WILL LAPAGE

We are the sum of our beliefs, numbering in the hundreds, but the two or three that we choose to focus on are often the very ones that define us. Incredibly, we are not particularly uncomfortable with such simplistic judgments of our complex nature: "Christian conservative," "east coast liberal," "southern redneck," etc. With false modesty we may even brag that what you see is what you get! Clearly, the rush to judgment, at least between humans, is nothing new if we assume Matthew to have been a reliable social critic of his times: Judge not, lest ye be judged. However, in today's complex, multi-ethnic society, labeling our fellow citizens on the basis of such skimpy data is unacceptably inept, and potentially dangerous. Stereotyping, profiling, once a common step in scientific inquiry, has acquired something worse than a bad name; it is the equivalent of prejudice in action. It's an admission of shallow thinking or, more accurately, the replacement of real thinking with pseudothinking that is neither critical nor skeptical. For professional interpreters, racial profiling flies in the face of our need to be relevant.

In today's complex, multi-ethnic society, labeling our fellow citizens on the basis of such skimpy data is unacceptably inept, and potentially dangerous.

Words are important even when they remain unspoken. So, if making judgments is an unavoidable human trait, as well as an essential means of coping with complexity, what are its pluses and minuses for the process of interpretation? First, however, let's understand exactly what a judgment is: Every judgment is a statement of belief. Right or wrong, it's a conclusion, an assessment, an opinion, and a statement of finality. It's all of these things plus the collection of thoughts that produced it. So, judgment is a process as well as the result of that process.

Profiling is a process that can lead to a rush to judgment. It's also what we do when we use taxonomic keys for identifying species of unfamiliar objects in nature. And, it's what we automatically do when fine-tuning our presentations to fit the audience: ages, sexes, family status, dress, places of origin, first-time visitors, even the smiles on their faces. Yes, faces can be a reliable clue as to whether a person really wants to be there. Of course, that pained expression may also reveal uncomfortable chairs, malfunctioning air exchange, or poor acoustics.

Clearly, profiling is one of many tools interpreters can use in their search for insight, understanding, and relevancy. Just as clearly, it is not a tool designed for rendering judgments about complex human beings. The misuse of any tool says more about the user than it does about the subject. Consider peer evaluations, for example. When lazy administrators and lazy editors

use peer evaluations as the sole basis for their decisions, they are misusing the tool. They are, in fact, abdicating their judgment to others—rejecting the very job they are paid to do. Similarly, when we allow peer pressure to dictate which lever we pull in the voting booth, we fail to exercise our democratic responsibility for reasoned judgment.

Interpretation is also a tool, well designed for increasing understanding, and less so for rendering judgments. Judgments are more appropriately the province of science and research. Even there, we recognize the existence of an element of doubt. It's called probability. An understanding of the past can aid in predicting the future, but it's always an imperfect interpretation. The best interpretation is, therefore, that which reflects a preponderance of scientific (impartial?) judgment, recognizing of course that science is still at work, and the jury is still out on the question of what's "best," what's "true?"

One of the most dangerous assumptions (judgments) any interpreter can make is that the audience is uninformed. We disdain being labeled, and so do they. Right up there with the belief that the audience came seeking the light, is the belief that we, the interpreters, have custody of the one true answer. So, is there a place for judgment in the interpreter's tool kit?

The interpretive relationship is fragile, transitory, and wholly dependent on mutual respect. The brevity of that relationship suggests that good judgment will be much in demand. In fact, it may be the most valuable tool in the kit. At the simplest level, interpreters must be able to judge how much is enough? The best interpretation is sometimes the least interpretation. Sometimes we just need to stand aside and let the object of our interpretation "speak" for itself, exude its own mystery, challenge the imagination, and restore the sense of wonder. At the most complex level, the interpreter's opinion (best judgment) is essential and expected. And, if that judgment flies in the face of conventional wisdom and the party line, it becomes invaluable toward providing a full and provocative interpretive experience. Between those extremes, the opportunities for interpretive judgment are rich and exciting. From the design of facilities to on-site and off-site programming, successful interpretation hinges on good judgment.

Interpreters must be able to judge how much is enough? The best interpretation is sometimes the least interpretation.

We make hundreds of judgments throughout the process of interpretation, from planning the experience, to delivering it, and beyond. What information sources should I use? Do I update my sources or go with what I've done in the past? How do I ensure the presentation will be relevant to diverse audiences? What stories will best illustrate my points? How can I be more provocative and maybe even inspirational? What are the connections between my topic and the issues of the day? All of these judgments draw upon our beliefs and our experiences. And, any one of them can spoil the day if it's a bad judgment.

