The Smithsonian Institution's

Guide to Interpretive Writing for Exhibitions

Table of Contents

Foreword

During a given year, millions of visitors experience the wonder of the Smithsonian's exhibitions. The unsung hero in these interactions is the writing that brings to life exhibitions of all shapes and sizes with concise, evocative language. The text needs to connect emotionally and intellectually with our visitors, considering their different ages, diverse interests, and varying degrees of knowledge. It also must comply with the Plain Writing Act of 2010, which requires federal agencies to use clear communication that the public can read and understand.

A pan-institutional team of curators, exhibition developers, writers, and editors developed the *Smithsonian Institution's Guide to Interpretive Writing for Exhibitions* to help Smithsonian staff and contractors—as well as museum professionals outside the Institution—write more effectively for interpretive exhibitions. Much like the *Smithsonian Guidelines for Accessible Exhibition Design,* this document promotes text that is accessible and engaging to all visitors. I commend the work everyone did to assemble this manual, which describes interpretive writing and provides best practices, examples, and tips to improve the writing that accompanies our exhibitions. I know this guide will be a valuable resource for Smithsonian curators and exhibition teams in the years ahead.

Lonnie

Lonnie G. Bunch III
Smithsonian Secretary

Acknowledgments

This guide has been a labor of love for the core writing team. We first met to develop a workshop for Smithsonian staff interested in exhibition writing. In that workshop and subsequent discussions, we found a real need—not only for the type of information and guidance we could share, but also for a community of professionals to offer support, encouragement, and feedback. We are passionate about writing compelling exhibitions for visitors to the Smithsonian. And by coming together to develop, draft, and edit this guide, we have embodied the spirit of One Smithsonian—collaborative, creative, and interdisciplinary.

We hope that you find this guide not just useful, but inspirational.

What is this guide and who is it for?

In the spirit of the Smithsonian's mission to "increase and diffuse knowledge," we—a group of exhibition writers, editors, and developers from across the institution—wanted to share our knowledge, experience, tips, tricks, and philosophies in crafting engaging, accessible, visitor-centered exhibition text with you, our colleagues. We tried as much as possible to stick with the principles of interpretive writing that would be applicable in the broadest sense.

This guide is intended for anyone who wants help writing an exhibition. Whether you are new to exhibition writing, have years of experience, or are anywhere in between, this guide is for you.

You may notice there are questions and issues that your museum struggles with that are not addressed in this guide. Who on the team will write the exhibition text? What style guides will you use? (Many of us use the *Chicago Manual of Style* as a starting point and have developed in-house guides.) How will the exhibition script be formatted? Who will edit, review, and approve it? Even though the Smithsonian Institution is one organization, each museum* has its own idiosyncrasies of style, subject matter, and processes that its exhibition teams will need to consider. (We understand how important those things are—after all, we're on exhibition teams, too—but those issues are outside the scope of this guide.) Also, our visitors have different interests, come to see or do different things, and behave in different ways depending upon the venue. So, the label writing approach at the Hirshhorn Museum and Sculpture Garden may not be appropriate for the National Museum of Natural History, for example.

* For ease of reading, we use "museum" in this document to refer to all Smithsonian units that produce public-facing exhibitions.

This guide is not intended to be the definitive, last-word statement on interpretive exhibition writing. Nor is it meant to prescribe or mandate what individual Smithsonian museums and units must do in their exhibition galleries. This guide is a playbook for the exhibition development team and its members, who all bring different skills, expertise, and perspectives to the table. The conversation and guidelines offered in this document are done so in the spirit of helping all of us become better at serving our visitors.

The style of this guide is conversational, colleague-to-colleague, and at times informal and whimsical. We are all in this together, and we have found that sometimes a sense of humor can get any team through a tough patch.

What is interpretive writing for exhibitions?

In exhibitions, we use interpretive writing to communicate ideas to a wide range of visitors as they move through and interact with the many components of the gallery. **The goal of interpretive writing is to be clear, concise, and compelling so that nothing stands between the reader and the message.**

Writing for exhibitions

Exhibition writing is not the same as other writing you may have done in your career.

Exhibitions are their own animal. They tell three-dimensional stories. The words, graphics, objects, design, architecture, media, and interactives all work together to create an immersive environment to engage and delight our visitors. Our words can encourage visitors to call upon their senses of sight, hearing, touch, smell, and even taste, evoking a multisensory experience. Perhaps most important of all, our words, combined with all the other elements of the exhibition, can engage a visitor's sense of curiosity to find out more, making learning a lifetime pursuit.

This kind of writing needs to consider that visitors are moving through a physical, informal learning environment. Unlike most written material, which is read sequentially, there is no single way to experience an exhibition. Visitors will go where they like and read what they want, in any order they choose. Also, people's reading comprehension typically decreases when they have to stand or lean to read; when they are in unfamiliar and noisy areas; when they have to navigate crowds; and when they have to keep an eye on children, etc.

Interpretive writing

Interpretive writing helps visitors more easily take in content in an informal learning environment and capitalizes on the advantages of the exhibition medium.

The National Park Service, a leader in the field of interpretation, defines interpretive writing as writing that:

- draws from technical, informational, scientific, historical, and cultural sources;

- incorporates creative techniques;

- and seeks to connect readers emotionally and intellectually to the meanings and significance of the objects, artifacts, images, or other exhibition elements.

You most likely have experience writing in your academic and professional career. But there are some key differences between interpretive writing for exhibitions and other writing you may have done.

- Unlike writing a book, exhibition writing cannot cover the entire topic comprehensively and won't be read over a long period of time.

- Unlike writing a paper, article, or essay, it most likely will not be read from beginning to end.

- Unlike writing for the web or other digital platforms, it has strict space limitations and cannot be updated quickly. It needs to have staying power.

- Unlike writing for an advertisement, it is not about pushing a product, but about engaging visitors with our content and meaning.

- Use the tools and style of fiction to heighten the dramatic true story behind an artwork.

- Offer rich details and employ sensory language to describe the cultural context of an object.

- Define words and explain concepts to inform the visitor about the importance of a specimen.

- Choose your words to craft an argument supporting a certain view of a photograph.

Interpretive writing is a style of writing adaptable to many forms. While this guide focuses on the physical exhibition space, many of the interpretive writing tips and principles can be adapted and applied to other experiences, such as online exhibitions or in-person guided tours. Just keep in mind that visitors (or readers or users) have different motivations, needs, and behaviors in each platform or venue.

Why interpretive writing? Visitors!

In a museum exhibition, your target audience is the visitor, and interpretive writing is your communication tool. To craft effective text, you need to have a clear understanding of your visitors—who they are, what motivates them, and how they behave in your museum. Visitor studies can help answer fundamental questions about your audience, such as:

- Who's coming, and why?

- Who's not coming, and why?

- How do visitors spend their time?

- What do they already know, what do they want to know (or do), and what do they need to know?

- What obstacles stand in their way of understanding or engaging with the exhibition?

Visitors enjoy exhibitions at the National Museum of Natural History.

Who are Smithsonian visitors?

Even though each museum targets different audiences—with different interests, expectations, and behaviors—we know from evaluation studies that our visitors share many characteristics. While these general findings about Smithsonian visitors are useful, the best way to understand your museum's audience is to conduct your own visitor studies.

In 2017, Smithsonian Organization and Audience Research (SOAR) conducted a year-long, four-season visitor study covering all Smithsonian museums and the zoo. Below are a few significant findings that help us understand Smithsonian visitors. We've included a link to the full report in the "Additional resources" section.

- Visitors come from many different places: 66% are U.S. tourists, 19% are international tourists, and 15% live locally.

- They represent all age groups and levels of education.

- Some visit alone. Others come in groups with children, other family members, or friends.

- They are often trying to cover a lot of territory in a limited amount of time.

- Some are native English speakers; many are not.

- They likely have limited or no previous knowledge of the subject matter of the exhibition they are visiting.

- More than half are visiting your museum, or the Smithsonian, for the first time.

- About a third are visiting more than one museum in a day.

Understanding visitor behavior

People behave and learn in informal spaces, such as museum exhibitions, differently than they do in more formal education settings, such as a classroom or lecture hall. Visitors have the freedom to structure their own experiences, and what they learn often depends on how motivated they are to learn it. Museum visits—even class trips—rely on visitors voluntarily engaging with content.

Understanding visitor behavior, interests, and motivations can help us improve visitor experiences and better meet content and mission-driven goals. Visitor studies conducted by the Smithsonian Institution and other museums and researchers provide insight into visitor motivations and behavior.

Visitors have a variety of motivations and agendas for coming to your museum.

Visitors go to museums for reasons that may have nothing to do with reading labels and learning. While there is a small group of visitors who want in-depth, specific content, most Smithsonian visitors are more generally interested in seeing iconic objects, exploring based on what piques their curiosity, and enjoying a pleasant day with others—all while picking up some new information and enriching their understanding.

Visitors have limited time and attention.

The *Four-Season Survey of the Smithsonian Visitor Experience* found that, on average, visitors reported spending 1 hour and 54 minutes in a museum. Bear in mind that visitors don't spend all their time in the museum visiting exhibitions; they chat with friends and family members, visit the gift shop or cafe, attend films and public programs, go to the restroom, and spend time on their devices.

