



# TOXEY/MCMILLAN DESIGN ASSOCIATES

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## Exhibit Design Workshop

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*Cover image: Splash! Into the Edwards Aquifer Exhibit, Austin Nature and Science Center: finished exhibit with sign mock-up*

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## Exhibit Design Workshop Agenda

- 8:30 AM     **Registration**
- 9:00 AM     **Welcome:**  
              Texas Historical Commission
- 9:10         **Introduction:**  
              A. Overview of the workshop  
              B. Hands-on activity and participant introductions
- 9:35 AM     **Exhibit Design Process Part 1: Theme, Objectives, Interpretation**  
              A. Presentation  
              B. Hands-on activity
- 10:45 AM    Break
- 11:00 AM    **Exhibit Design Process Part 2: Conceptual Design**  
              A. Presentation  
              B. Hands-on activity
- 12:30 PM    Lunch and structured networking
- 1:30 PM     **Exhibit Design Process Part 3: Design Development**  
              A. Presentation
- 1:55 PM     B. Hands-on activity
- 2:50 PM     Break
- 3:05 PM     **Exhibit Design Process Part 4: Production Design, Budgeting,  
              Scheduling, Fabrication & Installation Planning, Evaluation**  
              A. Presentation
- 3:30 PM     B. Hands-on Activity
- 3:45 PM     Closing remarks and discussion
- 4:00 PM     End of workshop

## **Interpretive Exhibit Design Process at a Glance**

### ***A. Pre-Design***

1. Establish Exhibit Committee
2. Establish Exhibit Goals and Objectives
3. Establish Exhibit Theme

### ***B. Conceptual Design***

4. Research Exhibit Content (libraries, archives, field work, interviews, photographs, film/video)
5. Brainstorm Ideas for Exhibit Components
6. Measure and draw exhibition space or site
7. Sketch ideas

### ***C. Design Development***

8. Write sign text and A/V scenarios, scripts, and storyboards
9. Design graphics
10. Develop space layout, exhibit component designs, and display case designs (draw floor plan and exhibit plans, elevations, and model)
11. Design interactives
12. Design lighting

### ***D. Production Design***

13. Develop construction drawings for exhibits
14. Develop Production Budget
15. Develop Production Schedule

### ***E. Production***

16. Fabricate Exhibit Components
17. Install Exhibit Components

### ***F. Post-Production***

18. Test and Fine-tune Exhibit Components
19. Evaluate Exhibit

## **Exhibit Design Process Part 1: Theme, Objectives, Interpretation and application of these to exhibit development and design**

### **Interpretation for Exhibits**

The National Association for Interpretation (NAI) defines Interpretation as "a mission-based communication process that forges emotional and intellectual connections between the interests of the audience and the meanings inherent in the resource."

[<http://www.interpnet.com/>]

In other words, *interpretation* goes beyond displaying information. It is a form of teaching. To teach a new concept to someone, you have to build upon that person's previous knowledge. You have to relate it to them and make it relevant to them. Interpretation does this: it gives meaning to something specific (and new to visitors) by revealing connections to larger stories that they know. Once the new information has been placed within a broader, known context, then the particularity of the new information can be established and given value.

Another aspect of interpretation is that it inspires critical thinking. It encourages the visitor to ask the essential question: WHY? If you can engage visitors mentally by getting them to think and ask questions and seek answers, then you have them hooked.

One exhibit design tip is that it is easier to engage visitors mentally (in order to teach them your exhibit content) if you have physically and emotionally engaged them. This trick forms the basis of interactive exhibits. People learn more and remember more if they have analyzed and worked their brains and bodies than if they have tried to learn through rote memorization.

We often use the term "story" to describe the product of interpretation. This word is the operative device for interpretive exhibits, as it is for most teaching. Our society learns through stories. We read books in a narrative format. Our television programs and movies follow this same format. This is the way that our society is trained to learn, so in using this device, you (the person wanting to teach), will be able to reach your visitors.

Another thing to remember is that we each see the world through our own lens. The history or the natural history event that you want to teach is your version of a story. Someone else would see it and tell it differently. As teachers, we need to keep in mind that no perspective is absolute.

The person who is credited with articulating the ideas behind Interpretation (in this sense of the term) and codifying the field is the writer, Freeman Tilden, who wrote for and about the National Park Service. His famous book, first published in 1957 (and reprinted 11 times, to total 62,500 copies) and still guiding the profession, is called *Interpreting Our Heritage*. Through his study of the interaction between visitors and naturalists at national parks, he

made six basic observations, or principles. These form the foundation of interpretive exhibit design.

Drawn from his original text, they are:

1. "The Visitor's First Interest: Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile." (p. 11)
  2. "Raw Material and Its Product: Information, as such, is not interpretation. Interpretation is revelation based upon information. But they are entirely different things. However, all interpretation does include information." (p. 18)
  3. "The Story's the Thing: Interpretation is an art, which combines many arts, whether the materials presented are scientific, historical, or architectural. Any art is in some degree teachable." (p. 26)
  4. "The chief aim of Interpretation is not instruction, but provocation." (p.32)
  5. "Toward a Perfect Whole: Interpretation should aim to present a whole rather than a part, and must address itself to the whole man rather than any phase." (p. 40)
  6. "Interpretation addressed to children (say, up to the age of twelve) should not be a dilution of the presentation to adults, but should follow a fundamentally different approach. To be at its best, it will require a separate program." (p.47)
- There are a number of other excellent books on interpretation for exhibits, for example, Beverly Serrell's *Exhibit Labels* and Sam Ham's *Environmental Interpretation: A Practical Guide*. See also the bibliography at the end of this workbook.
  - The only way to reach your visitors is to make the material that you are presenting relevant to them—here is Tilden's point again. It is imperative to demonstrate how your exhibit material relates to larger themes that your visitors know. This is the BigPicture.
  - Next, you need to demonstrate how your material is special or is divergent from the big story, in other words, why are you exhibiting it?
  - Together, your interpretation should answer the question: why would the visitor want to know this?

## Exhibit Themes and Objectives

The exhibit design process begins with developing a **theme** and establishing **objectives**.

### *Establishing an Exhibit Committee*

To develop the exhibit's theme and objectives and to act as a sounding board through the design and development process, an exhibit committee may be formed. This should not be a large group since consensus would be hard to achieve. Seven to nine members representing a cross section of the museum's administration or its stakeholders is ideal. More people may be brought in later for expanding the content or proofreading signs. The exhibit theme may even be the product of the curator alone or the head of the exhibit research team. Developing exhibit objectives, however, has programmatic implications that require the input from different areas of the museum's administration.

### *Why Develop a Theme?*

- A strong exhibit has a theme.
- Meaningful interpretation has a theme.
- Themes organize and focus an exhibit and make it meaningful to visitors.
- As Sam Ham states, "Exhibits that are designed first to communicate a theme, and then to look attractive, will be more effective than those that are designed solely to look good." (p. 236).
- The bottom line is that "people"--your visitors—"remember themes. They forget facts." (Ham, p. 39).

### *How to Develop a Theme*

To define the theme, ask yourself or your team: What's the big idea? What is the message? In one sentence, articulate what you want your audience to be able to state at the end of the exhibit experience. This is the *theme* or the *message*.

- Ideally, the theme is a short and simple sentence presenting one, specific idea.
- The *theme* is not the *topic* of the exhibit.
  - The *topic* is much broader and is not a sentence. It is the general subject matter. For example, your topic might be: Cattle drives in Northwest Texas.
  - The *theme*, however, is the message that you want your visitors to get from the exhibit. Your theme for this exhibit might be: *Social hierarchies developed among cattle drivers in northwest Texas.*

OR your theme might be: *Texas cattle-drivers learned the tricks of their trade from their Spanish predecessors.*

OR your theme might be: *The influx of immigrants into the Northeast after the Civil War provided a market for Texas beef, which walked half-way to the dinner table and was sent the rest of the way by refrigerated rail from Chicago.*

The last example is a bit too long and complex, but you can see the difference between the broad, general topic and the message-carrying theme. An infinite number of themes can be developed for any topic.

The research, information, presentation, colors, materials, graphics, lighting – in short, every part of the exhibit design and interpretation will be affected by the selected theme. This is because the purpose of the theme is to provide a unified, clearly defined message. Unity of message is developed through unity of all the supporting materials, that is, the entire exhibit design and interpretation.

- If you are familiar with writing essays, the theme of an exhibit is equivalent to the thesis of a paper.
- This is the “so what” factor. What is it that you want your visitors to understand about your topic?
- The theme also implies what the exhibit is **not** about. For example, in the previous example about cattle drives, all three sample themes indicated that their respective exhibits were not about farmer/rancher range wars.
- Distilling a theme is often the hardest part of exhibit development. If you have a loose collection of donated objects as your collection, you will need to look for a thread that connects them or look for a larger picture or message that they contribute to. The broader your collection, the harder it is to define a theme.
- To define your theme, consider your collection, conduct additional research to broaden your understanding of your topic, analyze and summarize this material, and continue to distill it until you have a one-sentence statement.
- Although you might use your theme as the exhibit title, this message might not be literally stated anywhere. In either case, it will inform and guide all interpretation and even design decisions.
- A dissertation could be written on any aspect, artifact, or specimen of any exhibit. Use the established theme to limit the information that you present. If your theme has to do with the craft involved in making 19<sup>th</sup>-century farm tools, then limit your discussion to one of craft; do not present volumes of other information about the tools and their uses. This is important, because it drastically reduces the amount of research and work that you might otherwise do if trying to represent everything known on a broad topic.
- One reason for streamlining the material that you present is that when it comes to attracting and maintaining your visitors' attention, time is essential. You have about 45 seconds to get your message across for any particular exhibit element before you lose your visitors' interest. So get to the point quickly and do not bog down the visitor with extraneous information.
- The ABCs of exhibit design are that exhibits should be:  
A: Attractive, B: Brief, and C: Clear [Fazio and Gilbert (1986); Ham, p.237]

- Sam Ham’s step-by-step worksheet, below, walks you through his process for developing a theme. Numerous examples of strong and weak themes follow. For further reading on the subject, see Ham, p. 34–38 and Serrell, p.1–8.

**“In Three Steps, Anybody Can Write a Theme”** (from Ham, p. 37)

1. Select your general topic (*for example, “our soil”*) and use it to complete the following sentence:  
 “Generally, my presentation (talk, exhibit, etc.) is about \_\_\_\_\_  
‘our soil’.”  
 (put your general topic here)

2. State your topic in more specific terms and complete the following sentence:  
 “Specifically, I want to tell my audience about \_\_\_\_\_  
‘the importance of conserving soil’.”  
 (put your specific topic here)

3. Now, express your theme by completing the following sentence:  
 “After hearing my presentation (or reading my exhibit, etc.), I want my audience to understand that \_\_\_\_\_  
‘it’s necessary to conserve our soil in order to increase our crops and to protect the quality of our water’.”  
 (put your theme here)

**Good examples of Themes** (from Ham, p. 35, 38 and Serrell, p. 3–5)

- “Native birds in this country are rapidly disappearing.”
- “Studying how birds fly led to the invention of early airplanes.”
- “Our children depend upon us to take care of their natural resources.”
- “Preserving biodiversity is like having a life insurance policy.”
- “Bluegrass makes our water cleaner.”
- “Careless spelunkers can upset a delicate balance of life.”
- “Exploring caves is a sensuous experience.”
- “Three main factors determine how geysers work.”
- “Lincoln’s life was often marred by tragedy.”
- “To understand the Mayans, one must understand their fascination with the stars.”
- “A tiny rare plant in Mexico saved the U.S. corn crop.”
- “Most of what we know about the Universe comes from messages we read in light.”
- “A healthy swamp—an example of a threatened ecosystem—provides many surprising benefits to humans.”
- “What the artists portrayed about the West in these paintings is largely fiction, which had an impact on perpetuating myths about the West in other media.”