We all make bad judgments from time to time. In fact, bad judgments provide the experience that is necessary for making good judgments. Look at your own judgment record. Have you ever sent an email that you regretted sending? Ever misjudged the actions of another? Ever made a bad investment? Rushed to judgment without knowing the

Advertisers

facts? And, have you ever wondered why some people seem to have a better judgment record than others? Perhaps they've mastered a few simple principles for minimizing bad judgments such as: 1. Never judge in haste; 2. Always check your facts; and 3. Discuss your ideas in advance with a colleague.

It's not only our own judgments that have an impact on our interpretations—the judgments of others can be supportive or devastating. I recently indulged myself by spending a month visiting museums and nature centers, and pueblos and parks, in the Albuquerque/Santa Fe area. I was astounded by the good judgment and tastefulness I encountered at every turn. When the principles of design are consciously blended with the principles of interpretation the resulting experience can be spectacular. In that setting, the rare instances of failed judgment become all the more puzzling. And, the failures of maintenance stand out as the most baffling.

When inspirational facilities, bespeaking pride in heritage, bear highly visible evidence of inadequate budgets for maintenance, credibility is the first victim. An interpretive panel proclaiming pride which has been marred with graffiti or faded beyond legibility sends a message of cognitive dissonance, at a minimum, and one of a lack of pride at its worst. The interpreter's task is rendered near impossible by somebody's judgment to shave the maintenance budget. Every day, every month, every year, without remediation continues to produce victories for the vandals and for the foolish judgment of savings over pride.

The interpreter believes in the vital importance of cultural heritage—so important that we dedicate our lives to its preservation—hopefully so important that we take a stand against all threats to that preservation. In my judgment, desecration of the artifacts of our heritage, including failures of maintenance, are a far higher crime than the desecration of the symbols of heritage. Because we are the sum of our beliefs, it is as much the interpreter's job to demand good maintenance and sound budgetary judgments as it is to keep their own interpretive tools and judgments sharp.

> The only true protection that our parklands and their magnificent heritage have is an informed and involved public.

At the risk of offending the gods of bureaucracy, I long ago concluded that the only true protection that our parklands and their magnificent heritage have is an informed and involved public. And, the key to achieving that level of eternal vigilance is interpretive competence. That is, a combination of good training and good judgment.

"Whoever sets himself up as a judge of truth and knowledge is shipwrecked by the laughter of the gods."

—Edmund Burke

ABOUT THE AUTHOR

Will LaPage, an educator, author, mentor, and an NAI Fellow and founder, passed away March 31, 2017. He was an advocate for the profession and for our treasured places.

Four Strategies for Responding to Questions

(Especially When You Don't Know the Answer)

The way you handle questions has a large impact on your credibility. You may be asked questions to which you don't know the answer, you may misunderstand the question, or you may benefit from a small bit of time to consider the correct best answer. Here are four strategies to help increase your credibility when answering questions.

ETHAN ROTMAN

1. Prepare.
Write a list of questions you may be asked, write the answers, and practice delivering these answers before you are in front of your audience.

2. Remember, you are an expert.
You know your topic, your job, and your project.

3. Buy time (and think).
Use these statements sparingly to help gain focus:

- "That is a great question."
- "I am glad you asked."
- "Make sure I understand what you are asking."
- "I am not sure I understand what you are asking. Can you give me a bit more background? "

4. Use your audience.
If you don't know the answer or don't know the entire answer, you still need to respond in a confident manner. Use these statements:

- Invite the audience to respond with their knowledge or opinions
- Turn the question into a conversation

5. Give an answer.
If you don't know the answer or don't know the entire answer, you still need to respond in confident manner. Use these statements:

- "Here is what I know about that…."
- "Here is what I don't know…"
- "This is what I will do to find out…"

Keep your answers short and concise, answer only what was asked, and resist the temptation to tell *all* you know about the question. When you are finished, ask to see if you have given the info being sought.

The best way to maintain your credibility as an expert is to prepare. Be ready for all questions, even the ones you do not know how to answer.

ABOUT THE AUTHOR
Ethan Rotman is a presentation coach offering workshops and coaching in the San Francisco Bay area. For more information, call 415-342-7106 or visit www.iSpeakEASY.net.

NAI CALENDAR

Conferences

NAI National Conference
November 14–18, 2017
Spokane, Washington
www.interpnet.com/conference

NAI International Conference
April 16–20, 2018
Reims, France
www.interpnet.com/ic

Certification & Training

Visit www.interpnet.com for details.