Visitors aren't there just to see your exhibition.

Many Smithsonian visitors, especially visitors from out of town, visit multiple museums in a single trip. The *Four-Season Survey* found that, on average, one in three visitors on the National Mall (36%) reported coming from another museum. Bear in mind that your exhibition may be just one of many they visit that day.

Visitors move through exhibitions quickly.

According to exhibition evaluator and author Beverly Serrell, visitors use exhibitions at an average rate of 200 to 400 square feet per minute, so the average visit to a 2,000-square-foot exhibition lasts just five to ten minutes. Visitors don't spend the entire time reading labels; they look at objects, watch videos, engage with interactives, and chat with friends and family members. Of course, the actual time individual visitors spend in your exhibition will vary, but studies at a variety of Smithsonian museums generally support this point.

Visitors read more than they expect they will, but still not much.

The *Four-Season Survey* found that, before their visit, only 4% of visitors predicted reading exhibition text. After their visit, 37% of visitors reported reading exhibition text. That includes everything from just reading one label to all the labels. And 63% don't report reading any text.

Visitors suffer from museum fatigue.

After prolonged visits, visitors often suffer from "museum fatigue," or a lack of energy and attention. Researcher Stephen Bitgood found that visitor attention drops after 30 to 45 minutes in a museum. Visitors respond by changing from moving slowly through the exhibition to cruising through the halls and being very selective.

An exhausted visitor takes a break in the *Americans* exhibition at the National Museum of the American Indian.

Visitors have basic needs

Visitors can't learn from or engage with content unless their basic physical and psychological needs are met. The first step to creating an enjoyable and enriching experience for visitors is to meet their basic needs.

Museum professionals Judy Rand and Elissa Frankle Olinsky have summarized these needs in digestible formats, which we present below. Rand articulates an 11-point Visitors' Bill of Rights. Olinsky's Hierarchy of Visitor Needs represents museum visitors' needs as a pyramid. Interpretive writers should keep visitor needs top of mind while crafting exhibition text.

Visitors' Bill of Rights

In her trailblazing 1996 article "The 227-Mile Museum, or, Why We Need a Visitors' Bill of Rights," Judy Rand recounts how a white-water rafting trip with her husband inspired her to codify visitor needs into a short list reminding museum professionals to put visitors first. Below is Rand's Visitors' Bill of Rights.

- **Comfort** (Meet my basic needs.)
- **Orientation** (Make it easy for me to find my way around.)
- **Welcoming/Belonging** (Make me feel welcome.)
- **Enjoyment** (I want to have fun!)
- **Socializing** (I came to spend time with my family and friends.)
- **Respect** (Accept me for who I am and what I know.)
- **Communication** (Help me understand, and let me talk, too.)
- **Learning** (I want to learn something new.)
- **Choice and control** (Let me choose; give me some control.)
- **Challenge and confidence** (Give me a challenge I know I can handle.)
- **Revitalization** (Help me leave refreshed, restored.)

© Judy Rand, judy.rand@mac.com

Olinsky's Hierarchy of Visitor Needs

Twenty years later, museum professionals were still grappling with centering visitor needs when Elissa Olinsky applied Maslow's Hierarchy of Needs onto the museum experience in her 2016 article "Maslow in Museums." Her model encourages exhibition teams to consider how to meet visitor needs closer to the base of the pyramid, so that visitors can move up the hierarchy and more fully engage with the exhibition's content.

Olinsky's Hierarchy of Visitor Needs

Elissa (Frankle) Olinsky, 2016

Self-Actualization
How will this change my perspective on life?

Highest Psychological Needs
How does this affect my life? How can I take action on this?

Higher Psychological Needs
What am I learning? How does this concept connect to something I've seen before?

Basic Psychological Needs
What is this place? What do I do here? What will I learn? How will I learn?

Physiological Needs
Where is the bathroom? Where am I? Where do I eat? Where can I sit down? How long will I be here? Where do I go next?

Accessibility and Safety Needs
Am I safe here? Am I welcome here? Am I able to experience and learn in this place? Can I enter the front door?

Elissa Frankle Olinsky's Hierarchy of Visitor Needs, 2016, CC BY-SA 2.0
https://www.frankleolinsky.com/maslow-in-museums

As you can see, visitors' basic needs of safety, comfort, orientation, and inclusion must be met before they can engage meaningfully with the actual content of an exhibition. As we learned from the COVID-19 pandemic, visitors need to know that museums are taking safety measures before they'll visit. These concerns are usually handled at the museum level, but don't shortchange them in your exhibition. We recommend checking in with these tools as you write and edit your exhibition text. Ask yourself if you have met your visitors' needs.

Visitor snapshots

Before you dive into the actual writing guidelines, consider these four fictional but realistic scenarios to help you better understand the challenges visitors face and how they move through our spaces.

Scenario 1: One person with a free afternoon during a conference decides to check out a museum. They find an exhibition that interests them and spend an entire hour there.
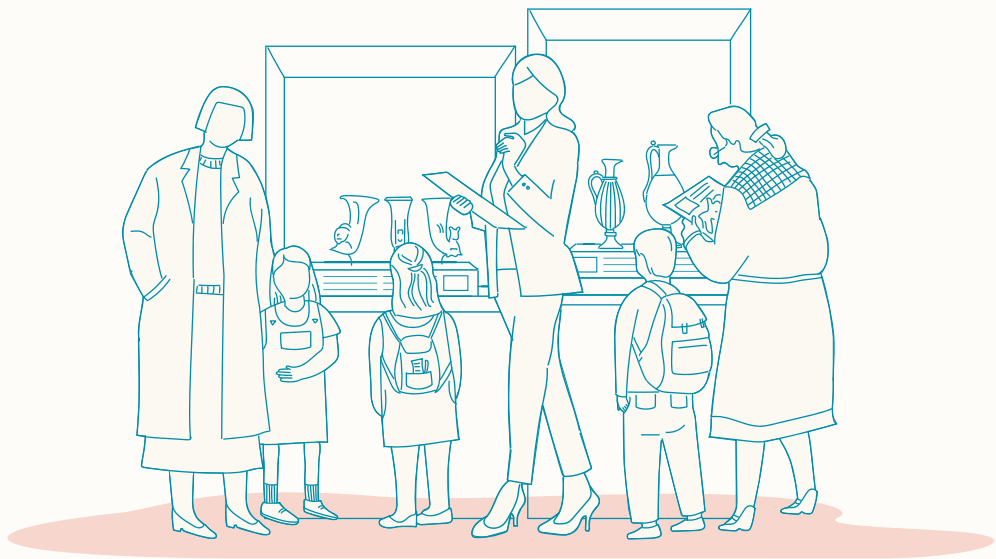
They walk in and see that a lot of other people are in the gallery. They try to start at the beginning, but there's a bit of a bottleneck. They try to read the intro panel, but there are people in the way, so they only skim it. To get away from the crowd, they move to a different section with fewer people in it. They stop at the objects that catch their eye and read the labels, sometimes moving around the gallery to find wall panels to learn more about the topic. They read lots of things, but not necessarily completely. They read in a random order determined more by ease of visibility than content or order.

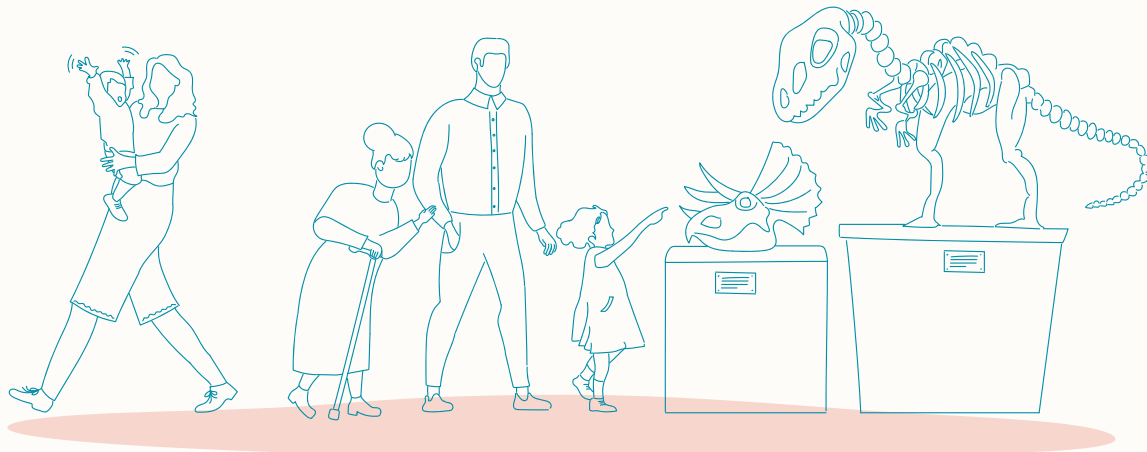They check the time and realize it's time to head back to the conference. They don't get to finish going through the exhibition, but they order a book on the topic online that will be waiting for them when they get back home.

This was a great afternoon and they want to learn more.

Scenario 2: A family vacation. Two parents, one first grader, one toddler, one grandparent.