**Poor examples of themes** (from Serrell, p. 3–5)

- “This exhibit is about the settlement of the western United States.” This theme is too broad; it is instead an exhibit topic.

-“Visitors will learn about molecular structure, chemical reactions, and the scientific process of analyzing unknown substances.” This theme presents several big ideas without an overall unifying idea.

### ***How to Develop Exhibit Objectives***

Another set of tools that will provide you with a track and help you stay on it is exhibit *objectives*.

- Use your theme and the principles of interpretation to develop objectives for the exhibit. These should answer the questions:
  - 1) What do you want the visitor to learn?
  - 2) Why would the visitor want to know this?
  - 3) How do you want the visitor to use this information?
  
- Objectives, like the theme, help you to streamline the material that you present.
- Objectives are measurable and help you to evaluate the exhibit's success.
- Objectives can include:
  - **learning objectives:** content or information that you want the visitor to know  
Examples:
    - “Upon completion of interacting with this exhibit the majority of visitors will be able to list three ways [that] plants have been used for medicine.”
    - “Upon completion of interacting with the exhibit the majority of visitors will be able to describe the concept of ‘lift’ in making airplanes fly.” [from John Veverka, various articles]
  
  - **emotional objectives:** support and enthusiasm for your cause, continuing beyond the exhibit experience, for example, the preservation of historic structures or the protection of wildlife.  
Examples:
    - “Upon completion of the exhibit ..., the majority of visitors will feel a sense of sadness about children working in the coal mines of Wales.”
    - “Upon completion of the exhibit, the majority of visitors will feel an increased need to quit smoking.”
    - “Upon completion of the exhibit, the majority of visitors will feel a greater sense of community (local history) pride.” [from Veverka, various articles]
  
  - **behavioral objectives:** “address the question of ‘how do you want the visitors to USE the information you (the exhibit) are giving them.’ This is what you want the visitor to DO!” Visitors will be inspired to get involved with this or other projects, donate funds to the project or organization, join the organization, or explore other exhibits and programs.  
Examples:
    - “Upon completing interacting with the exhibit, the majority of visitors will want to contribute to preserving historic homes in some way.”
    - “Visitors will want to learn more about the history of the mound builders.”

- The visitor will join the museum membership.
- The visitor will return to the museum more often. [from Veverka, various articles]

o **How many objectives does an exhibit need?**

The target range is 3–5 objectives (and no more than 7 objectives) for an exhibit.

## Exhibit Design Process Part 2: Conceptual Design

### Research and Design Process:

Having carried out initial research to help define a theme and objectives, you then enter the conceptual design phase of the process. This is where you will do the majority of the content research (including collecting images for later graphic and video production). This is also where creativity is unleashed in the form of brainstorming. The result of the conceptual design will be a series of sketches that rough-out the major storylines, the presentation space, the look and feel of the presentation. Use the theme and objectives throughout the conceptual design process to guide, focus, and limit your research and design work.

### Research

#### ○ *Research in Depth*

- After defining the theme, go back for more in-depth research.
  - Start with libraries and archives, and, by extension, librarians and archivists.
  - These sources lead to other sources: private collectors and other specialists (for example, historians, scientists, etc.). During this process, push research out of the library and into the field.

#### ○ *Fieldwork and Participatory Research (Learning by Doing)*

- This is the foundational idea of interactive exhibits.
- In order to design immersive exhibits, you need to immerse yourself in the topic and the research.
- If you do not thoroughly know your topic, you cannot develop a convincing exhibit.

#### • *Photograph*

- Scan all available archives of historic photographs and other collected materials and take your own photographs of places, people, artifacts, etc. for use in graphics and videos.

#### • *Film*

- If there is a possibility that you will be using video in your exhibit, you can be collecting footage as you research. This can be used in producing exhibit videos. By collecting this graphic material during the research stage of the process, you can save time and money during the production phase.

- **Collaborate**

- Throughout the research process, tap available (largely local) human resources, who can share their knowledge, materials, and enthusiasm for the subject matter.
- Not only do these folks provide a wealth of information, but by being involved in the exhibit development and interpretation, they also buy in to the project, which is essential to its success.

## **Design**

- **Design Brainstorm (and DRAW!)**

- Once you have collected a mountain of research material, you are ready to do something with it. The first step is to brainstorm. Brainstorming is a semi-structured exercise to generate a lot of ideas collaboratively and quickly.
- Brainstorming rules: accept everything; all ideas are valid (i.e., do not criticize ideas and do not hold back ideas)
- Brainstorming takes both verbal form and graphic form. Generate ideas verbally and sketch them.
- Drawing is important to exhibit design. Training in drawing, however, is not important. Stick figures and simple line drawings do the job of working out ideas graphically and spatially. Drawing is an essential tool to increase visual communication of your ideas

- **Narrow, combine, refine**

- Once you have a pile of sketches and lists of exhibit ideas, stop the brainstorming. Cull the best of them.

- **Select your direction**

- Shape the selected brainstorm ideas into storylines and exhibit circuits that you can further develop and refine.



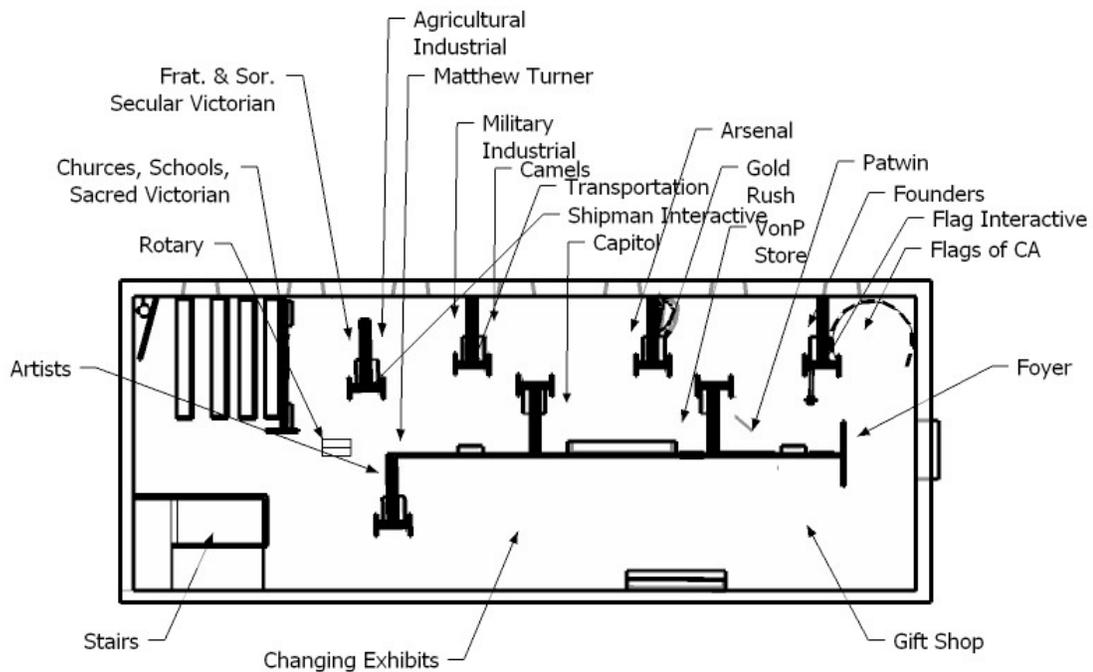
Sample brainstorming sketches; Courtesy of Toxey/McMillan Design Associates

- **Photograph the Space or Site**

- You can see things in photographs that you miss in person and you can develop your sketches onto photographs (literally).

- **Measure the Space or Site and Develop an Exhibit Plan**

- Develop a preliminary floor or site plan for the conceptual design.
- Using either a computer design program or pencil and paper, draw a plan of the existing space or site. You may want to make several photocopies of the base plan. Sketch your exhibit plan over this.
- Consider the flow of visitors through the space and the ordering of exhibits, using the exhibit theme and objectives as guideposts.



*Benicia Historical Museum: building floor plan with concept for exhibit placement; Courtesy of Toxey/McMillan Design Associates*

**Approaches to exhibit design/display** (see images, p. 43):

There are several established approaches to the display of artifacts and information. A few of these are:

- ***Grandma's attic aka cabinet of curiosity approach***, in which objects are grouped—possibly by some ordering system and possibly not—and crowded together with minimal if any interpretation. With enough generations of accumulation, the results can be fascinating and visually compelling; however, they are usually dismissed as dusty clutter. Visitors may be entertained or bored by the setting, but they will probably not be enlightened by the experience due to the absence of interpretation.

Lacking interpretation and thoughtful design, this approach to museum display is disfavored and considered to be outdated by contemporary museum practitioners.

- ***Art museum approach***, in which objects are displayed singly, usually without context, and with some though not generous information (often not in the form of interpretation, but even art museums are beginning to include more interpretation). In this approach, the aesthetic value of the object is considered to be supreme, eclipsing social, historical, and any other of the many values that the object also has.
- ***Ethnographic museum approach***, in which an object is grouped with other similar objects. In this approach, its artistic value is eclipsed primarily by its utility and craftsmanship, often tied to an explanation of geographic variations. Secondly its social context may be brought out. The focus of this approach, therefore, is to present the life of the object when it was made and used. These values are illustrated in sign text and diagrams and occasionally in theatrical settings—but theatrics may cross the line into the next approach.
- ***Dioramas, house museums, and site museum approach***, which places objects in a physical and often social setting, in itself providing interpretation for the objects. This approach reminds visitors that the objects on display were not made for museum display but for use in everyday life—or in the case of a nature exhibit, this approach reminds visitors of the natural origins of the objects. Even a painting, though ornamental, was made to adorn a house or church wall, not a museum, generally speaking. In order to appreciate these objects and better understand them, therefore, this approach presents the objects in their intended contexts.
- ***Immersive environment approach***, which is related to the previous one. Like the house museum and site museum, the focus of the immersive exhibit extends beyond the objects displayed and into the setting, which is experienced and interpreted. Unlike the house museum and site museum, however, the environment may be completely artificial.
- ***Hybrids*** of the above approaches. For example, you could combine immersive environments with the art or ethnographic museum approach by placing archival display cases within experiential settings. Another example of hybrids is the minimalist scenes abstracted from nature as settings for artifacts. These are currently

avored at the National Museum of Natural History. This diverges from the highly articulated and scientifically accurate settings previously favored by natural history museums, which are now out-of-fashion.

All of these approaches, and others as well, are valid. The approach you take depends upon a number of variables, including personal choice, budget, design strength, production capability, and decisions that you have made regarding interpretation, theme, and objectives. These also inform design decisions.

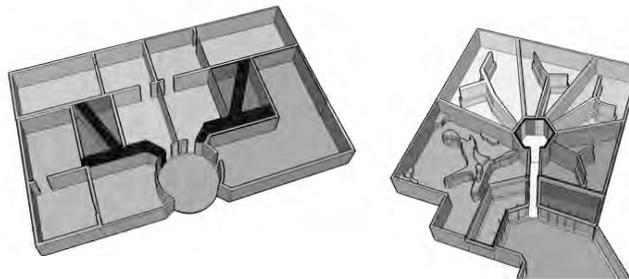
## Exhibit Design Process Part 3: Design Development

While all of the approaches to exhibit design described above can produce successful though dramatically different results, they can be helped or hindered by other areas of design: graphics, colors, sign layout, space layout, artifact/specimen mounting, and lighting. Working these out constitutes the design development stage of the process.