Certified Interpretive Guide (CIG)
July 25–28, 2017, West Columbia, TX
July 25–28, 2017, Odem, TX
August 5–13, 2017, Phoenix, AZ
August 15–18, 2017, Palm Desert, CA
August 16–19, 2017, Tifton, GA
August 17 – September 7, 2017, Springfield, IL
August 21–24, 2017, Lisle, IL
August 22–25, 2017, Milford, OH
August 28–September 1, 2017, Brookfield, IL
September 11–14, 2017, Estes Park, CO
September 11–14, 2017, Norwalk, CT
September 18–21, 2017, Bellevue, NE
September 25–28, 2017, Sandy Springs, GA
October 16–20, 2017, Chicago, IL
October 24–27, 2017, Millersville, MD
November 7–10, 2017, Littleton, CO
November 13–16, 2017, Bretton Woods, NH
November 27–30, 2017, Tulsa, OK
December 5–8, 2017, Millersville, MD
January 8–11, 2018, Phoenix, AZ

Certified Interpretive Host (CIH)
August 30–31, 2017, Tulsa, OK

Certified Interpretive Guide Train–the–Trainers
July 24–28, 2017, Fort Collins, CO
September 24–28, 2017, Kirkwood, MO
October 2017, Seattle, WA (Exact Dates TBA)

Certified Interpretive Host Train-the-Trainers
September 29–30, 2017, Kirkwood, MO

Combined Certified Interpretive Guide & Host Train-the-Trainers
September 24–30, 2017, Kirkwood, MO

Social Interpretation: Design & Social Media
September 11–12, 2017, Fairfax, VA

You: *The Artist*

Communicating science…interpreting science… becoming an artist of science.

Freeman Tilden, in his third principle of interpretation wrote, "Interpretation is an art, which combines many arts, whether the materials presented are scientific, historical, or architectural. Any art is in some degree teachable."

JAY MILLER

This is my favorite of Tilden's six principles. Tilden must have thought it pretty important because he listed it third—after *relate* and *reveal*, but before *provoke*. That's a pretty prestigious spot in *the* list. Yet #3 is often skimmed over in the discussion of interpretation. There seems to be a lot of confusion about this third principle. When it is discussed, I often hear remarks about using arts and crafts, or that we should use more art in programs. The former is way off; the latter is a very fine idea, but it too is off the mark.

I definitely like incorporating the arts in interpretation and love the Hudson Valley School, Albert Bierstadt, Thomas Moran, Ferde Grofé's "Grand Canyon Suite," Aaron Copeland's "Appalachian Spring," Igor Stravinsky's "Rite of Spring," and

Mist in Kanab Canyon, Utah, by Thomas Moran

Smetana's great symphony celebrating the mighty river: "The Moldau." All of these enrich the perception of place through the eyes, ears, and hearts of the greatest artists, and they open our hearts to new heights of awareness and inspiration…yet that was not what Tilden wrote.

Tilden (who was himself an artist, playwright, author) is adding to the definition of interpretation itself. He is describing what interpretation *is*, rather than what it does or how it is pursued. And he is addressing the interpreter directly—the interpreter, *you*—can *learn* this skill. It's not a concept or an axiom or a philosophy to be memorized and recited, but a practice to be engaged in, an active act of interpretation that the best interpreters master like every artist does—through practice.

I believe Tilden's intent is clear and direct. He was defining the person of the interpreter. The best interpreter is an artist. The best pianists practice daily, the best artists plan coherently and paint or write constantly. As they do, their quality of performance or product changes, it grows and improves throughout their lifetime.

To be the best interpreter you study the art of interpretation and constantly improve your interpretive skills. With practice you get better, your art gets better. Your selection of color and balance, light and shadow, your nuances, your composition, your ability to bring your audience with you, your ability to use the best phrase, the right prop, and the perfect gesture, your ability to bring your audience to the edge of awe, then stand back and let the awakening awareness of self-actualization overtake them. These are all part of the art of interpretation created by you, the artist interpreter. These beautiful interpretive arts are not learned in the classroom or through reading a book or a blog, but, like any art, they are learned through practice, sensitivity, and awareness—awareness that you, the interpreter, are the artist.

Interpretation is an art…and like any art, with study and practice, you, the artist, improve.

ABOUT THE AUTHOR

NAI's president Jay Miller served as Chief of Interpretation for Arkansas State Parks for three decades. Currently, he teaches interpretation at Arkansas Tech University and is a speaker, planner, and trainer. Reach him at jmiller@interpnet.com.

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