At long last the family arrives in Washington, D.C. They can't wait to see the Smithsonian! After a long drive the previous day, they woke up in their hotel this morning and set out for the museums. They figured out the Metro and now they're walking on the National Mall. The National Mall!! They can feel the history. They are excited. They are inspired. They are . . . really hot. So hot. It's 20 degrees hotter than it is back home in July. And how can it be this humid and not be raining?

They make it to the first museum. Grandma is a bit winded and her knee really hurts. They sit for a minute before going into any exhibitions. They pick an exhibition. It's colorful and fun and the first grader is having a blast. The toddler, well, he's cranky. He's hungry. Oh no! Can't eat in the exhibition gallery! Mom takes the toddler to eat a snack. Dad stays with the first grader and Grandma. Ten minutes later they go and join Mom.

They look at only three or four cases, read maybe a third of the labels, but the adults walk away knowing a few new intriguing facts and the first grader is as interested in the topic as a six-year-old can be. They have a lovely time and will talk about this for months. The first grader will grow up and remember how great it was when Grandma went to the museum with them.

This was a great day, and they loved the exhibition.

Scenario 3: Incredibly interested kid, less interested parents.
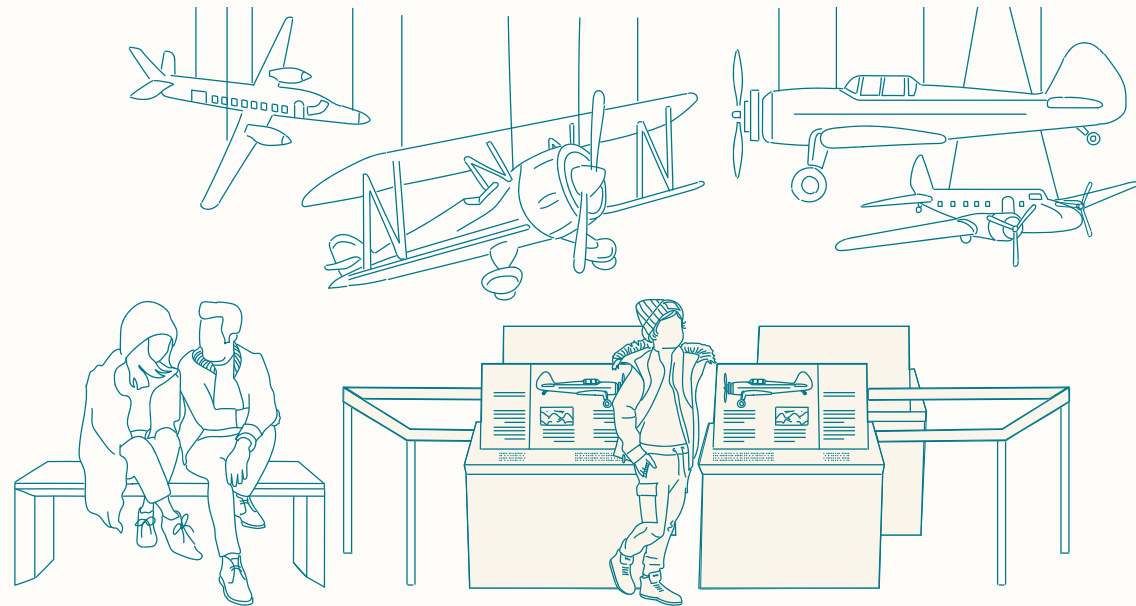
It's cold and rainy in Washington. Cabin fever sets in and it's time to get the family out of the house. NOW. Their child is an airplane fanatic. They decide to go to something at the National Air and Space Museum. Again. Mom and Dad are into it for about 15 minutes. Their kid? He is reading all the labels!

Twenty minutes later, he's still reading. All. The. Labels. Every last one. They're pretty sure that one was about the grant funding. Can't we just go home? Someone has to make dinner. And there's a load of laundry that hasn't been folded yet. Did we get the oil changed? Mom and Dad go about the business of managing their lives while junior happily reads every stinking label.

Well, one of them had a great time.

Scenario 4: Field trip!

Finally, after selling all that wrapping paper and boxes of candy bars, the eighth-grade class has made it to Washington! They launch themselves off their buses onto the National Mall and head to the Smithsonian in their matching school T-shirts. Those neon shirts really pop in all those selfies they're taking in front of the iconic objects. The brave chaperones keep reminding them that they have to write reports about their museum visit and "PAY ATTENTION!! *That's HISTORY!! It's IMPORTANT!!*" But alas, the eighth-grade class advisor can practically hear the uploads to social media.

The kids have a blast. And much to their advisor's surprise, the reports are pretty good. And even she has to admit that when she scrolls through her social media, the pictures of the kids are pretty cute. Maybe she'll have to come back with her own kids when they get a little bigger.

In each of these scenarios, interpretive exhibition writing could help our visitors' engagement. The next section, "Interpretive writing guidelines," includes our recommendations for crafting exhibition text that will meet your visitors' needs, support their agenda, and connect your content to their learning. As you read through them, consider which guidelines you would use to facilitate the visitors' experiences in these scenarios.

Interpretive writing guidelines

These guidelines will help make your writing more interpretive, accessible, and engaging for all visitors. They are informed by what we've learned through our experience studying visitor behavior and creating exhibitions.

Successful exhibitions are audience centered. Identifying your primary and secondary audiences early in the exhibition development process and matching your educational objectives and communication goals to the audience will help focus your content and script development. Most visitors "sample" content in random and non-sequential ways. Some will skim text, others will do a deep dive, and others will read hardly anything at all.

The guidelines below are not necessarily sequential, but we have grouped them in roughly the order in which you might encounter them in the exhibition development and script writing process. At the end of this section, you'll find all the guidelines on a single page for easy reference.

Getting started

Some decisions are best discussed and agreed upon by team members early in the exhibition writing process. These decisions will provide essential guidance as you proceed into the weeds of drafting individual labels.

1. Make content pathways for a variety of visitors

Some visitors want just the big idea, so give them a heading or subheading that encapsulates the main point of the label. Some visitors want to skim, so give them a summary sentence in addition to the heading. Other visitors want to know more, and more extensive labels will satisfy them.

Establishing a text hierarchy early and using it consistently throughout an exhibition will help visitors figure out right away where to find the information they need or want. Remember that they're in an exhibition for an experience, not just the text.

- Use headings and subheadings (also called headers or headlines) to organize ideas and prepare visitors for what they'll encounter.

- Use headings and summary sentences to grab visitors' attention.

- Focus on one big idea or theme per section.

- Organize text into independent and manageable chunks.

- Make label hierarchies clear and use consistent language and signage for wayfinding.

Text hierarchy in *Deep Time,* the National Museum of Natural History, 2019. Photo by Loren Ybarrondo

2. Set standards for label lengths

Each museum should set its own standards for label type and length. Audience behavior should be the driving factor when considering what is appropriate for your museum. Whether your maximum Intro label length is 50 or 150 words, what's most important is to have articulated standards. Standards help keep curators, developers, writers, and editors on track as they craft exhibition content and text. Certainly, deviating from the standard may occasionally be appropriate. With standards in place such deviation becomes a conscious and deliberate decision.

Beverly Serrell's book *Exhibit Labels: An Interpretive Approach* is a useful guide for developing your museum's standards for label lengths.

Main Types of Interpretive Labels	Purpose	Number of Words
Exhibition Titles	to attract attention	1–7
	to inform about the theme	
	to identify	
Introductory Labels	to introduce the big idea	20–125
	to orientate visitors to the space	
Group Labels	to interpret a specific group of objects	20–75
	to introduce a subtheme or section	
Caption Labels	to interpret individual objects, models, phenomena	20–75

Used with permission from Beverly Serrell's *Exhibit Labels: An Interpretive Approach*

3. Identify your museum's voice

A museum's voice communicates its personality and core values to the visitor. This could include words and phrases that the museum never uses, ways that it does or doesn't frame certain content, and characteristics that it always has.

The voice should be used consistently within and across the museum's exhibitions. We encourage each museum to discuss and determine what its voice is and what qualities it evokes.

While distinct from one another, the voice of each Smithsonian museum should be compatible with the following Smithsonian Brand Values.

- **Authentic.** We stay true to the Smithsonian's purpose to increase and diffuse knowledge.
- **Trustworthy.** We inspire confidence in our audience.
- **Conversational.** We're smart and accessible.
- **Informative.** We connect the dots, so the public doesn't have to.
- **Relevant.** We reflect an understanding of audience needs and interests.
- **Enthusiastic.** We genuinely enjoy sharing information with others.

4. Identify the exhibition's tone

In contrast to voice, tone changes as appropriate for the subject matter and the intended audience. An individual has a certain personality, but if they are telling a story about something terrible, they tell it differently than if they are talking about a cute thing their cat did. If they are talking to toddlers, they have a different attitude than when talking to middle schoolers. Each exhibition can have its own tone (e.g., hopeful, serious, questioning, humorous, provocative, etc.). Exhibition design contributes to tone through design motifs, color choices, graphic layouts, and three-dimensional details such as in-case plinths and mounts.