### Space layout

There is no golden rule for exhibit space layout. Variables to consider are: how many visitors do you expect to receive at any one time? What is the target age group? What sort of circulation or organization of exhibit elements will best develop the exhibit storylines and support the exhibit theme and objectives?

- The circulation route could be linear (or more likely, curvilinear), room-by-room (though unstructured within any one room), centripetal, completely random, and so forth. It is easiest to build upon a story with a linear path, but that does not necessarily suit the space and the exhibit's other logistical requirements.
- Another thing to keep in mind are ADA (Americans with Disabilities Act) requirements, such as a 48" minimum passage at all times to allow wheelchair access. ADA also defines maximum slopes of ramps and heights of handrails. The full set of ADA Guidelines for Buildings and Facilities (ADAAG) can be found at: <http://www.access-board.gov/adaag/html/adaag.htm>.
- The building code, which for Texas is the IBC (International Building Code), specifies exit locations, exit signs, sprinkler systems, etc.
- The floor plan may also need to accommodate places for ticket sales, ticket taking, and docent or guard surveillance of the exhibit. You may want to consider installing a camera system. These have become inexpensive.
- When organizing the floor plan of the exhibit, try to project where people will be grouping (for example, around an interactive or a display case), and be sure to provide circulation space around these magnet spots in order to avoid bottlenecks.



*Exhibit layout scenarios, ESC2 Children's Museum; Courtesy of Toxey/McMillan Design Associates*

## Artifact/Specimen mounting

The aesthetic approach toward exhibit design that you choose (art museum, ethnographic museum, etc.) will influence decisions on how to mount and display artifacts/specimens. Will you be developing furnished rooms or dioramas in which the objects are presented apparently *in situ*? Will you be presenting them as singular objects of art, individually displayed on pedestals and possibly protected by Plexiglas cases? Will you need to provide an archival display case to protect environmentally sensitive objects from UV light, humidity change, temperature change, and insects? How much theft protection do you need to provide at this site?

- **Mounting devices:** Obviously, the mounting device should not harm in any way the artifact or specimen. Not only should a clasp, nail, or wire not damage the object, but also be aware of chemical reactions between different materials. Less visible to the eye are the chemical reactions to artifacts and specimen caused by the off-gassing of paints and adhesives—as well as by humidity, light, and other environmental factors. (We will discuss, next, construction materials to use in the fabrication of archival display cases.) To avoid chemical reactions to mounting devices, consider using fishing line or heavier acrylic line to suspend objects, thereby avoiding metal hardware. Consider placing smaller objects on glass shelving to avoid contact with wood or metal. This provides the additional benefit of allowing views of the underside of objects and allowing light to pass through shelves, lighting lower shelves as well.



*National Museum of the American Indian: Plexiglas shelves and steel mounts support artifacts; these plus sculptures transform a flat wall into a three-dimensional display; Courtesy of Toxey/McMillan Design Associates.*

- **Display Case Fabrication:** Display cases provide theft and dust protection for objects. If built with archival materials, they also provide protection from environmental agents including UV rays, off-gassing chemicals, and insects. They can also be provided with humidity, ventilation, and temperature controls. Be aware, however, that no display case can provide as much protection as an acid-free box in a dark, climate-controlled storeroom. Also be aware that although the easiest and most economical display case construction may be rectilinear, a display case need not be boxy in form.
- **Archival Display Cases:** If constructing an archival display case, you will need to coat any wood or masonry with two coats of vapor-barrier paint (for archival use). It is also advised that you cover display surfaces with conservation-quality fabric (attached with staples or adhered with archival quality glue). Wall joints should be sealed with 100% silicone. You will need to use UV-protective tempered glass or UV-protective Plexiglas. And you will need to use an archival weather stripping around any opening to stop the entry of insects. Many vendors specialize in these materials.



*Left: Archival display case themed to fit setting of Seguin Safety Rest Area; Courtesy of Toxey/McMillan Design Associates*

*Right: image reproduced with permission of Rick Jellow, Luxam, Inc.*



- The National Park Service has produced a document (*Conserve O Gram*, Number 18/2 (August 2004), reproduced here as Appendix 1, p. 48), which lists and discusses chemically stable plastics and fabrics for use in collections care and exhibition (i.e., display case construction) and vendors of these products.

Some vendors of archival supplies are:

- University Products, (800) 628-1912 <http://www.archivalsuppliers.com>
- Art Preservation Services, (212) 722-6300 <http://www.apsnyc.com/>
- B&J Rubber Products (760) 872-1799 <http://www.bjrubberproducts.com/>
- Conservation Resources International (800) 634-6932  
[www.conservationresources.com](http://www.conservationresources.com)
- The Archive (Milan, Italy)  
[http://www.shadesdirect.com/conserv\\_prods\\_eng/environmente.htm](http://www.shadesdirect.com/conserv_prods_eng/environmente.htm)

- ***Collections Management Review:*** The major conditions that damage artifacts and accelerate their deterioration are: light, dust, relative humidity (both high and low), heat, insects, and mishandling. Ideal conditions for artifacts are a temperature- and humidity-controlled location (appropriate to the material) in which items are stored in acid-free boxes with no light exposure. Archivists realize the impracticality of a museum of replicas in which the originals are off-limits, so their next suggestion is to rotate items and not leave anything on permanent display. The general rule of thumb is to employ this practice for sensitive collections (e.g., papers, photographs, textiles), placing them on display for no more than three months at a time, and placing them in appropriate, archival storage (devoid of light; preferably in acid-free boxes in an environmentally controlled setting) when not on display. Exceptionally fragile items should not be displayed but should be kept in archival storage (with very limited handling) and represented in an exhibit and for purposes of general research through photographs, digital scans, and/or reproductions.

Levels of environmental agents should be monitored, recorded, and controlled (light, relative humidity, temperature, air pollution, insects).

Texas Association of Museums (TAM) lends its members environmental monitoring kits, which include light meters.

- **How to measure/control light:** Use a light meter to measure visible light and a UV meter to measure ultraviolet light. (See below for ways to control light.)
- **How to measure/control relative humidity:** [Definition: **Relative humidity (RH)** is the amount of water vapor in an air sample compared to the maximum amount of water vapor that the air can hold at the same temperature and pressure.] Use a psychrometer to measure. Recommended levels of relative humidity vary with the material. Humidifiers and dehumidifiers can be installed in exhibit and storage areas to control humidity, and some HVAC systems control humidity as well. To lower the RH in a display case or storage unit, silica gel can be used effectively, but it has to be monitored and replenished. Alternatives are saturated salts and saturated solutions of calcium nitrate. For discussions of this topic, see “Using a Psychrometer to Measure Relative Humidity” (NPS Conserve O Gram Number 3/1, July 1993), and see “Controlling Relative Humidity with Saturated Calcium Nitrate Solutions,” by Julie Creahan.

**Environmental Standards for Collections (Paragon Research Associates, 2005)**

Collection Materials	Temperature (degrees F)	Relative Humidity	Allowable Fluctuations (+ or – w/in 24 hours)
Mixed Materials	68-72	50%,	5% and 2-3°
Metals	68-72	below 40%	5% and 2-3°
Composite Objects	68-72	50%	5% and 2-3°
Paintings	68-72	40-55%	5% and 2-3°
Works on Paper	68-72	45-50%	5% and 2-3°
Leather	68-72	45%-55%	5% and 2-3°
Natural History / Furs	below 70 (lower if possible)	40%	5% and 2-3°
Photographic Material	60 or below	30-35% (optimal)	7°
Magnetic Media	65	30%	3% and 2-3°
Textiles	41-50	40-50%	5% and 2-3°
Books and Paper	60	40-55%	3% and 2-3°

- **How to measure/control insects:** For measuring pest levels, use adhesive traps sold by archival and pest control suppliers. For controlling insect entry into archival display cases, seal openings with archival, self- adhesive, weather stripping. For killing insects in artifacts and props, the preferred method is freezing. See, for example, “An Insect Pest Control Procedure: The Freezing Process” (NPS Conserve O Gram Number 3/6, July 1994).

- In addition to monitoring and controlling these environmental hazards, museums large and small can mitigate environmental damage to sensitive collections by providing archival storage, archival display cases, appropriate HVAC systems (and, if possible, back-up HVAC systems), and back-up power systems.

### **Signage:**

Signs are very versatile. They range from the iconic *index card* or *wooden park sign* to immense *murals (aka supergraphics)*. Interpretive text and graphics can be concentrated in areas or spread over a larger experience. They can provide an *auditory* dimension as well. Due to decreasing costs of flat panel monitors, *electronic signs* are becoming prevalent. Their attraction is their changeability: one sign can provide information in multiple languages, and it can be constantly updated. Drawbacks of electronic signs are: need of a computer-savvy person to make changes, cost of energy to power them, resultant heat increase, and inherent unattractiveness. It is difficult, though not impossible, to integrate them with an exhibit setting—other than a high-tech exhibit.

*Remember*, when designing an exhibit, that you are not limited to index cards and letter-sized-signs. Signs can be incorporated into any other display element and can be turned into props, themselves, or into space separators. In other words, signs do not need to remain a two-dimensional layer of words: they can expand interpretation into the third dimension, becoming part of the experiential, tactile exhibit themselves.

Other types of signs that you may want to include: *Wayfinding signs, Maps, Exhibit Title sign, Donor appreciation sign, Exhibit Section/Sub-section text panel, Artifact/specimen labels, Online signs, and Projected signs.*

- **Sign Design: Text**

- *Hierarchy of lettering* to reach different types of museum-goers (streakers, strollers, and studiers): For an interpretive sign, layer information by putting the main message as the title in very large lettering. A Streaker will read this, get the message, and move on. For each point that the sign makes, provide a subtitle, again summarizing the message and in a fairly large type. The Strollers will read these and move on. For the detailed text expanding each point, use a smaller size of lettering. The Studiers will read it all.
- Put your main message and supporting messages into the main title and subtitles, so that streakers and strollers get the point, even if they don't have time to learn the details. The more provocative your wording, the likelier that people will



- Readers may not read the sub-sections in the order you expect. Therefore each sub-section needs to be able to be read on its own, without being informed by the previous sub-section.
- Use simple language and avoid intimidating, million-dollar words. If a technical term is needed, then define it.
- Use action verbs and active voice. For example, instead of saying: “Feuds between ranchers and farmers were increased by population pressures pushing westward,” say: “Population pressures pushed westward, causing feuds between farmers and ranchers.”
- Keep language informal, and make it personal by relating your material to people, in general, or your viewer, in particular. Remember to make your interpretation relevant to the viewer by linking it to his/her life, experience, or knowledge.
- Have topic specialists read your signs for accuracy.
- Also have several additional people proofread your signs for spelling, grammar, and punctuation. To make sure that a consistent set of writing rules is followed, use a standard style guide and ask your proof readers to follow the same guide. Examples are: the *Chicago Manual of Style*, the *MLA Handbook*, Turabian’s *A Manual for Writers of Term Papers, Theses, and Dissertations*, and Strunk and White’s *The Elements of Style*.

*National Museum of American History: TOO MANY WORDS + too few images + lack of hierarchy of lettering size + lack of color and of imaginative graphic layout = no visitors reading the signs or viewing the exhibit; Courtesy of Toxey/McMillan Design Associates*



- The *lettering sizes* that you need depend upon the font (or type style) that you use and the proximity of the sign to the viewer. It is rare that the selected type size is too large. To test the size—and you should always test this sort of thing—make samples (mock-ups) and try them in the actual places that you plan to mount the signs. Have children, adults, and elderly people test them for readability. Ham, p. 266, provides a chart of font sizes for different viewing distances. This can be a helpful starting place, but testing sizes on site with your public is the best guide.
- Though you might decide to use different fonts for titles, subtitles, text, and captions, do not mix more than two (or three at the most) on a sign, and remember to be consistent with your font choices throughout the exhibit. Also remember that simplicity increases clarity.
- *Font tips:*
  - 1) Serif fonts are easier to read than Sans-Serif for printed text; the opposite is true for electronic text (electronic signs, monitors)
  - 2) Text written in ALL CAPITALS is harder to read than text in Upper and Lower Cases. All caps can work well for a short title and give it prominence on a sign.
- White letters on a dark background or dark letters on a light background will increase legibility. If you have a varicolored background, you could use white lettering with dark outline or shadow to help it stand out.

*Sample type styles: Serif (above), Sans-Serif (middle), and All Caps (below)*

Neither a borrower nor a lender be; For loan oft loses both itself and friend, And borrowing dulls the edge of husbandry. This above all: to thine own self be true, And it must follow, as the night the day, Thou canst not then be false ...

Neither a borrower nor a lender be; For loan oft loses both itself and friend, And borrowing dulls the edge of husbandry. This above all: to thine own self be true, And it must follow, as the night the day, Thou canst not then be false ...

NEITHER A BORROWER NOR A LENDER BE; FOR LOAN OFT LOSES BOTH ITSELF AND FRIEND, AND BORROWING DULLS THE EDGE OF HUSBANDRY. THIS ABOVE ALL: TO THINE OWN SELF BE TRUE, AND IT MUST FOLLOW, AS THE NIGHT THE DAY, THOU CANST NOT THEN BE FALSE ...

- Once you have developed the layout for one sign (for example, the interpretive sign that will appear in the first exhibit area) use it as a template for the other areas' interpretive signs. Also use the font, color, and other layout decisions that define that sign to guide the design of other types of signs for the exhibit, for example, the exhibit entrance sign, way-finding signs, donor signs..., and even artifact/specimen labels. This unity will help focus the exhibit and emphasize your singular message.
- *Consistency* is the most important guide to follow in exhibit design. It will lead to unity, which, in turn, supports your theme.

- ***Sign Design: Graphics***

- Most viewers (especially young ones) are more apt to look at images than to read words. Use graphics wherever possible to illustrate concepts and to diminish use of text.
- Write about what the visitor can see: do not write about things that you are not illustrating or otherwise demonstrating. In other words, provide an illustration for every point that you make in your signs. If no illustration (diagram, photograph, etc.) accompanies a written point, your readers will miss it. However, if the sign is a label accompanying a specific artifact/specimen, then the artifact itself is the illustration and does not need to be reproduced on the sign.
- Unless you have a high-end printer or other output source that uses archival inks or paints or unless you have the capacity to reprint signs regularly, then you will want to avoid colored signs. They will fade quickly, especially if exposed to direct sunlight. One way to delay fading is by placing UV-treated glass or Plexiglas over the sign or coating it with UV- retardant varnish or laminate.
- Other stable sign materials to consider, which will impact the amount and type of information provided, are: vinyl graphics, wooden signs, and high-pressure plastic laminates.

**Where to have vinyl graphics made:**

Sign shops as well as many graphics shops, like Kinko's, have computer-controlled vinyl cutting machines. They also offer many other sign printing solutions.

### **Where to have high-pressure plastic laminates:**

iZone in Temple, Texas: 888-464-9663 ([izoneimaging.com](http://izoneimaging.com))

Fossil Industries in New Jersey: 800-244-9809 ([www.FOSSILinc.com](http://www.FOSSILinc.com))

#### **• Sign Design: Layout**

- Limit content on an interpretive panel to 3-4 points. Because each point needs an illustration, think of how to organize the text and graphics on the sign. The most important goal of graphic design is readability. Simple, clear organization of material will accomplish this. The same hierarchy of lettering discussed above can be used to organize major and minor points on a sign. Direct the viewer's eye to main points first by making these larger and/or placing them at the top of the panel.
- Another thing to note—and this goes for every topic addressed here— you can borrow ideas from other exhibits. Look about you when you visit a nature trail, historic site, interpretation center, or museum. Notice colors, lighting, display case design, and sign layout. Notice what works well and what does not, and incorporate the good ideas into your own exhibits.

#### **Graphics** (see images, p. 42)

Graphics are not limited to historic photographic prints. They can include recent photos, old or current maps, diagrams, drawings, paintings, and digital versions of any of these. Once scanned, they can illustrate signs, provide sign backdrops, be turned into murals, be used in video production, etc. Many museum-goers would prefer pictorial to textual interpretation. Provide both!

- Do NOT overlook the fact that you must gain permission (preferably written) to reproduce any copyrighted graphic material. It is also advisable to give written credit to these and to textual sources.

#### **Colors** (see images, p. 43)

Color schemes are particularly vulnerable to fashion trends. This is partly because paint is fairly easy and inexpensive to change and because a change in color can dramatically alter the appearance of a place. You know that you are in a space designed in the early 1980s when you see shades of brown and orange. Art museums usually favor neutral colors (white and off-white) to allow a blank canvas for the display of art. The palette currently favored in many museum settings is neutral colors combined with pastel accents, but DO NOT let fashion dictate your design. Instead, think of color as a design **tool** and use it to support your message,

your theme. It is another language to use in your interpretation. Be creative with color and have fun with it.

- Color can be used to soothe, shock, excite, provoke, amuse...
- Like sound, it contributes to an ambience, a feeling. In fact, some of the same words are used to describe both sound and color: theme, harmony, lush, rich, light, dark...
- Color use is a field of study of itself. There are both formulaic and intuitive approaches.
- Like any design project, the best way to learn is through experimentation.
  
- **Base and Accent Colors:** A good rule of thumb to follow is to select one to two base colors and one to two accent colors. The base colors will be used in the largest quantities, for example, they will cover exhibit cases and backgrounds; they may cover pedestals, frames of signs, and sign supports. Accent colors will be used in smaller quantities to add sparkle to the ensemble.

How to pick base colors:

- 1) The topic of the exhibit can suggest base colors: e.g., a water exhibit may use blues or aquas; a plant exhibit may use greens.
  - 2) The location of the exhibit may suggest base colors for an exhibit integrated with its setting.
  - 3) The artifact or display items themselves may suggest predominant colors to use either to blend with them or to set them apart.
- For free, professional advice on color combinations, look at Home Depot's house color sample combinations. For a detailed discussion of color schemes for exhibits, see Ham, p. 256–263.

### **Lighting** (see images, p. 43)

Natural light is comfortable for the eyes and cuts down on lighting costs and heat loads. The prime example of effective use of natural lighting is the Kimbell Art Museum in Fort Worth, in which natural light is filtered and reflected onto vaults to evenly light the exhibit halls with indirect light.

Except in this highly crafted and controlled system, however, natural light, especially direct natural light, introduces both visible light and ultraviolet (UV) light to your exhibit and artifacts, causing damage. It is therefore recommended to limit light damage by controlling exposure to natural light, as well as artificial light.

All light (visible and UV; natural and artificial) causes damage, which is both cumulative and irreversible. For a very clear and thorough explanation of this process and its prevention, see “Protection from Light Damage,” by Beth Lindblom Patkus and published in the Northeast Document Conservation Center’s *Preservation Leaflets* series (available online at: <http://www.nedcc.org>).

Some materials are more susceptible to light damage than others. If you are displaying a collection with varied tolerance to light, develop a light strategy for the most sensitive items. The Texas Historical Commission publishes a lighting information sheet entitled, “Recommended Light Levels for Museum Collections” It provides the following guidelines for light tolerances:

	Visible light	Ultraviolet (UV) light
Sensitive collections Including textiles, watercolors, photographs and other papers	Maximum: 50 lux (5 footcandles)	Ideal: 0-10 microwatts per lumen Maximum: 75 microwatts per lumen
Less sensitive collections Including oil paintings, wood and leather	Maximum: 150 lux (15 footcandles)	Ideal: 0-10 microwatts per lumen Maximum: 75 microwatts per lumen
Least sensitive collections Including most metal, ceramics, stones and glass	Maximum: 300 lux (30 footcandles)	Ideal: 0-10 microwatts per lumen Maximum: 75 microwatts per lumen

UV light can and ideally should be eliminated from exhibit and storage areas. Because it is not visible to human eyes, its absence is unnoticed. Since we need visible light to see, it is harder to limit its use; however, this can be done through careful control: 1) placing sensitive items in dark storage when not on display; 2) turning off exhibit lights (as well as lights in storage and research areas) when not in use; and 3) carefully selecting lighting units and calculating the amount of exposure to them.

Ways of reducing/controlling visible and UV light:

- o Windows and skylights can be treated with films, plastics, varnishes, or paint (white titanium dioxide) that cut down UV and visible light rays. See “Choosing UV-Filtering Window Films” (NPS *Conserve O Gram* Number 3/10, August 2004) as well as Patkus’s article. Natural light can also be blocked with curtains, shades, and blinds. Artifacts should never be exposed to direct light (which will also fade signage and other exhibit components).
- o If you eliminate natural light from the exhibit space, you will have greater

control of light damage through artificial lights, but these, too, cause damage and need control. Another advantage of artificial light is that it emits a lower percentage of UV radiation. In addition to protecting artifacts, a natural-light-free space allows greater control of the visitor experience (i.e., the exhibit design). A disadvantage of eliminating natural light, however, is the increased energy cost to produce artificial light.

- Conventional incandescent light bulbs emit very little UV light and do not require UV filtering. These include ordinary household light bulbs as well as some exhibition lighting, e.g., Reflectorized (R ), Ellipsoidal Reflectorized (ER), and Parabolic Aluminized Reflector (PAR) lamps.
- Halogen light bulbs (known as tungsten-halogen or quartz lamps) emit significant UV light and therefore require UV filters. In exhibition lighting, these include Halogen PARs and Mirrored-Reflector (MR) lamps.
- Fluorescent lamps, including the new compact fluorescents, also emit UV light. To limit UV rays emitted from fluorescent light sources, there are soft plastic filtering sleeves and hard plastic filtering tubes that fit over fluorescent lamps to absorb UV rays.
- The visible light emitted from fluorescent lamps is also more damaging to artifacts than the visible light from incandescent (tungsten) lamps. This is a second reason to choose incandescent over fluorescent; unfortunately, fluorescent bulbs are far more energy efficient than incandescent bulbs.
- Fiber optic lighting is considered to be the best for exhibition. It is energy efficient, produces virtually no heat (infrared radiation), does not transmit UV light, and can be introduced directly into display cases, thereby allowing you to focus the light and reduce ambient light levels. The drawback is expense.
- Lighting technology advances quickly, and you may want to research the latest commercially produced systems. For example, keep an eye out for the new electrodeless lamp that is currently being developed. Be aware, however, that bulbs are expensive, especially for the newest lighting technologies. The goal in lighting is to know if you want a broad fan light or a spot light, learn how to achieve this with as cool a light as possible, learn how to filter it for UV radiation, and learn how to train or baffle the light to achieve indirect lighting of artifacts.
- “Indirect and low lighting will spare the object, and it will also require less adjustment of the eye from areas of intense light to those of relative darkness, allowing the use of lamps with a lower wattage throughout

exhibit spaces. A gradual diminution of light levels through a series of rooms may accustom viewers' eyes to lower exhibition light levels. Strategic placement of labels explaining the reason for low light levels can be used to educate patrons.” (Patkus).