It is helpful for exhibition development teams to talk about tone early in the script writing process to set parameters and get agreement. An extensive list of tone words is provided in the "Additional resources" section.
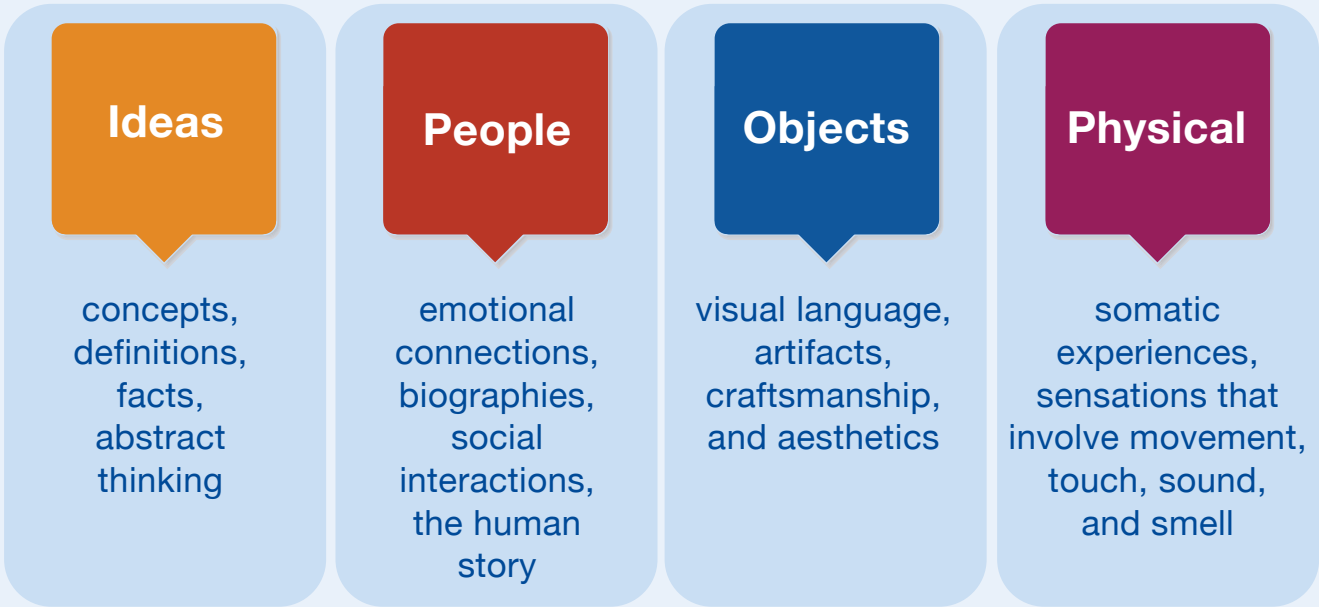

Headers from *Nation to Nation* (opposite) and *Americans* (above), both at the National Museum of the American Indian, are both direct and conversational in voice but indicate different approaches to tone.

Photo above by Thomas Loof

5. Make your exhibition IPOP

The Smithsonian IPOP model recognizes that visitors gravitate to experiences and content based on their personal preferences. The four key dimensions of experience according to the model are:

Ideas	**People**	**Objects**	**Physical**
concepts, definitions, facts, abstract thinking	emotional connections, biographies, social interactions, the human story	visual language, artifacts, craftsmanship, and aesthetics	somatic experiences, sensations that involve movement, touch, sound, and smell

This model can help you think about how to reach a broad audience while planning exhibitions and when drafting the exhibition script. Think about using different entry points to hook visitors into your content. Consider how your word choices reflect your own preferences and how you can vary your language to appeal to other preferences.

IPOP was developed in 2012 by the Office of Policy and Analysis (now known as Smithsonian Organization and Audience Research). More information about the model can be found in the "Additional resources" section.

The big picture

These next guidelines focus on the overall nature or characteristics of good interpretive writing for exhibitions.

6. Tell a story

At its core, interpretive writing is storytelling. Everyone likes a good story. As you're writing your exhibition, find ways to use storytelling techniques to add drama, emotion, and human interest. Whether you are drafting introductory text for the whole exhibition or an interpretive label for an object, your story should not just be a series of dry facts.

> **21 Purari Delta Field Notebook 17**
> Joshua A. Bell, 2002
> *Loaned by Joshua A. Bell*
>
> Paper's light weight has advantages. While a student, Smithsonian curator Bell dropped this notebook in the Purari river in Papua New Guinea. The notebook floated—a feature not yet standard on modern laptops.

From *Documenting Diversity: How Anthropologists Record Human Life,* Smithsonian Libraries and the Smithsonian's National Anthropological Archives, 2020

7. Write so each label can stand alone

Each label should offer enriching information independently. Visitors can encounter labels in any order, and we can't guarantee that they'll read any given label before encountering the next (or that they'll read that label at all).

Party Animals

Formal banquets played an important role in diplomacy during the Zhou dynasty. Large or novel objects were made to impress guests, who had plenty of time to study the attractive pieces on the table.

Fitting in the form of a tapir with dragon interlace
Middle Eastern Zhou dynasty, ca. 500–400 BCE
State of Jin, Houma foundry
F1940.23

From *Art and Industry: China's Houma Foundry,*
National Museum of Asian Art, 2017

8. Be engaging, not exhaustive

Exhibitions should **NOT** include everything known about a topic. The goal is to provoke the visitor's curiosity, so that they want to find out more. The exhibition experience should be a threshold to learning, not the endpoint. One technique to engage visitors is to address them directly with a question or a statement.

Gestures of Acknowledgment

I see you.

In many cultures, tilting the head down with just enough movement shows respect. (To be more formal, voice your greeting when you nod.) But the up nod, the grip, and giving dap are African American greetings, usually male. The up nod lets the other person know you see them and may not want or be able to say something. The grip acknowledges a close connection. Giving dap, a sign of respect, can also substitute for hello.

From *Cultural Expressions,* the National Museum of African American History and Culture

9. Be concrete, not abstract

Avoid general, vague, or abstract language that flattens ideas. Instead, use specific, concrete, and descriptive language to paint a picture, add context, or make a comparison to something familiar.
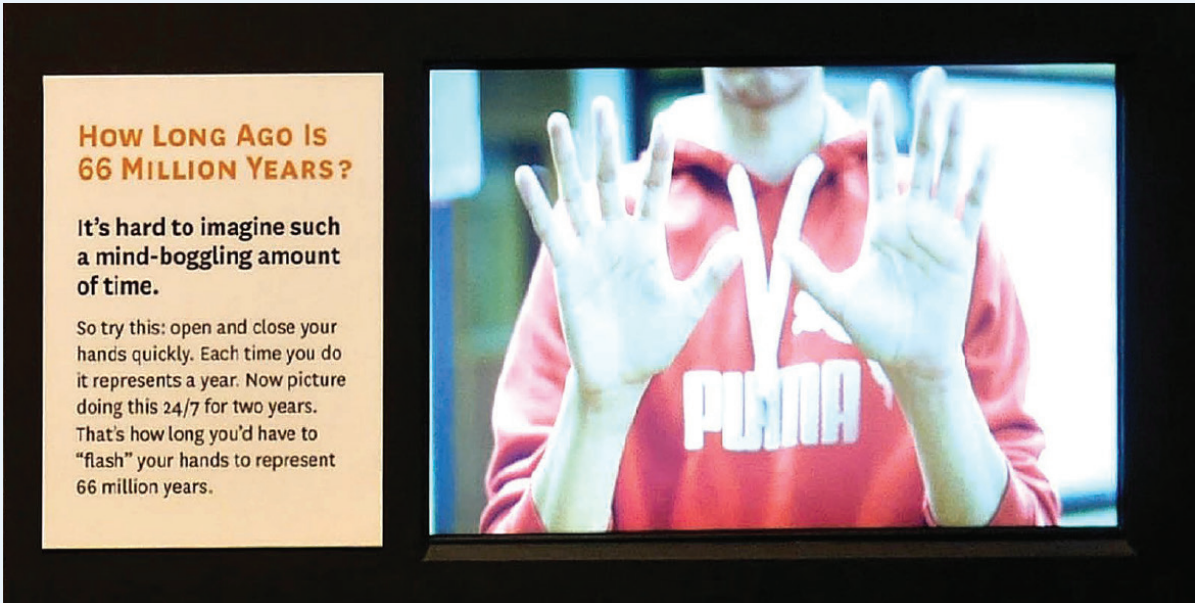
From *The Last American Dinosaurs: Discovering a Lost World,* the National Museum of Natural History, 2014

10. Be relatable

Read the label and ask yourself, "Is this the voice of someone I would love to sit next to at a potluck?" Passion and enthusiasm are great in exhibitions. Speak to your audience in direct and engaging ways. Excite them. Make it personal. People like meeting real scientists/historians/artists/explorers/etc. in exhibitions instead of feeling like a disembodied, impersonal institution is speaking to them.

Visitors create their own learning experiences, based on their own background and interests. Emphasize the relevance of your content to your visitors' lived experiences and make connections to their daily lives when possible. Ask visitors to tap into their personal experiences, perspectives, and prior knowledge.