- Using the maximum recommended light exposure values charted above and the strength of your lighting system (measured in lumens), you can calculate the maximum number of hours that you can expose the artifacts to light. “For example, a limit of 50,000 lux hours per year could be achieved by keeping the lights on for 10 hours per day, either at 100 lux for 50 days or at 50 lux for 100 days. It is important to remember that even with such guidelines, some fading will occur. The goal is to achieve a workable compromise between exhibition and preservation.” (Patkus).
- If you are dealing with low ceilings or open ductwork, you may want to paint your ceilings black, limiting lighting to pathways and exhibits. This will cut down on light in general (reducing the damage of visible and unfiltered UV light), and it will also serve to focus the visitor's attention where you want it. One advantage to a white ceiling, however, is that if painted with white titanium dioxide (which is UV absorbent), it can further reduce UV emissions and light a space indirectly.

### **Film & Video**

While the workshop does not have time to go far into the area of film and video production, be aware of the fact that this lies within your capabilities. The process for creating film and video is a microcosm of the exhibit design process. You follow the steps of:

- Research
- Develop a Theme
- Develop a Scenario
- Develop Storyboards—which are a cartoon-like sketches of the final product
- Write the script
- Cast the voice and acting talent
- Select music
- Film or video tape the production
- Edit

### **Adding Third and Fourth Dimensions** (see images, p. 44)

Studies show that visitors remember:

10% of what they hear,
30% of what they read,
50% of what they see,
90% of what they do.

This means that making exhibits three-dimensional, multi-sensory, and

interactive will bring about the most learning.

- **Three-Dimensional:** Start by making exhibits that people need to walk through and around. Also important is the provision of seating—preferably themed to the exhibit—so that visitors interact with the setting and have an opportunity to rest. Making exhibits three-dimensional also adds interest. A three-dimensional exhibit will draw far more visitors than a flat one. This is part of the attraction of dioramas, which additionally inform by providing physical and social contexts for exhibit materials. The diorama can leave the confines of glass cases and handrails and can become a walk-through experience. In other words, the theme can expand to fill the entire exhibit hall, turning the visitor into an actor.
- **Four-Dimensional: Time/Interactivity.** Exhibits that change over time (moving or altering by themselves or with the help of visitors) are even more engaging to visitors. When visitors learn by doing, the experience and therefore the message will be remembered most fully. Think of how to make your lessons participatory. One technique that is over-used by museums and non-effective is the question-and-answer exhibit in which the activity is to open a hinged door to learn the answer. This activity does not reinforce the theme: it is not interpretive. An example of interactivity that teaches is having visitors turn a water wheel to see how the force of water turns gears to grind grain.
- **Multi-sensory:** The ultimate learning context that meets the most learning styles and ages is therefore a multi-sensory, multi-dimensional exhibit. Think of ways to develop and support your theme by addressing the senses often ignored by exhibits:
  - Sound:* adding voice, sound effects, and music
  - Touch/Smell:* adding tactile and olfactory elements; this may be as simple as using materials for handrails and display cases that reinforce exhibits themes: warm, weathered woods or cold metals. You can also heat and cool separate exhibits areas to reflect storylines and themes. Interactive exhibits also provide obvious tactile experiences.

## Objectives and Products of Design Development

Over the course of the Design Development phase of the project, you enhance and strengthen the Conceptual Design. Each change that you make, like widening a doorway to meet ADA requirements, will affect other parts of the exhibit, for example, the placement of signs. As you work through the development of the areas discussed above and as you plan for the positioning of exhibit elements, artifacts, and display cases, your design will

take more concrete form. The instruments for giving it this form are **drawings** and **models**.

- **Drawings:**

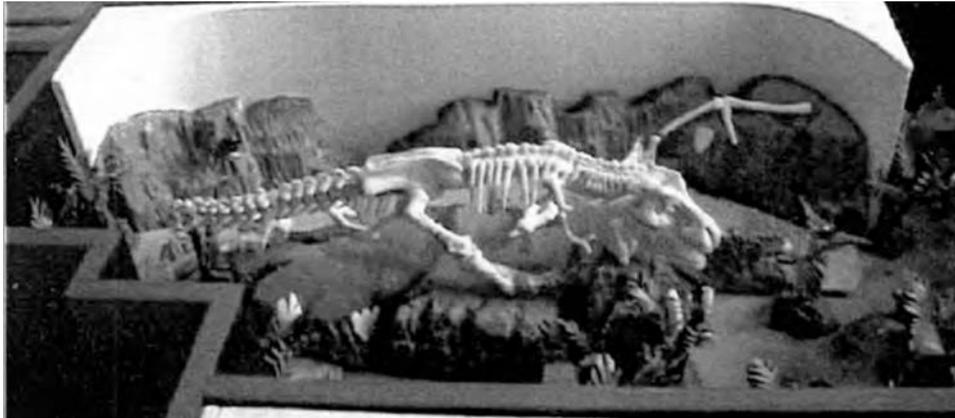
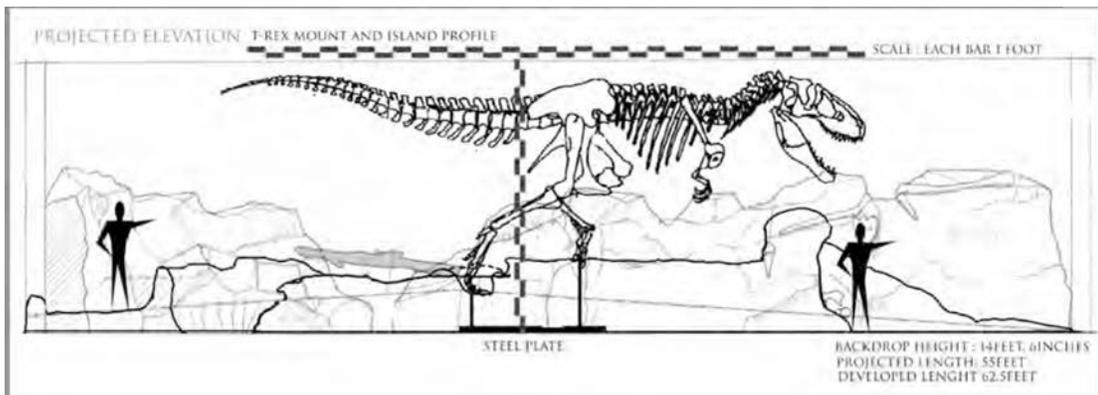
- The basic drawing that you need to make is a *floorplan* or a *site plan* (for an exterior exhibit); however, if you want to expand and further develop the visual presentation of your design, the following is a list of other drawings that may be helpful to you. In architectural terms, these drawings together with the floorplans and site plan form the “design development package.”
  - *Section*: this is a cut (usually vertical) through a building or site. It is useful for studying vertical space. For example, if you have signs or exhibit elements that you want to suspend from ceiling joists, a section can help you plan these
  - *Reflected ceiling plan*: this is a mirror image of a ceiling. It is used by interior designers to plan for lighting, among other things.
  - *Elevations*: these are similar to sections; however, instead of representing vertical space, they present walls (exterior or interior). These are useful for planning the locations of signs, dioramas, display cases, and large exhibit components as they relate to surrounding walls.
  - *Perspectives*: using vanishing points, these drawings depict a space as it appears to the human eye.
  - *Renderings*: though most commonly associated with perspective drawings, this term refers to any of the above drawings once it is colored, shaded, and prepared as a presentation drawing.
- Drawings and sketches can be colored and thereby turned into renderings, which are useful in fund-raising. If digitized, these can be printed out and mounted on presentation boards. They can be sent to the local newspaper, put on a website, and printed into newsletters and brochures. These various products can, in turn, be used to generate community awareness of your activities. This usually results in community support for and excitement for the project.

- **Model:** The other design tool, which is even more accessible to non-architects who might be reviewing the design, is a scale **model** of the space with your exhibit in it. Using the dimensions of the space that you have taken for drawings, you can build a model. Depending upon how large the space is, you will probably want to build it to 1/4- or 1/2-inch scale. That means that one foot of real space is represented as either 1/4 inch or 1/2 inch in the model. You can use any material (even Jell-O or sugar cubes), but cardboard does the job well and inexpensively. The more complex your project, the more necessary a model will be to study the spatial conditions in three

dimensions. It helps you test your ideas and modify them before investing resources in producing them. In addition to helping you design the space, a model is an effective tool for winning support of boards of directors and the public as well as bringing in funding.

The computer program, **Sketchup**, allows digital modeling.

- It is a fast, cheap, easy way to design, develop, and visualize a project.
- With it, you can transfer concepts through email or via a website.
- With the Pro version, you can export directly to CAD.
- You can print different views of the model as presentation drawings.



*Texas Dinosaurs, Dallas Museum of Natural History: drawing, model, realization; Courtesy of Toxey/McMillan Design Associates*

## Exhibit Design Process Part 4: Production Design

This final portion of this workbook addresses the logistics of exhibit production, including developing budgets and schedules, planning fabrication and installation, some tips on exhibit fabrication, guidelines for facilitating exhibit installation, fine-tuning installed exhibits, and approaches to exhibit evaluation.

### Production Design

Production Design is the "get real" phase of exhibit design, in which you determine how you will build the exhibit by analyzing the skills and materials that will be needed. If you are not going to fabricate the exhibits in-house, then you will also have to produce **Construction Documents**. They are the kit of drawings that tell a carpenter or other fabricator how to build the exhibit.

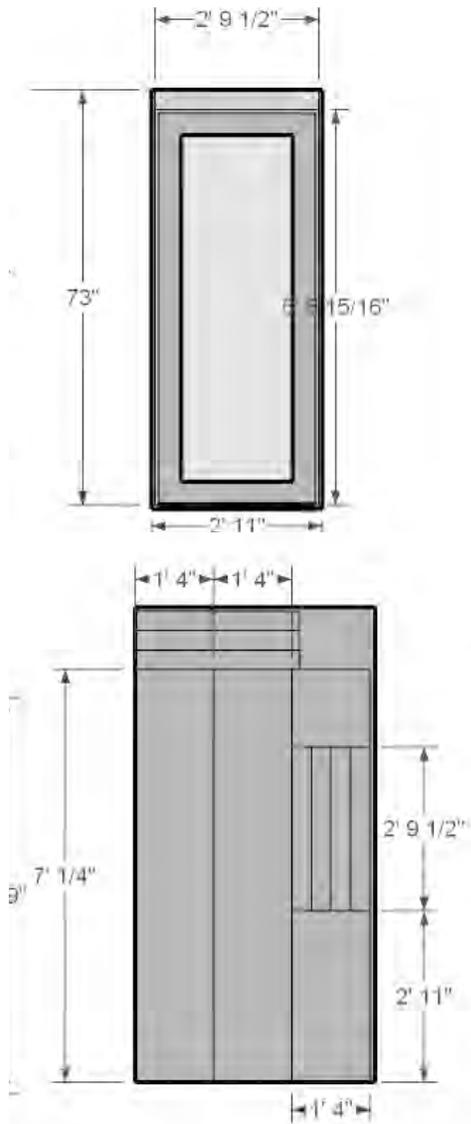
### Budget

- Begin by listing every material (with cost estimates) and every task (with time and cost estimates) that will be needed to produce the design that you have developed:
  - Building materials, building trades, lighting, wiring, sound systems, music, voice and/or acting talent, audio/visual recording, props, electronics, programming, locating display items and needed artifacts, collections restoration and preparation, graphic production, laminating, crating, shipping, redo's, installation, closing the facility for installation, repairs and touch-ups, cleanup, mounting artifacts, managing production, purchasing, installation, fund-raising, overhead costs (postage, telephone, utilities), website design, website hosting, evaluating, updating, printing fundraising materials, mailing fundraising materials, ....
- Modify your design as necessary to fit available funds or, if funding is insufficient, divide your project into phases of development to meet projected future funding.
- Refine your budget.

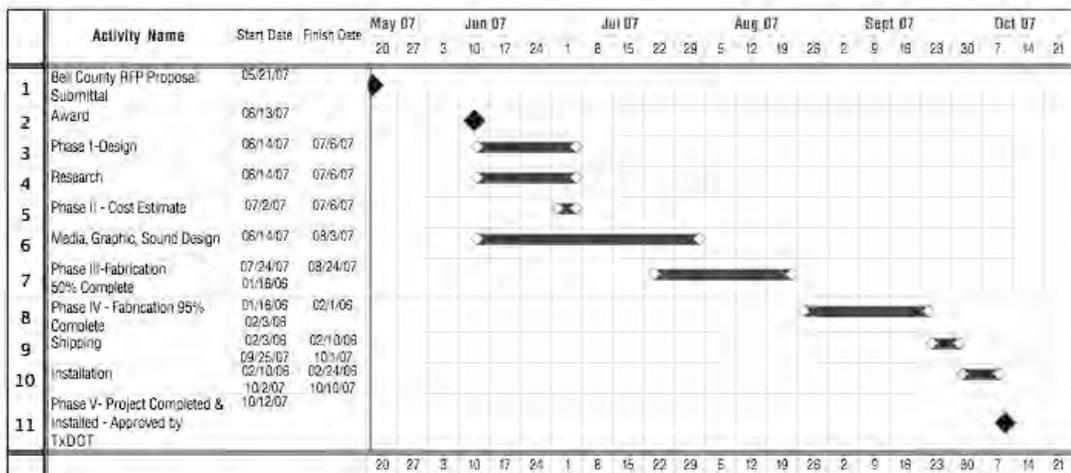
### Scheduling & Logistics

One simple, inexpensive scheduling program is called Fast Track. There are probably free or bundled ones that you also have access to. The purpose of the schedule is to transform the budget into a graphic form with a timeline. With this, you can map your purchasing, manpower, space use, production of exhibit elements, shipping and installation, preparation of the collection, use of gallery and temporary gallery spaces, closure of areas to the public, grand opening, press releases, etc. Remember to include things like organizing shipping or rental of installation equipment (scaffolding, palette jacks, fork lifts) in advance of the date that you need them. Like the budget, you can update and revise this document as the project progresses.

Left: Display case production design; Right: sample budget; Bottom: sample production schedule; Courtesy of Toxey/McMillan Design Associates



	Sq.Ft./Qty	Cost per	Installation	Subtotal	Total
<b>Foyer</b>					
Map projector	1	3450	575	4025	
Map Computer	1	1725	57.5	1782.5	
DSL Feed	1	34.5	57.5	92	
Projector 1	1	2875	575	3450	
Projector 2	1	2875	575	3450	
Projector 3	1	2875	575	3450	
Computer 1	1	2300	115	2415	
Computer 2	1	2300	57.5	2357.5	
Computer 3	1	2300	57.5	2357.5	
Computer 4	1	2300	57.5	2357.5	
Glass 1	1	1725	575	2300	
Glass 2	1	1725	575	2300	
Glass 3	1	1725	575	2300	
Rock	500	115	1150	58650	
Ceiling Black	6000	2.3	460	14260	
Counter	30	23	345	1035	
Main Sign	1	2300	115	2415	
RHC Sign	1	1150	230	1380	
Theater Sign	1	1725	230	1955	
Exhibit Sign	1	2300	115	2415	
Gift Shop Sign	1	1150	115	1265	
Changing Exhibit Sign	1	575	115	690	116702
<b>Cowboy Poetry Stage</b>					
Rockwork	700	115	1725	82225	
Lighting	5	230	575	1725	
Soundsystem	1	1725	345	2070	
Carpentry	200	28.75		5750	
Seating	150	23		3450	
Flags	6	115	115	805	
Elevator	1	23000	11500	34500	
Seating Storage	150	11.5	2300	4025	134550
<b>Theater</b>					
Seating	49	172.5	1150	9602.5	
Screen	300	11.5	1150	4600	
Projector	1	5750	1150	6900	
Sound System	1	2300	1150	3450	
Rock	320	57.5	2300	20700	
Fiber Optic Stars	2000	5.75	1150	12650	
Illuminators	2	575	230	1380	59282.5
<b>Film1 for Theater</b>					
Actors	20	2300		46000	
Costumes	20	345		6900	
Sets	20	1150		23000	
Props	50	57.5		2875	



## Planning Fabrication

Based upon your detailed budget, you will be able to plan your fabrication. In addition to the materials and skills that you have itemized, consider construction space needs, power needs, work lighting, specialty tools, exhaust fans, and so forth.

- Remember to use materials that are appropriate to the care and maintenance of the collection. Also remember to leave ample time for materials to cure and off-gas before introducing artifacts and specimen.

## Planning installation

Guidelines for facilitating installation:

- food and beverages for the installation crew
- extra supplies and tools: always have a supply of screws, nails, bolts, washers, wood glue, super glue, epoxy glue, basic paint colors and samples of paints used to build exhibits and signs, paint brushes, shims, hammers, screw drivers (flat and phillips), scissors, cable ties, etc.
- vehicle and driver available for hardware store runs
- names of installation crew reinforcements to call—or just ask extras to come

## Post-installation fine-tuning

Be prepared to make refinements and adjustments to the exhibit once it has been installed and tested by the public. These may include adjusting lights, increasing or decreasing sound levels, changing a music track, broadening a passageway (if possible), and correcting typos. Some museums choose to have a soft opening when the exhibit has been installed and a grand opening after the snags have been worked out.

*Left: Benicia Historical Museum, adjusting video projections and sound volume after installation; Right: Medina County Safety Rest Area: adjusting lighting after installation; Courtesy of Toxey/McMillan Design Associates*



## Evaluation

The ideal evaluation process is to build mock-ups of the planned exhibit components and signs before building the real deal. Then, test these mock-ups on the general public or on a specific group that represents the target audience (like the city's fifth-grade science classes). Analyze results of the test, and evaluate the exhibits for their effectiveness. Finally, make design modifications before constructing the permanent exhibits.

Based upon the objectives (learning, behavioral, and emotional) that you originally defined for the exhibit, develop a series of questions that quantify and qualify the exhibit's achievement of these objectives. Additional questions that you may want to ask include: were the signs legible and comfortable to read (i.e., positioned well, large enough lettering, lit well...)? Was there sufficient lighting of displays? Were the learning needs of the target audience met (or was the interpretation geared too high or too low)? Were audio tracks audible? Was there sufficient interpretation?

- **Evaluation data** can be collected in a number of ways. For example,
  - 1) Docents talking with visitors can casually gauge their reactions to the exhibit and through questioning can learn if the visitors understood the main theme.
  - 2) Visitors can be asked to sign a guest book and give voluntary comments (and monetary contributions) following their exhibit experience.
  - 3) This sort of feedback can be collected for each individual exhibit component or for the ensemble.
  - 4) A docent or evaluator can collect data by watching and recording people's reactions as they interact with or do not interact with exhibits. For example, do visitors read the instructions? Do they stay long enough to listen to the entire recording? Do they get excited and bring their friends or parents to see the exhibit, or do they walk by without glancing at it?
  - 5) For a more empirical evaluation, visitors can be asked to fill out formal questionnaires after their exhibit experiences in order to evaluate their responses and the amounts that they learned from the exhibit.
  - 6) For a very thorough, quantitative evaluation, visitors can be asked to fill out questionnaires before entering the exhibit to determine their previous knowledge of the subject matter. They can then be asked to fill out a second questionnaire upon exiting the exhibit to determine their knowledge of the subject matter afterward. The effectiveness of the exhibit to teach its subject can be determined by comparing the pre- and post-test scores.

A good book to guide exhibit evaluation is new one by Beverly Serrell, *Judging Exhibitions: A Framework for Assessing Excellence*.

On the following page is a sample exhibit evaluation form supplied to visitors of the "RACE: Are We So Different?" exhibit after their visit.



### Exhibit Evaluation

Now that you have viewed and discussed **RACE: Are We So Different?** We would greatly appreciate it if you could please help us to gage the effectiveness of this exhibit by filling out the following evaluation.

1. Overall, what did you think of the exhibit?

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2. Did you learn new information from the exhibit?

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3. Was the information in the exhibit easy to understand and enjoyable to experience?

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4. Was there any part of the exhibit that you particularly liked? Particularly disliked?

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5. How was your discussion of the exhibit? Were the provided questions a helpful assistant?

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6. How could your experience at the exhibit and the discussion been improved?

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7. How has the way you understand race changed as a result of the exhibit?

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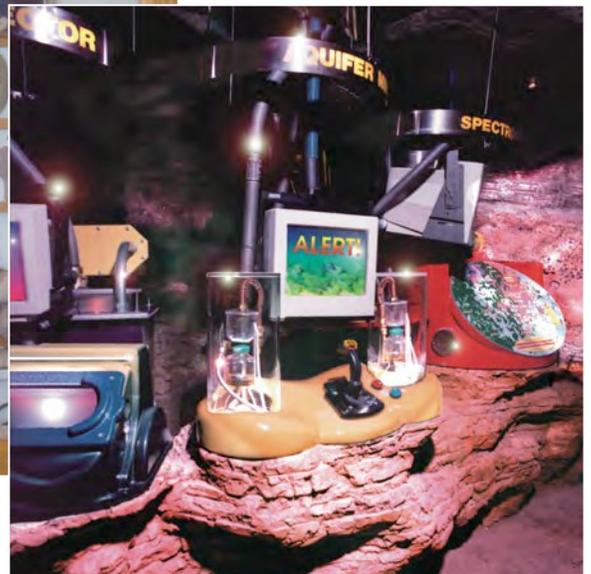
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Please include any other comments on the backside of this evaluation.  
After completion please return to New Detroit  
by fax at (313) 664-2071 or by mail at: New Detroit, 3011 W. Grand Blvd., Suite 1200, Detroit, MI 48202

## Exhibit Design Illustrations: Approaches to exhibit design

Top to bottom: Grandma's attic; hybrid exhibit; art museum; ethnographic museum; immersive exhibit;  
Courtesy Toxey/McMillan Design Associates



## Exhibit Design Illustrations: Use of graphics in signs and murals

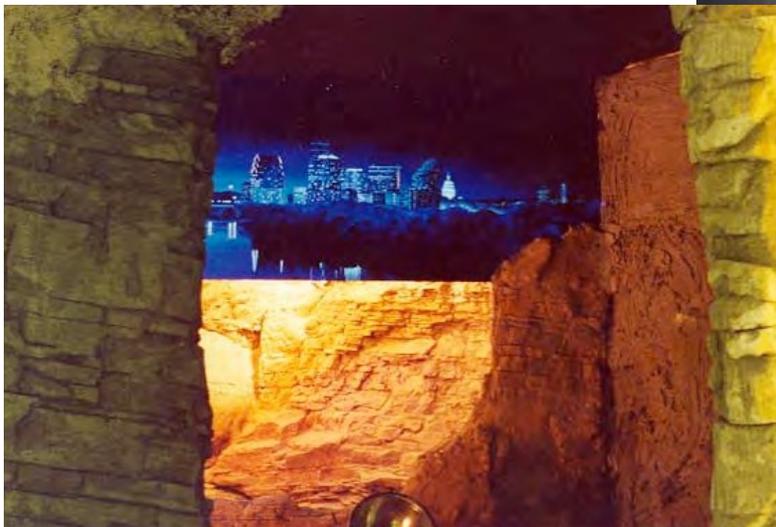
Historic photos and photo collages transformed into wall murals: Folsom History Museum (top); Donley County Safety Rest Area (bottom); Courtesy Toxey/McMillan Design Associates



## Exhibit Design Illustrations: Color and Lighting as design tools

Upper three images: examples of fiber optic lighting, reproduced with permission from Rick Jellow, Luxam, Inc.