However, be careful about using pop culture references, in-jokes, or cultural trends—especially for long-term or permanent exhibitions. These can become dated quite quickly.
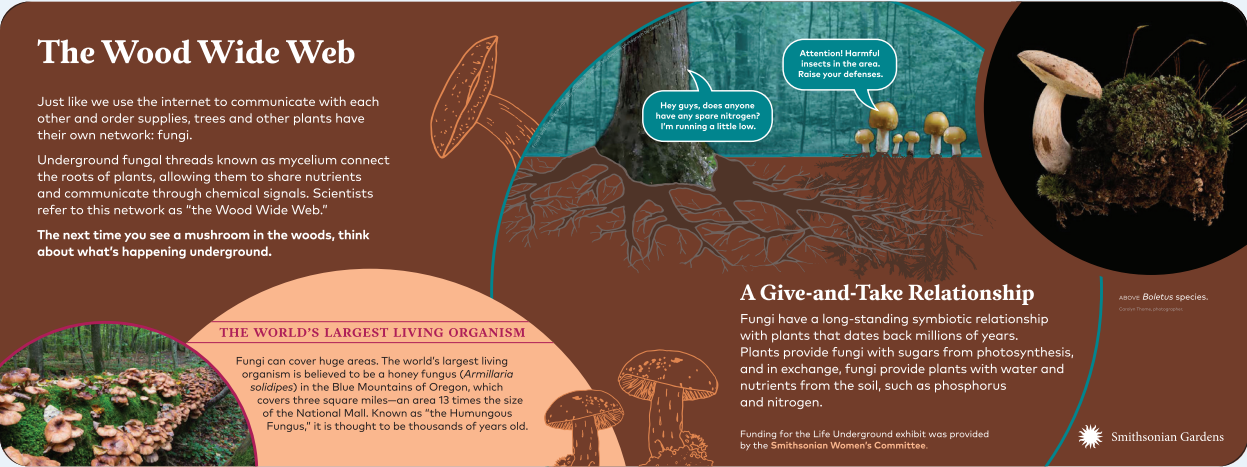
From *Habitat,* Smithsonian Gardens, 2019

11. Refer directly to something the visitor can see

Exhibitions work best when they rely on objects and images. In exhibition writing, we're fortunate that the object we're writing about is usually right in front of the visitor. Encourage visitors to examine an object more closely. Point out interesting features that can help visitors understand the significance of the object or tell them things that are not obvious at first glance or from observation alone.

From *Wonder,* Renwick Gallery of the Smithsonian American Art Museum, 2015
Artwork by Jennifer Angus, Photo by Ron Blunt

JENNIFER ANGUS

born Edmonton, Canada 1961; resides Madison, WI
In the Midnight Garden, 2015
cochineal, various insects, and mixed media
Courtesy of Jennifer Angus

Angus's genius is the embrace of what is wholly natural, if unexpected. Yes, the insects are real, and no, she has not altered them except to position their wings and legs. The species in this gallery are not endangered, but in fact are quite abundant, primarily in Malaysia, Thailand, and Papua New Guinea, a corner of the world where Nature seems to play with greater freedom. The pink wash is derived from the cochineal insect living on cacti in Mexico, where it has long been prized as the best source of the color red. By altering the context in which we encounter such species, Angus startles us into recognition of what has always been a part of our world.

This label accompanied Jennifer Angus's art installation (opposite).

12. Give visitors the space to have their own reactions

Beauty and bravery are in the eye of the beholder. You can heighten the drama or emotion of your text, but don't tell a visitor how they're meant to feel. They may not feel that way, or you may be depriving them of the opportunity to have an emotional experience of their own.
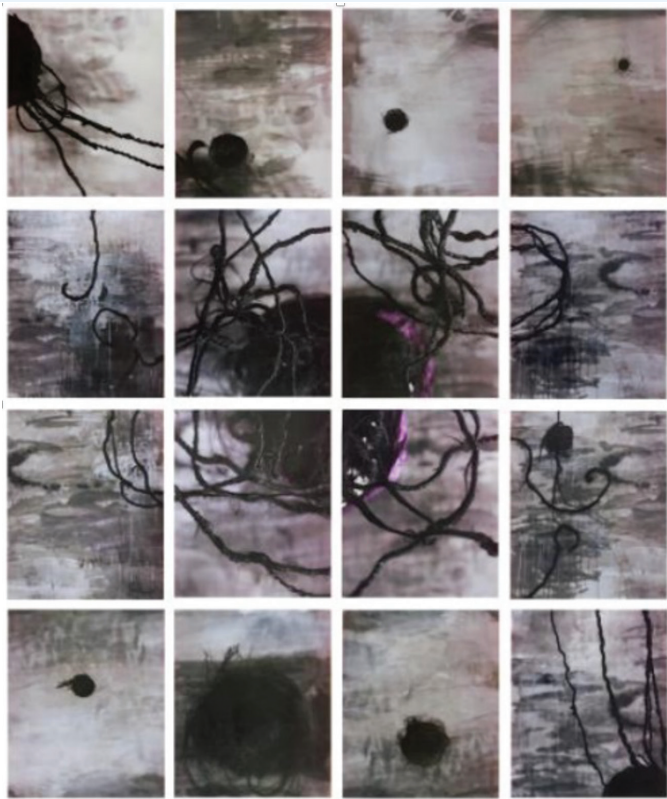
María Magdalena Campos-Pons, *Constellation,* 2004, instant color prints, Smithsonian American Art Museum, Museum purchase through the Luisita L. and Franz H. Denghausen Endowment, 2013.23A-P, © 2004, María Magdalena Campos-Pons

Campos-Pons's braided and dreadlocked hair, which meanders across the multipaneled composition, takes the shape of a spiral constellation, or a nest, the temporary home of migrating birds. She created this work, which merges elements of photography, painting, and performance, to explore the parallels between her migration from Cuba and the displacement of Africans during slavery. Each photograph can be read as a dreamy landscape or a lyrical trace of diasporic memories.

From *Our America: The Latino Presence in American Art,* Smithsonian American Art Museum, 2013

The mechanics

The next guidelines dig into the nitty-gritty of drafting sentences and making word choices.

13. Use plain language so a broad audience can understand

When writing for the public, we can't assume all visitors have in-depth knowledge on topics referenced in an exhibition. Write for the non-specialist. Use language that is simple, concise, and not technical to explain concepts and topics that might be unfamiliar to visitors. When specialized vocabulary is needed, introduce it early in a label, and provide a concise definition. When the language helps visitors understand something new to them, they are more likely to continue. You can find more information about plain language in the *Federal Plain Language Guidelines* (link in the "Additional resources" section).

Mixed Up and Recombined

Influenza is a master of adaptation. Different influenza viruses can combine to create new strains. These new strains can spread rapidly before people have built up immunity to them.

A virus from a bird and another from a human infect the same host.

The bird virus and the human virus infect the same cell.

The new virus strain infects a new host, who has no immunity.

The genes get mixed and produce a new virus strain.

From *Outbreak: Epidemics in a Connected World,* National Museum of Natural History, 2018

14. Write for reading aloud

Check your language by reading aloud when you edit. This will make your writing more conversational. Also, some of your writing will likely be read aloud—some visitors might be reading the text to children or others in their group who do not read English.

BEFORE

Wilbur Writes to the Smithsonian

The Wrights formally expressed their desire to join the aeronautical community in this letter Wilbur wrote to the Smithsonian Institution on May 30, 1899. After affirming his belief that human flight was possible, he declared his intent to pursue research in the field. Toward that end, he requested whatever publications on the subject the Smithsonian could provide.

AFTER

Wilbur Writes to the Smithsonian

On May 30, 1899, Wilbur Wright wrote a letter to the Smithsonian Institution, declaring his belief that human flight was possible. He asked for any publications the Smithsonian might have that would help with his research.

From *The Wright Brothers & The Invention of the Aerial Age,* the National Air and Space Museum, in development

15. Write to an eighth-grade reading level or below

Even if your visitors are able to read and understand college-level discourse, that doesn't necessarily mean that they want to do so while on a leisure outing and on their feet. Writing to an eighth-grade reading level does not mean "dumbing down" content or "talking down" to visitors, nor does it mean you can only write about topics learned in or before middle school. It also does not mean you are writing for a 13-year-old eighth-grade student. Reading level is about the readability of your text based on sentence length, the number of syllables in the words you use, and sometimes vocabulary and sentence structure.

The paragraph above is written at an eighth-grade reading level. This whole document is at a tenth-grade reading level. *TV Guide* and *Readers Digest* are written at the ninth-grade level. National Public Radio typically writes at the eighth-grade level, while the most popular novels are written at the seventh-grade level.

If you write at an eighth-grade reading level, you broaden the audience you reach. Your teen and adult audiences are likely to easily understand regardless of what field they specialize in or how much education they have. If your exhibition seeks to engage a younger audience, write to that age.

16. Use active voice

It's easier to visualize a described action when you know who is doing what. Arranging sentences in the order of subject + verb + object will help your readers better understand who did what to what—which creates concrete visuals that aid comprehension.

BEFORE

> Movements of Przewalski's horses are monitored by SCBI scientists with camera traps and satellite tracking collars.

AFTER

> SCBI scientists monitor the horses' movements using camera traps and satellite tracking collars.

From *Przewalski's Horse,* the National Zoological Park, 2020

17. Put a single idea in each sentence

Simple sentences aid reader comprehension and memory. The best way for our brains to learn new information is in small, simple chunks. Watch out for the warning signs that you're trying to force multiple ideas into a single sentence: conjunctions, semicolons, dashes, and words such as "however," "although," and "despite."

Interesting sentence structure is great when you're on the couch. It's less great when you're reading the sentence to a three-year-old in a public space. It's downright annoying when you're trying to read it and the three-year-old is dragging you away from the panel.

18. Use short sentences

Short, active sentences are easier to read and understand. We recommend keeping your sentences to 15 to 20 words or fewer and never more than 25 words. Complicated constructions with multiple clauses can trip up readers, especially those reading content aloud to a child or other companion. Short sentences can be just as poetic, compelling, and memorable as long sentences. Again, read your sentences aloud to see how they flow.

Gone with the Wind

Wind is one of the main ways plants spread their seeds. Seeds dispersed by wind are usually smaller and lighter than other seeds. The longer a seed stays in the air, the farther it can be blown from its parent plant.

From *Habitat,* Smithsonian Gardens, 2019

19. Use inclusive language

Use language that makes all visitors feel welcome and respected, and that respects the individuals and cultures featured in our exhibitions. Inclusive language covers topics from sex and gender to race and ethnicity, from disabilities to cultural differences. We have included a link to *The Diversity Style Guide* in the "Additional resources" section for reference.

Using inclusive language means making conscious choices that may be unfamiliar or uncomfortable to the status quo. For example, using singular "they" when the gender is unknown or when that is a person's personal pronoun is becoming more acceptable, allows all visitors to see themselves in your text, and is less awkward than variations of "he/she." But it is often discouraged in formal writing and will get tagged by some reviewers. If you plan to use it, put it in your style guide for the museum or style sheet for the exhibition.

BEFORE

After a racing accident rendered him a quadriplegic, Sam Schmidt continued racing with adaptive technology and became a race team owner. He wore a baseball cap with reflective infrared sensors that transmitted his head movements via cameras to a computer. This enabled him to steer and accelerate a specially equipped 2014 Corvette to 106 mph (171 km/h).

AFTER

Sam Schmidt sustained a spinal cord injury in a racing accident. He continues racing with adaptive technology and has become a race team owner. He wears a baseball cap with reflective infrared sensors that transmit his head movements via cameras to a computer. This enables him to steer and accelerate a specially equipped 2014 Corvette to 106 mph (171 km/h).

From *Nation of Speed,* the National Air and Space Museum, in development

20. Personal pronouns are OK—don't fight them

You may have been told that "we" and "you" aren't appropriate for formal writing, but they can be for interpretive writing. While "you" nearly always refers to the visitor directly, make sure you are clear about "we." If meant to refer to all people, think about whether your statements are truly inclusive. If meant to refer to a specific group, say so. For example, the exhibitions that opened the National Museum of the American Indian in 2004 used "our" to mean Native people. In *Americans* (opened 2018), "we" was used as "we, Americans" meaning all Americans, Native and non-Native.

Automatic voting machine, 1898

We stand in line with friends, neighbors, allies, and rivals. Sometimes silent, sometimes chatting, maybe even discussing the candidates we're waiting to decide between. But our final vote, whether it's behind a curtain or a cardboard screen, is a private moment. By the 1890s voting had moved from a public declaration to a secret ballot. This machine's gear mechanism and curtain were designed to ensure accuracy, security, and privacy.

Gift of Rockwell Manufacturing Company Automatic Voting Machine Division

From *American Democracy: A Great Leap of Faith,* National Museum of American History, 2017

21. And finally, edit!

In the words of respected interpretive writer Judy Rand, who described her editing process in *Exhibition* magazine, "less is more." Writing short labels is incredibly difficult, as anyone who has ever drafted label text knows. And, Rand explains, editing interpretive text is a completely different skill set than writing it: "It requires enormous self-restraint and discipline: honing, paring and polishing, all in the service of clarity for readers." She encourages interpretive writers to work with editors whenever possible, and to self-edit as well. "Think more. Write less. Edit."

Also, don't get too hung up on mid-20th-century grammar and style rules at the cost of fluidity or ease of reading. Colloquial phrasing is often fine. Exhibition text is meant to be less formal than academic prose. Check with the most recent style guides, such as the *Chicago Manual of Style* and the *Associated Press Stylebook,* if something makes you uncomfortable.

Pioneers of the U.S. General Aviation Manufacturing Industry- Beech, Cessna, and Piper

The creation of the private or general aviation industry was a chicken and egg problem, do pilots or planes come first? In 1929 private flying was mainly for wealthy sportsman pilots or working pilots flying expensive or large planes. Many aviation enthusiasts wanted smaller simpler aircraft that didn't exist. Designers needed a pool of pilots to successfully market their ideas. The depression delayed both the market and the industry, but by 1939, more than 7,000 new private aircraft were produced in one year. In one decade, and in spite of the Great Depression, three manufacturers—Beechcraft, Cessna, and Piper—created both the aircraft and the pool of pilots necessary for this transformation. All three saw robust production during World War II as their small aircraft were needed for military transport, utility and liaison flight duties. They dominated general aviation production after World War II, and the brand names continued into the 21st century.

THE BIG THREE
in Aviation Manufacturing

Once you have learned to fly your own plane, it is far less fatiguing to fly than it is to drive a car

" "
William T. Piper

Which came first, the pilots or the planes? In a single decade—despite the Great Depression—manufacturers Beechcraft, Cessna, and Piper created both the aircraft and the pool of pilots that transformed general aviation. Before the 1930s, private flying had been for wealthy sports pilots or working pilots flying expensive planes. Many aviation enthusiasts wished for simpler aircraft, and designers needed pilots to market their ideas.

The military needed the companies' small aircraft during World War II. Post-war, the "big three" went on to dominate general aviation production, with their legacy continuing into the 21st century.

From *We All Fly,* the National Air and Space Museum, in development

1. Make content pathways for a variety of visitors.

2. Set standards for label lengths.

3. Identify your museum's voice.

4. Identify the exhibition's tone.

5. Make your exhibition IPOP.

6. Tell a story.

7. Write so each label can stand alone.

8. Be engaging, not exhaustive.

9. Be concrete, not abstract.

10. Be relatable.

11. Refer directly to something the visitor can see.

12. Give visitors the space to have their own reactions.

13. Use plain language so a broad audience can understand.

14. Write for reading aloud.

15. Write to an eighth-grade reading level or below.

16. Use active voice.

17. Put a single idea in each sentence.

18. Use short sentences.

19. Use inclusive language.

20. Personal pronouns are OK—don't fight them.

21. And finally, edit!

But wait, there's more!

As we said above, this list is not comprehensive. But we think it will help you craft engaging, accessible, and enjoyable interpretive text for your visitors. We have added further guidance and articles on interpretive writing in the "Additional resources" section. In the next section, we look at strategies that five Smithsonian museums have implemented to introduce, increase, and improve interpretive writing for exhibitions.

Okay, but *how* do I implement or support interpretive writing at my museum?

In the "Interpretive writing guidelines" section, we focus on tools that the individual writer can use in drafting engaging, visitor-centered panels and labels. Becoming familiar with those guidelines and using them can dramatically improve your exhibitions. But even so, you may find yourself struggling to convince others in your museum of the benefits.

Some Smithsonian museums have a process and culture that supports interpretive exhibition writing; others don't—yet. In this section, we focus on how exhibition development teams and museum leadership can champion interpretive writing and a visitor-centered approach. We've included five "case studies" from Smithsonian museums that can serve as examples for encouraging and implementing this approach in your museum.

Goal: Introducing a complicated topic in an audience-friendly way

Museum: **National Museum of the American Indian**
Exhibition: ***Americans***
What: **Formative testing of introductory text**

The exhibition development team for *Americans* conducted three rounds of formative evaluation to see how receptive our public would be to an exhibition that presented hundreds of representations of Indians and said, "Relax, we're not going to guilt-trip you." The team knew that some people would hope for a playbook of sorts—for example, sports mascots = bad and state seals = okay. But there is nothing straightforward or easy about the Indian imagery out there. It runs the gamut from racist to beautiful to downright bizarre. The team didn't want to let our visitors off the hook that easily; we wanted them to engage with the material, think for themselves, and come to their own conclusions.

Formative evaluation of early drafts of the introductory text demonstrated that visitors felt unmoored by an approach that was too open-ended. They wanted to know where the museum stood. The result is an introduction that poses questions but is clear about NMAI's take on the issue. The language is direct and disarming, with elements of whimsy, surprise, and humor. It expresses difficult truths about the country without distancing.

Prototyping content for the *Americans* exhibition at the National Museum of the American Indian

Photo by RK&A

Goal: Taking a new look at old labels

Museum: **Freer Gallery of Art**
Exhibition: **Reinstallation of permanent collection**
What: **A new approach to writing and presenting object labels**

Before the Freer Gallery of Art's closure in 2016–2017, the museum's director instructed all staff to participate in conducting visitor exhibition studies and the three editors on staff to devise and lead workshops on effective label writing. The editors selected an outside facilitator to lead three days of mandatory, off-site workshops for all staff who wrote for the public. This proved vital to the success of reinterpreting the museum and became a real bonding experience.

When the Freer reopened, the permanent collection was installed in thematically defined galleries (rather than solely by geography) with new object labels. Each label is 75 to 100 words in length and starts with a headline that ranges from serious to curious to humorous. The director's insistence and support were essential to changing the culture and practice of label writing within the museum.