Lower left: Splash! Into the Edwards Aquifer exhibit, Austin Nature and Science Center Lower right: conceptual design for ESC2 Children's Museum; Courtesy of Toxey/McMillan Design Associates



## Exhibit Design Illustrations: Adding dimensionality and interactivity

Top to bottom: Polk County History Museum; Splash! Exhibit; National Museum of American History; Dallas Museum of Natural History; Splash! Exhibit; Courtesy of Toxey/McMillan Design Associates



## Resources for Further Study

The Texas Historical Commission's Museum Services Program has a large collection of books and resources related to collections and exhibit design. Not only can Museum Services help you determine which books and resources are best for your organization to invest in, but it provides other guidance as well.

See also the American Alliance of Museums' website for exhibit-related publications:  
<http://www.aam-us.org/bookstore/index.cfm?mode=group&id=8>

## Books and Articles for Exhibit Design Reference

Kenneth L. Ames, Barbara Franco, L. Thomas Frye, eds., *Ideas and Images: Developing Interpretive History Exhibits* (AltaMira Press, 1992)

Robert L. Barclay, Andre Bergeron, Carole Dignard, and Carl Schlichting, *Mount Making for Museum Objects* (Canadian Conservation Institute, 1998)

Julie Creahan, "Controlling Relative Humidity with Saturated Calcium Nitrate Solutions," WAAC Newsletter 13:1 (January 1991), p. 17–18; available online at:  
<http://palimpsest.stanford.edu/waac/wn/wn13/wn13-1/wn13-106.html>

James R. Fazio and Douglas L. Gilbert, *Public Relations and Communications for Natural Resources Managers* (Dubuque, Iowa (USA): Kendall/Hunt Publishing Co., 1986)

Sam H. Ham, *Environmental Interpretation: A Practical Guide for People with Big Ideas and Small Budgets* (Golden, CO: North American Press, 1992)

Ivan Karp and Steven D. Lavine, eds., *Exhibiting Culture: The Poetics and Politics of Museum Display*, (Washington, DC: Smithsonian Inst. Press, 1991)

Anna-Marie Kellen and Karin L. Willis, *Standards Manual for Signs and Labels* (American Association of Museums, 1996)

Larry Klein, *Exhibits: Planning and Design* (Madison Square Press, 1987)

Barry Lord and Gail Dexter Lord, eds., *The Manual of Museum Exhibitions* (AltaMira Press, 2001)

Gail Dexter Lord and Barry Lord, eds., *The Manual of Museum Planning* (AltaMira Press, 2000)

- Robert Lumley, ed., *The Museum Time Machine: Putting Cultures on Display* (New York: Routledge, 1988)
- Arminta Neal, *Help! For the Small Museum: Handbook of Exhibit Ideas and Methods* (Pruett Publishing Co., 1987)
- Beth Lindblom Patkus, "Protection from Light Damage," *Preservation Leaflets* (Andover, MA: Northeast Document Conservation Center, 2007) available online: <http://www.nedcc.org>
- Paragon Research Associates, *Wyoming State Museum and Archives Facility Needs Assessment* (Seattle, 2005)
- Alice Parman and Jeffery Jane Flowers, *Exhibit Makeovers A Do-It-Yourself Workbook for Small Museums* (AltaMira Press, 2008)
- Beverly Serrell, *Exhibit Labels: An Interpretive Approach* (Walnut Creek, CA: AltaMira Press, 1996)
- Beverly Serrell, *Judging Exhibitions: A Framework for Assessing Excellence* (Left Coast Press, 2006)
- Mary Sinker and Ian Russell, "Designing for Play," Association of Children's Museums newsletter, *Hand to Hand* (Summer 1998); available online
- George W. Stocking, Jr., ed., *Objects and Others: Essays on Museums and Material Culture* (Series: History of Anthropology, Volume 3} (Madison, Wisconsin, The University of Wisconsin Press, 1985)
- Freeman Tilden, *Interpreting Our Heritage* (Chapel Hill: University of North Carolina Press, 1977)
- Texas Historical Commission, "Recommended Light Levels for Museum Collections" (Austin, Texas Historical Commission) available online: <http://www.thc.state.tx.us/>
- John Veverka & Associates, various articles and books listed on:  
<http://www.heritageinterp.com/library.htm>
- Lothar P. Witteborg, *Good Show: A Practical Guide for Temporary Exhibitions* (Washington, DC: Smithsonian Institution Traveling Exhibition Service, 1991)

## Websites for Exhibit Design and Interpretation Reference

Harpers Ferry Center/NPS [www.nps.gov/hfc](http://www.nps.gov/hfc)

National Association for Museum Exhibition  
<http://n-a-m-e.org>

Exhibit Builder Magazine online  
[www.exhibitbuilder.net](http://www.exhibitbuilder.net)

National Association for Interpretation (NAI)  
[www.interpnet.com](http://www.interpnet.com)

National Park Service *Conserve O Gram* series  
[http://www.nps.gov/history/museum/publications/consveogram/cons\\_toc.html](http://www.nps.gov/history/museum/publications/consveogram/cons_toc.html)

American Alliance of Museums (AAM)  
<http://www.aam-us.org/>

Texas Association of Museums (TAM)  
<http://www.texasmuseums.org>

International Council of Museums (ICOM)  
<http://icom.museum/>

International Council on Monuments and Sites (ICCOMOS)  
<http://www.icomos.org/>

Board Source (support for non-profits)  
[www.boardsource.org](http://www.boardsource.org)

Association of Children's Museums (ACM)  
[www.childrensmuseums.org/](http://www.childrensmuseums.org/)



# Conserve O Gram

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## Safe Plastics And Fabrics For Exhibit And Storage

### *Introduction*

Always use archival or conservation quality materials for your collection. "Archival" or "conservation" quality refers to materials that are physically durable and chemically stable. Several types of plastics and fabrics fall into this category. Such items are said to be "inert," as they do not release degradation products that can be harmful to collections. Use these materials whenever possible to ensure the safety and stability of museum collections in storage, exhibit, and transport. To choose a suitable material, consider the following factors:

#### 1. Nature of the storage material

- Consider its:
  - physical and chemical properties
  - texture
  - permeability/breathability
  - durability
- Does it carry a static charge that could attract dust and other abrasives?
- Does its composition allow for long-term or short-term use?
- Is it appropriate in an exhibit setting or better for storage or shipping only?

#### 2. Nature of the object

- Consider the physical and chemical composition of the object to be stored or displayed.
- What is the object made of?
- What is its texture, size, and condition?
  - Some objects may have rough sur-

faces that snag on certain protective supplies.

- Others may have structural or compositional weaknesses that require specific supportive materials.

#### 3. Nature of the storage/exhibit environment

- Consider all of the environmental factors including relative humidity (RH), temperature and light exposure.
- If the RH is high or fluctuates, would it be better to use a breathable textile instead of plastic?
- If the temperature fluctuates, does it affect RH and condensation in that area?
- How is the ventilation and particulate build-up?
- Would plastic protect better than fabric in a dusty environment?
- Will the storage or exhibit materials be exposed to light and/or UV radiation? If so, this might cause:
  - fading
  - deterioration
  - off-gassing

**Note:** Some plastics and textiles emit harmful degradation products when exposed to UV radiation, heat, and solvents.

#### 4. Nature of the purpose

- Consider the purpose:
  - Exhibit: which requires aestheti-

- cally pleasing or non-visible materials?
- Storage: will it be long or short term?
  - Transport: for protection in shipping? This may require extra precautions to avoid breakage, but may not require long-term exposure to the packing material.
  - Consider each situation and object on a case-by-case basis.
  - In some cases, non-archival quality materials may be a more cost-effective and appropriate solution (such as during transport) when their exposure to the object is minimal and of short duration.

For collections, never use plastics with fillers, plasticizers or other additives. These can release harmful degradation products over time. Also, avoid plastics that have chlorine or sulfur containing compounds. Such plastics can off-gas volatile acids and harm collections. Do not use any of the following plastics for long-term storage or exhibit purposes:

- PVC (polyvinyl chloride)
- PVDC (polyvinylidene)
- PVA (polyvinyl acetate), found in adhesives and paints
- acidic polyesters
- polyurethane foams
- chloroprene (e.g. Neoprene®)
- urea formaldehyde panels (such as Gator Foam®)

**Plastics and Foams**

Plastics are synthetic materials constructed principally from carbon, silicon, hydrogen, nitrogen, oxygen and chloride. The sources for these elements are usually oil, coal and natural gas. During manufacturing, these familiar elements are recombined through chemical reactions to form new substances. This means that there are a variety of plastics suitable for museum use. Although many plastics appear similar, the process and chemicals used in manufacture vary.

Instead, use safer plastic alternatives such as:

- polyethylene (PE)
- polypropylene (PP)
- polystyrene
- acrylic
- inert polyester films and sheeting

The following chart lists plastics that are commonly used for museum storage, exhibit, and packing purposes. Most are of archival quality, except those listed for short-term use.

<i>Material</i>	<i>Description</i>	<i>Uses</i>	<i>Types</i>	<i>Remarks</i>
Mylar® or Melinex®	Pure polyester, transparent film.	Provides a protective layer for objects, paper and textiles. Good for encapsulation of documents and photos in paper conservation.	Available in different thicknesses. Made in cut sheets, rolls and various sizes of prefabricated envelopes.	Chemically stable. Acts to filter out some ultraviolet (UV) radiation. When used under blotter paper, it prevents acid migration to specimens.