Gallery view of *Promise of Paradise: Ancient Chinese Buddhist Sculpture,* Freer Gallery of Art, Smithsonian Institution, Washington, DC

Photograph by Colleen Dugan

Goal: Getting the team on board for interpretive writing

Museum: **National Museum of Natural History**
Exhibition: **All in-house exhibitions**
What: **Exhibition Boot Camp**

At the beginning of any new exhibition project at NMNH, the director of exhibitions puts together the core team: the players who will make the exhibition a reality. A core team normally includes an exhibition developer/ project manager (for large exhibitions, these may be two different people), a designer, a writer, an educator, and one or more subject-area specialists (curators or scientists).

Boot Camp is a short (one to two hours) introductory experience. Because most subject-area specialists do not have extensive experience developing exhibitions, the Boot Camp goals are to highlight: 1) how an exhibition is made and 2) the roles and responsibilities of each core team member, as well as their areas of expertise and skill. Boot Camp sets clear expectations for what each team member will be doing and can expect from their colleagues. Boot Camp starts the exhibition development process from a place of mutual respect and understanding.

Informal feedback on Boot Camp has been nearly uniformly positive, with both exhibition professionals and subject-area specialists reporting that it was worth their time.

WORKING AS A TEAM

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY | OFFICE OF EXHIBITS

The core team for the *Outbreak* exhibition at the National Museum of Natural History

NATIONAL MUSEUM *of* NATURAL HISTORY
☀ Smithsonian

EXHIBITION BOOT CAMP

WHAT DO FOSSILS REVE TYRANNOSA

GENOME UNLOCKING LIFE'S CODE

OFFICE OF EXHIBITS
SPRING 2018

Goal: Channel broad staff expertise into visitor-friendly exhibition language

Museum: **National Museum of American History**
Exhibition: **Several in-house exhibitions**
What: **Editorial Services Meet-and-Edit**

Agreement is important on exhibition scripts. The team involved in making a script at NMAH often includes curators, historians, educators, interpretive planners, exhibit developers, writers, and editors. These players bring not only their professional expertise but also their individual experiences as museum visitors to the table. But when those specialists write and review materials separately, through disjointed passing of documents via email, a lot can get lost. A rewrite or a trim could affect meaning in an unintended way or make the text harder for visitors to read in the already challenging exhibition gallery environment.

For projects at the museum that cover complex or sensitive topics, for projects with multiple authors, or for projects with teams that simply enjoy collaborative writing, we host what we call meet-and-edits. Team members gather in an office where the script is projected for all to see, or on a digital call with the script screen-shared. The team appoints a "driver": a single person with access to the script and responsibility for updating it during the session. That person also manages the conversation (going through the script label by label and ensuring all have a chance to share their recommendations) and mediates any disagreements (finding common ground between parties and offering alternatives that satisfy the concerns of all). The dynamic give and take of experts negotiating around a common text—sharing their concerns, standing up for critical components, learning from their colleagues' experiences, and talking through possible options— often yields a version that best serves the visitor.

The end result often doesn't look like what was originally drafted, but rather a product of the best of all the team's skill and experience—which is, in the end, better for the visitor.
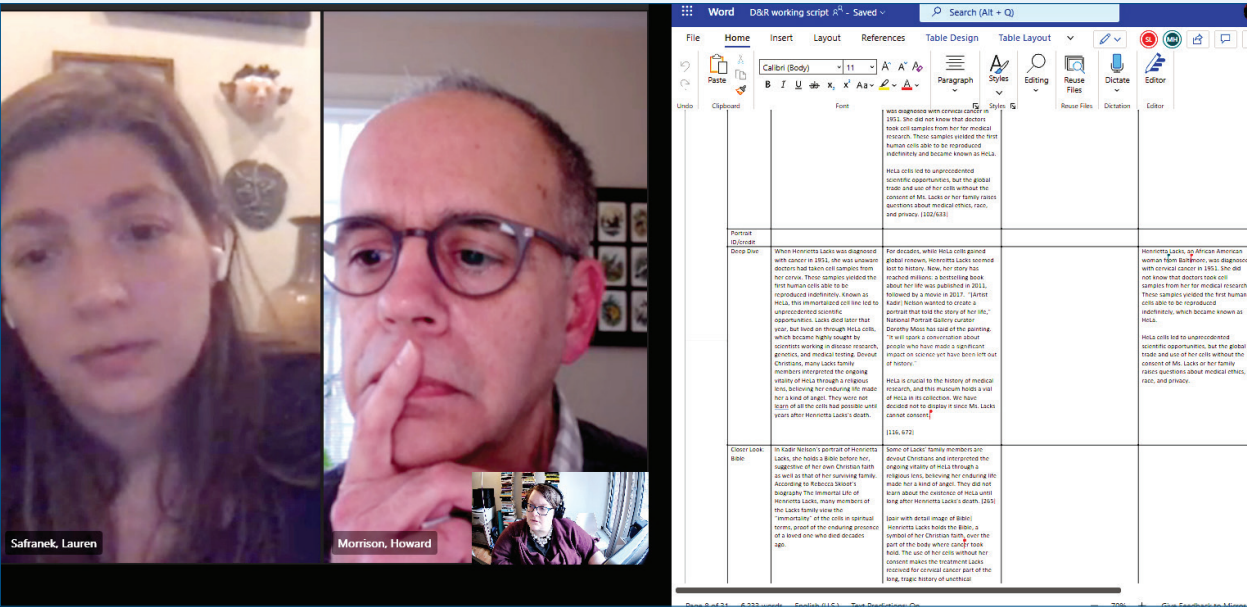

Editorial Services Meet-and-Edit at the National Museum of American History

Goal: Bring transformational experiences to visitors

Museum: **National Air and Space Museum**
Exhibition: **All exhibitions in the National Mall building**
What: **Integrate scriptwriting into the exhibition design process**

As part of the NASM's multi-year renovation project, our visitor evaluations showed the existing galleries had very short dwell times, indicating that visitors did not read most labels. We wanted to incorporate interpretive writing to increase visitor engagement—but how? Most of our content experts who wrote scripts were not that familiar with this writing style. Moreover, scripts were typically written prior to the design of the exhibition. So, we tweaked the scriptwriting process, by breaking it down into iterative steps that dovetailed with the phases of exhibition design:

• Start with a curated content outline reflecting the gallery's big idea to inform the concept design.

• Reorganize the outline to fit a hierarchy of label types aligning with the space and objects during early design.

• In design development, content experts flesh out the "content to be conveyed" on labels—without writing script. Simultaneously the team "maps" labels on plans to integrate with the other exhibition elements. Some labels are combined, deleted, or added.

• At final design, we begin actual label writing, applying interpretive writing guidelines and using prescribed word counts and defined tone. Content experts and scriptwriters are mutually engaged in refinements of all drafts and final script, ensuring both accurate and engaging labels.
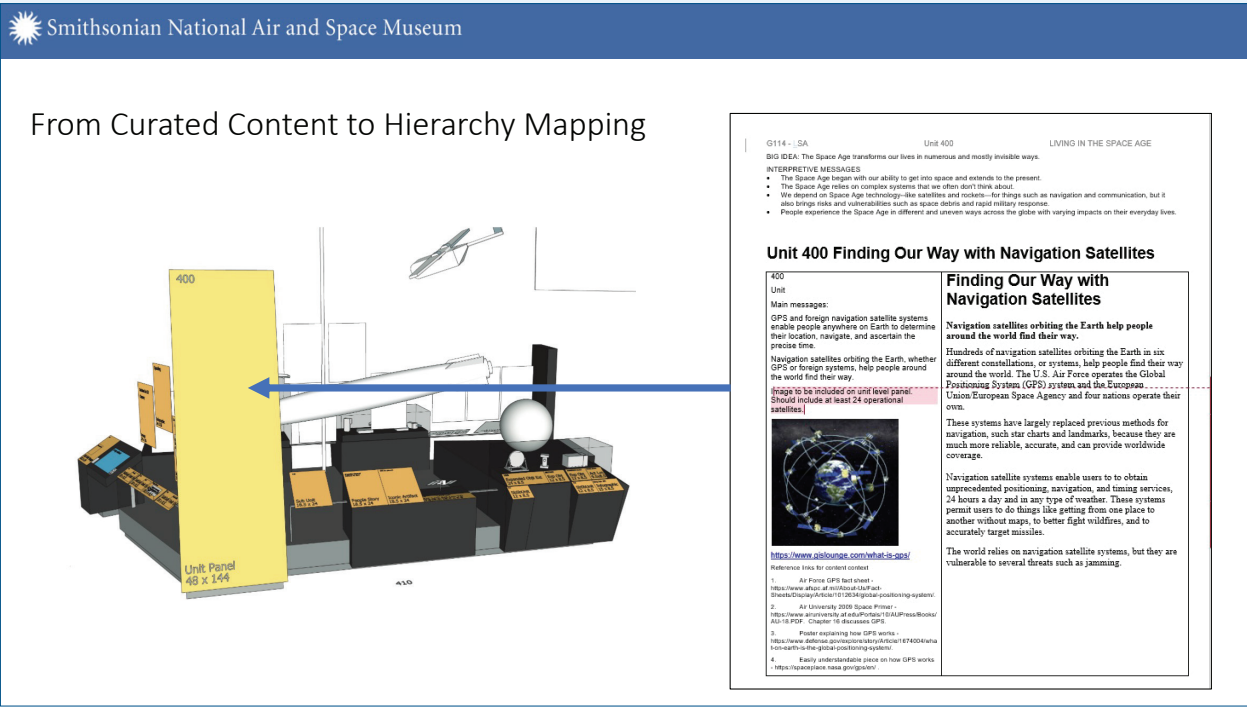
Before label writing, curated content is "mapped" to integrate within 3D exhibit spaces at the National Air and Space Museum.

Additional resources

There are many great resources out there about interpretive writing, plain language, and exhibition writing. Below are some that we have found helpful in our work.

Smithsonian resources:

- *A Guide to Exhibit Development* by Smithsonian Exhibits: http://exhibits.si.edu/wp-content/uploads/2020/03/Guide-to-Exhibit-Development-Updated-with-Accessibility-Page-2-25-20.pdf

- *Guidelines for Label-Writers* by Smithsonian Exhibits: http://exhibits.si.edu/wp-content/uploads/2017/09/guidelinesforlabelWriters_8.29.pdf

- **IPOP** is a Smithsonian model for visitor experience preferences. See the *Curator* article v57, n1, 2014 Pekarik et al and https://www.si.edu/Content/opanda/docs/IPOP/IPOP%20short%20description%20150806.pdf

- *Smithsonian Guidelines for Accessible Exhibition Design* promotes text that is as accessible as possible to all visitors. See https://www.sifacilities.si.edu/sites/default/files/Files/Accessibility/accessible-exhibition-design1.pdf

- *The Smithsonian Visitor Journey: A Four-season Survey of the Smithsonian Visitors' Experiences Across Fifteen of the Smithsonian's Museums and its Zoo:* https://repository.si.edu/handle/10088/35822;jsessionid=E944549A7EB464765913444D6578534A

Other resources:

- **American Alliance of Museums** offers resources and workshops on interpretive label writing. It also sponsors an annual label writing competition. See https://www.aam-us.org/programs/awards-competitions/excellence-in-exhibition-label-writing-competition/

- *Complete Guide to Adult Audience Interpretive Materials: Gallery Texts and Graphics* by The J. Paul Getty Museum: https://www.getty.edu/education/museum_educators/downloads/aaim_completeguide.pdf

- *The Diversity Style Guide* is a good reference for inclusive language: https://www.diversitystyleguide.com

- *Exhibit Labels: An Interpretive Approach* by Beverly Serrell (Rowman & Littlefield, 2nd edition, 2015) is an excellent resource for exhibition writers.

- *Gallery Text at the V&A: A Ten Point Guide:* https://www.vam.ac.uk/__data/assets/pdf_file/0009/238077/Gallery-Text-at-the-V-and-A-Ten-Point-Guide-Aug-2013.pdf

- **GSA 18F's** Content Guide: https://content-guide.18f.gov/index.html

- *Less is More. And More is Less* by Judy Rand, a respected interpretive writer https://static1.squarespace.com/static/58fa260a725e25c4f30020f3/t/594d16c51b631be4c390c593/1498224358446/11_Exhibition_LessIsMore.pdf

- **The National Park Service** pioneered the practical application of Freeman Tilden's "Principles of Interpretation." NPS is renowned for its Interpretive Development Program, which includes modules on effective interpretive writing. See https://www.nps.gov/idp/interp/230/submit.htm

- **155 Words To Describe an Author's Tone:** https://www.writerswrite.co.za/155-words-to-describe-an-authors-tone/

- **The Plain Language Action and Information Network (PLAIN) website** includes the *Federal Plain Language Guidelines* and OMB's *Guidance on Implementing the Plain Writing Act,* both of which follow many of the same principles as interpretive writing. See https://www.plainlanguage.gov/law/

- **Plain Writing Act of 2010:** https://www.govinfo.gov/app/details/PLAW-111publ274

- **"Telling a Story in 100 Words: Effective Label Copy"** by Larry Borowsky, in the American Association for State and Local History's *Technical Leaflet #240*: https://gpmproject.files.wordpress.com/2012/09/6-borowsky-telling-a-story-in-100-words.pdf

- **Writing Effective Interpretive Text**, a resource guide by the Museum of New Zealand Te Papa Tongarewa: https://www.tepapa.govt.nz/sites/default/files/28-writing-effective-interpretive-text_0.pdf

Appendix: text for labels included as images

Olinsky's Hierarchy of Visitor Needs

Self Actualization: How will this change my perspective on life?

Highest Psychological Needs: How does this affect my life?
How can I take action on this?

Higher Psychological Needs: What am I learning? How does this concept connect to something I've seen before?

Basic Psychological Needs: What is this place? What do I do here?
What will I learn? How will I learn?

Physiological Needs: Where is the bathroom? Where am I? Where do I eat?
Where can I sit down? How long will I be here? Where do I go next?

Accessibility and Safety Needs: Am I safe here? Am I welcome here? Am I able to experience and learn in this place? Can I enter the front door?

Purari Delta Field Notebook 17
Joshua A. Bell, 2002
Loaned by Joshua A. Bell
Paper's light weight has advantages. While a student, Smithsonian curator Bell dropped this notebook in the Purari river in Papua New Guinea. The notebook floated—a feature not yet standard on modern laptops.

Party Animals
Formal banquets played an important role in diplomacy during the Zhou dynasty. Large or novel objects were made to impress guests, who had plenty of time to study the attractive pieces on the table.

Fitting in the form of a tapir with dragon interlace
Middle Eastern Zhou dynasty, ca. 500–400 BCE
State of Jin, Houma foundry
F1940.23

How Long Ago Is 66 Million Years?
It's hard to imagine such a mind-boggling amount of time.

So try this: open and close your hands quickly. Each time you do it represents a year. Now picture doing this 24/7 for two years. That's how long you'd have to "flash" your hands to represent 66 million years.

The Wood Wide Web
Just like we use the internet to communicate with each other and order supplies, trees and other plants have their own network: fungi.

Underground fungal threads known as mycelium connect the roots of plants, allowing them to share nutrients and communicate through chemical signals. Scientists refer to this network as "the Wood Wide Web."

The next time you see a mushroom in the woods, think about what's happening underground.

The World's Largest Living Organism
Fungi can cover huge areas. The world's largest living organism is believed to be a honey fungus *(Armillaria solidipes)* in the Blue Mountains of Oregon, which covers three square miles—an area 13 times the size of the National Mall. Known as the "Humungous Fungus," it is thought to be thousands of years old.

"Hey guys, does anyone have any spare nitrogen? I'm running a little low."
"Attention! Harmful insects in the area. Raise your defenses."

A Give-and-Take Relationship
Fungi have a long-standing symbiotic relationship with plants that dates back millions of years. Plants provide fungi with sugars from photosynthesis, and in exchange, fungi provide plants with water and nutrients from the soil, such as phosphorus and nitrogen.

Funding for the Life Underground exhibit was provided by the Smithsonian Women's Committee.

Above: *Boletus* species. Carolyn Thome, photographer

P. 37
Jennifer Angus
born Edmonton, Canada, 1961; resides Madison, WI
In the Midnight Garden, 2015
cochineal, various insects, and mixed media
Courtesy of Jennifer Angus

Angus's genius is the embrace of what is wholly natural, if unexpected. Yes, the insects are real, and no, she has not altered them except to position their wings and legs. The species in this gallery are not endangered, but in fact are quite abundant, primarily in Malaysia, Thailand, and Papua New Guinea, a corner of the world where Nature seems to play with greater freedom. The pink wash is derived from the cochineal insect living on cacti in Mexico, where it has long been prized as the best source of the color red. By altering the context in which we encounter such species, Angus startles us into recognition of what has always been a part of our world.

P. 39
Mixed Up and Recombined
Influenza is a master of adaptation. Different influenza viruses can combine to create new strains. These new strains can spread rapidly before people have built up immunity to them.

A virus from a bird and another from a human infect the same host.

The bird virus and the human virus infect the same cell.

The genes get mixed and produce a new virus strain.

The new virus strain infects a new host, who has no immunity.

P. 43
Gone with the Wind
Wind is one of the main ways plants spread their seeds. Seeds dispersed by wind are usually smaller and lighter than other seeds. The longer a seed stays in the air, the farther it can be blown from its parent plant.

P. 47
**THE BIG THREE
in Aviation Manufacturing**

"Once you have learned to fly your own plane, it is far less fatiguing to fly than it is to drive a car"
William T. Piper

Which came first, the pilots or the planes? In a single decade—despite the Great Depression—manufacturers Beechcraft, Cessna, and Piper created both the aircraft and the pool of pilots that transformed general aviation. Before the 1930s, private flying had been for wealthy sports pilots or working pilots flying expensive planes. Many aviation enthusiasts wished for simpler aircraft, and designers needed pilots to market their ideas.

The military needed the companies' small aircraft during World War II. Post-war, the "big three" went on to dominate general aviation production, with their legacy continuing into the 21st century.

Thank You

☀ Smithsonian