Polyethylene (PE) Film or Sheeting	Slightly opaque plastic film.	A less expensive alternative to Mylar® and Melinex®. Protects smaller artifacts, photos and paper from dust, abrasion and fingerprints.	Available in resealable bags, sleeves, and envelopes. All types come in a variety of sizes and thicknesses.	Inert and water resistant. Less chemically stable than polyester films and not as clear. Some recommend keeping bags open due to possible condensation in RH fluctuations.
Ethafoam®, Microfoam, Sentinel, or Cell-Aire®	Extruded, closed-cell polyethylene (PE) foam.	Provides cushioning and support in storage mounts. Good for packing and shipping. Sheets are good for lining drawers or shelves.	Available in various sizes, shapes and thicknesses (1/32" to 4"). From thick dense blocks to thin flexible sheets.	Inert, moisture and chemical resistant, lightweight and energy absorbent. Easy to shape with a knife. Edges can be abrasive requiring a liner when in contact with objects.
Plastazote® and Volara®	Closed-cell polyethylene (PE) foam.	Cushions collections in storage or shipping. Great for entomology pinning trays.	Available in a range of densities and thicknesses.	Denser and softer than Ethafoam® and similar products. Special manufacturing results in a smooth continuous surface. No harmful additives and ozone friendly.
Polyethylene (PE) foam rod	Polyethylene foam in a cylindrical shape.	Supports and cushions artifacts and specimens in storage and shipping. Used to gasket exhibit and storage cases and to plug specimen vials.	Available in various diameters from ¼" to 2".	Not to be confused with polyurethane "backer rod," which should not be used due to its tendency to off-gas harmful chemicals.
Coroplast® or Polyflute	Polypropylene and polyethylene corrugated board.	Makes great storage boxes and trays. Used in picture framing, backing prints, and shelf and drawer lining.	Available in a variety of thicknesses (2mm - 10 mm) and colors.	Plastic version of cardboard. Light, stable, and easily cut with a knife or straight edge. May degrade in sunlight. Watch channels for insects.
Bubble Wrap®	Low-density polyethylene.	Packing material that cushions and protects objects during transport.	Available in a variety of thicknesses and bubble sizes. Sold in rolls.	Avoid direct contact with objects that have a sensitive surface. Some brands of similar material may contain additives and emit harmful by-products. Do not use in long-term storage.

**Fabrics**

Many fabrics are safe to use with museum collections. They often are very cost-effective, too. You can use fabrics to:

- line exhibit cases
- separate objects from rough exhibit or storage supports
- cushion and support objects in long-term storage

You can choose from a variety of archival quality natural and synthetic textiles. The most common and cost-effective natural textiles used in museums are unbleached linen and cotton. Reliable synthetic products include polyester, poly-cotton blends, and acrylic felts.

Be sure to consider the fabric's fiber content and composition before using it. This is very important, especially if the fabric will:

- come in contact with an artifact
- be used in an enclosed exhibit case or storage cabinet

Avoid fabrics that contain finishing treatments. These products can emit harmful degradation products similar to those found in plastics.

Common finishing treatments include:

- fire retardants
- formaldehydes
- phosphates
- adhesives
- resins
- dyes

Look for fabrics with fibers that are held together by *thermalspin-bonding* (randomly placed fibers bonded with heat and pressure) or *needle-punching* (long, random fibers that are mechanically entangled). Also, choose fabrics with a texture that will not harm or stick to the surface of the object.

**Do not use:**

- **Wool or Jute**, which tend to be abrasive and release harmful by-products that can tarnish metals and cause degradation to other collections materials.
- **Carpet** can off-gas harmful emissions and attract dust and insects.

The following chart lists several useful archival quality fabrics for museum storage, exhibition, and packing.

<i>Material</i>	<i>Description</i>	<i>Uses</i>	<i>Types</i>	<i>Remarks</i>
Muslin	Light, woven, cotton fabric.	Used for storage covers, barriers, liners, display backgrounds, and restoration projects.	Unbleached, off-white fabric is available in a variety of weights and thread counts, and as a cotton-polyester blend.	Fabric should be washed before use, and at least once a year to remove any unwanted chemicals and particulates.
Calico Cloth and Unbleached Linen	Light, woven, natural linen fabrics.	Good for dust covers, support stuffing and as a barrier between objects and abrasive storage materials.	Archival quality includes unbleached and untreated linen available in a variety of thread counts.	Should also be washed like muslin. Very cost-effective material.

Cotton Stockinette	Woven cotton that stretches to any shape.	Provides storage and exhibit supports when stuffed with tissue or batting. Good for mounting hats, shoes, and bags.	Comes in a tube shape like a "stocking." Available in rolls.	Easy to use. Requires some stitching to enclose any stuffing within.
Twill Tape	Acid-free, twill-woven cotton "tape" or ribbon.	Used to label textiles, secure objects to mounts, or to tie bags and boxes.	Available in rolls from ¼" to 1" thick.	Soft but strong material that can be marked with acid-free pen for labeling.
Polyester Batting	100% needle-punched polyester that resembles "cotton candy."	Used as stuffing for cushion supports, lining drawers or boxes, and in textile conservation.	Available in bundles or flattened sheets.	Use only thermally bonded fibers, not resin-bonded. Does not absorb water, good in high humidity.
Polyester Felt (Polyfelt)	100% inert polyester. Thick, soft, synthetic felt material.	Provides cushioning in containers, drawers, and shelves. Texture helps prevent shifting of objects.	Available in ¼", ½", ¾" thicknesses. Comes in rolls or sheets.	Make sure to use only thermally bonded, virgin polyester felts to avoid harmful resins.
Tyvek®	Spin-bonded, non-woven, high-density polyethylene fibers. Material resembles a cross between fabric and paper. Contains Teflon®.	Good for shelf lining, dust covers, and as a barrier between objects and exhibit environment. Also can be used for specimen labels.	Available in rolls, in a variety of thicknesses and strengths.	Strong, flexible and smooth. Water and dust resistant, but gas permeable. Used commercially in construction, as indestructible envelopes, and protective clothing.
Remay®	100% spin-bonded, non-woven, polyester sheet.	Provides strong support. Good as a lining, backing, or for interleaving of paper, maps and textiles.	Available in rolls or by the yard.	Does not stretch or tear. Retains its physical properties when wet or with humidity fluctuations. More rigid than Tyvek® or natural fabrics.
Hollytex	100% spin-bonded polyester web sheet.	Same as Remay, but also used to cover fabrics and leather.	Available in rolls or by the yard.	Same properties as Remay®; greater tensile strength, is slightly thinner and less rigid.

Pellon®	Synthetic needle-punched 'fleece.' Sheet version of polyester batting.	Used in storage and exhibit mounts, and for lining and packing shipping crates.	Available at fabric and craft stores in various pre-packaged bags and sheet sizes.	Some Pellon® products are bonded with adhesives. Only use thermally or mechanically bonded Pellon.
Pongee	Synthetic, woven polyester fabric. Soft, slick and shiny.	Used for mounts in storage and display.	Available by the yard.	Does not snag or stick like polyester felts and fleeces. Good for objects with rough or delicate surfaces.
Nomex®	Woven synthetic nylon polymer. Soft, smooth texture. Fire and water-resistant.	Used as a packing material. Makes good object covers for long-term storage.	Available by the yard.	Chemically inert. Resists dust and does not support mold or mildew. Permeable to air and water vapor.

Consult your regional/SO curator and a conservator for more information on the proper use of, and sources for, archival quality storage, exhibit, and packing materials. Also, refer to the following NPS publications:

- *Tools of the Trade*
- *Museum Handbook*, Part I (Chapter 7 and Appendix G)
- other *Conserve O Grams*

The following list of suppliers serves as a preliminary guide for researching the purchase of supplies for your collection. There are numerous distributors of these products. Be sure to consider both convenience and price. **Note:** Check your local fabric and arts & crafts stores for some of these products.

### Suppliers

Archivart  
7 Caesar Palace  
Moonachie, NJ 07074  
(800) 804-8428  
www.archivart.com

Conservation Resources International  
5532 Port Royal Rd.  
Springfield, VA 22151  
(800) 634-6932  
www.conservationresources.com

Coroplast Inc.  
4501 Spring Valley Rd.  
Dallas, TX 75244  
(800) 666-2241  
www.coroplast.com

Dow Chemical (Ethafoam® etc.)  
P.O. Box 1206  
Midland, MI 48642  
(800) 441-4369  
www.dow.com

Dupont Co. (Tyvek® etc.)  
1007 Market Street  
Wilmington, DE 19898  
(800) 441-7515  
www.dupont.com; www.tyvek.com

Testfabrics, Inc.  
P.O. Box 26  
West Pittston, PA 18643  
(570) 603-0432  
www.testfabrics.com

University Products  
P.O. Box 101  
Holyoke, Massachusetts 01041  
(800) 628-1912  
www.archivalsuppliers.com

Voltek (Volara® products)  
100 Shepard St.  
Lawrence, MA 01843  
(800) 225-0668  
www.voltek.com

Zotefoams, Inc. (Plastazote® products)  
55 Precision Dr.  
Walton, KY 41094  
(800) 362-8358  
www.zotefoams-usa.com

Tetreault, Jean and R. Scott Williams. *Materials for Exhibit, Storage and Packing*, Version 4.1. Ontario: Canadian Conservation Institute, 1992.

Williams, R. Scott, et. al. "Guide to the Identification of Common Clear Plastic Films." *SPNHC Leaflets*, no. 3: Fall 1998.

Winsor, Peter and Stephen Ball. "Museum Conservation Materials." The Museums, Libraries, and Archives Council. Available on the web at: <<http://www.mla.gov.uk/information/advice/conserv15.asp>>

Janet Pasiuk  
Intern  
National Park Service  
Museum Management Program  
Washington, DC 20240

### References

Society for the Preservation of Natural History Collections. "Supplies and Materials for Museum Collections." Available on the web at: <[http://www.spnhc.org/documents/supplies\\_usa.htm](http://www.spnhc.org/documents/supplies_usa.htm)>

Storch, Paul S. *Exhibits and Storage Handbook*. St. Paul: Minnesota Historical Society Conservation Department, 2002.

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The *Conserve O Gram* series is published as a reference on collections management and curatorial issues. Mention of a product, a manufacturer, or a supplier by name in this publication does not constitute an endorsement of that product or supplier by the National Park Service. Sources named are not all inclusive. It is suggested that readers also seek alternative product and vendor information in order to assess the full range of available supplies and equipment.

The series is distributed to all NPS units and is available to non-NPS institutions and interested individuals on line at <[http://www.cr.nps.gov/museum/publications/consveogram/cons\\_toc.html](http://www.cr.nps.gov/museum/publications/consveogram/cons_toc.html)>. For further information and guidance concerning any of the topics or procedures addressed in the series, contact NPS Museum Management Program, 1849 C Street NW (2265), Washington, DC 20240; (202) 354-2000.

## Recommended Light Levels For Museum Collections

### While on exhibition:

	Visible light	Ultraviolet (UV) light
<b>Sensitive collections</b> Including textiles, watercolors, photographs and other papers	Maximum: 50 lux (5 footcandles)	Ideal: 0-10 microwatts per lumen Maximum: 75 microwatts per lumen
<b>Less sensitive collections</b> Including oil paintings, wood and leather	Maximum: 150 lux (15 footcandles)	Ideal: 0-10 microwatts per lumen Maximum: 75 microwatts per lumen
<b>Least sensitive collections</b> Including most metal, ceramics, stones and glass	Maximum: 300 lux (30 footcandles)	Ideal: 0-10 microwatts per lumen Maximum: 75 microwatts per lumen

- When exhibiting mixed collections, choose the recommended light levels for the most sensitive artifacts on display.
- Turn off lights in the exhibit area when not in use.
- Sensitive artifacts should not be on permanent display. Exhibit sensitive materials for no more than three months at a time.
- Light damage is irreversible and cumulative. Exposure at low levels for several months can have the same effects as a few days of bright sunlight.

### While in storage:

Museum collections should be exposed to no light at all while in storage. When it is necessary to introduce light levels into the storage area, limit the amount of exposure time as much as possible and filter all UV light.

### Don't have a light meter?

Members of the Texas Association of Museums (TAM) can borrow an environmental monitoring kit, which includes a light meter, for free. For more information, visit TAM's web site at [www.texasmuseums.org](http://www.texasmuseums.org).

## **Credits**

Toxey/McMillan Design Associates (TMDA) developed this workbook for the Texas Historical Commission as part of a workshop series in 2007. The workbook was updated by TMDA in 2009, and by Erin McClelland Museum Services in 2017.