



**Impact Planning, Evaluation & Audience Research**

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**Formative Evaluation:  
*Places of Invention* Exhibition**

*Prepared for the*  
**Lemelson Center for the Study of Invention and Innovation,  
National Museum of American History,  
Smithsonian Institution  
Washington, DC**

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# SUMMARY AND RECOMMENDATIONS

## INTRODUCTION

The Lemelson Center for the Study of Invention and Innovation at the Smithsonian's National Museum of American History contracted Randi Korn & Associates, Inc. (RK&A) to conduct a formative evaluation for *Places of Invention*, an exhibition funded by the National Science Foundation. This report presents findings from a first round of formative evaluation for the *Places of Invention* exhibition. The following summary is organized around the objectives for this round of evaluation and is followed by specific recommendations. As is typical in formative evaluation, there are certain challenges inherent in exploring the objectives while prototypes are under development. When interpreting the findings, we have been careful to consider these challenges to produce a summary and recommendations that are salient.

## SUMMARY BY OBJECTIVES

### VISITORS' USE OF THE PROTOTYPE EXHIBITS

Visitors used the prototype fairly extensively, with all groups visiting the Hartford and Hollywood sections, and the majority visiting the Hub Interactive Map. Additionally, the various components within the exhibition (e.g., interactives, video narratives, graphic panels), were all used to varying degrees by visitors. These findings are encouraging because they suggest that the exhibition will have something for everyone both in terms of content and types of experiences.

However, note that the introductory panel was looked at by only a few despite the fact that the evaluators specifically pointed it out to visitors. This is not so surprising, as it reinforces other research in the field showing that introductory panels are often overlooked (although they can be powerful organizers) (Serrell, 1996). Yet, the challenge of attracting visitors to introductory and orientation is a reminder for developers and designers to thread the big idea throughout the exhibition as the Lemelson Center intends.

### VISITORS' USE OF THE INTERACTIVES AND POTENTIAL BARRIERS TO INTENDED USE

#### VIDEO NARRATIVES

At least one member in most visitor groups used the video narratives. Generally, there was one visitor in the group, typically an adult, who played the video. Sometimes, others in the group would watch the video (often just parts of it) along with the initiating visitor, while in other cases, the initiating visitors watched alone. This is fairly typical behavior since videos tend to be of personal interest to some visitors and of little or no interest to others, which is why they normally have low usage (few visitors stop at them) but long dwell times (visitors who stop at them stick around) (RK&A, 2007; 2009). Since personal preference is the overriding factor for selecting to watch videos, the Lemelson Center should consider whether the videos in the exhibition will function similarly to prototypes (e.g., requiring activation) or whether they will play on a continuous loop. Both options have advantages and disadvantages. For instance, playing videos on a loop may capture the attention of those who do not have a penchant for videos. On the other hand, visitors who naturally gravitate to videos may be turned off by this approach since they will likely be jumping into a video mid-stream.

Usability issues with the video narratives are products of the prototype and not worth discussing (e.g., sound, intuitiveness of usability). However, there were negative comments about the narration of the videos that require consideration. For instance, some visitors referred to the historians as “talking heads” or said that they lacked passion. Additionally, a few lamented that they didn’t feature inventors in the story. These findings suggest that NMAH will need to take a more dynamic approach to the videos, perhaps by showing the historians interacting with relevant objects.

### **MANUFACTURING INTERACTIVE**

The manufacturing interactive was used by the majority of groups, which is moderate usage for an interactive. Likely, the complex look of the interactive (e.g., multiple stations and lengthy directions) may have discouraged some from participating. However, almost all who started using the interactive persevered through to the end of the process of making a cardholder, which suggests that the interactive is engaging for those who choose to engage with it. Additionally, the display of the interactive in its prototype form was quite crowded, which also may have deterred some people (e.g., visitors did not want to wait to use the exhibit); this could potentially be an issue even in the final version of the interactive given the length of time it takes visitors to go through the process of making a cardholder.

There were several usability issues with the interactive, largely owing to the fact that the interactive was in a very preliminary stage at the time of testing. These hiccups are still worth noting because they provide insight into how the interactive may be further designed for optimal use. First, following the instructions was difficult for many. Simplifying and fine-tuning the written instructions will be helpful, as well as presenting clearer images of the product in its various stages. Also, further designing and fine-tuning the jigs will be crucial. As we observed, visitors often had trouble determining where to put the metal ring in Station 2 and difficulty understanding how line up the wire and operate the slider in Station 3. Along with clearer instructions, using colors and labels on the jigs may help clarify this issue. Again, visitors persevered through the process, which bodes well for the success of the interactive.

In the further remediation of the interactive, the Lemelson Center and Roto should consider how to reinforce content in this interactive. While for some, the interactive clearly supported the content of the rest of the Hartford section and ideas about manufacturing and precision tooling, a significant proportion of visitors left the interactive with superficial ideas about the intended content. It seems that visitors who left the exhibition with a strong understanding of how the interactive supported concepts of manufacturing and precision tooling read the graphic panels OR someone in their group read the graphic panels and parlayed this information to group members who were using the interactive. The latter suggestion is purely a hypothesis based on evidence that children tended to use the interactive while adults stood back and coached the children but also looked at things like graphic panels and object photos. Conversation between groups at the Manufacturing Interactive often went undocumented given that the evaluator had to stand behind the visitor in order to overhear such conversation.

### **TECHNICOLOR INTERACTIVE**

The Technicolor Interactive was very popular, with nearly all groups and all group members using the interactive during their visit. It also proved easy to use. While there are a few things that Roto and the Lemelson Center can do to improve the interactive’s functionality, such as creating a ledge or providing markers to line up the transparencies on the lightbox, these factors did not impede its intended use and enjoyment.

The prototype may, however, be further remediated to support visitors’ understanding of the Technicolor process. In interviews, visitors clearly indicated that the interactive related to the Technicolor process although they rarely demonstrated an understanding beyond this (e.g., indicating that the Technicolor camera filtered the image onto three strips that were then layered like the

transparencies in the interactive). Simply reworking the instructions and materials surrounding the interactive may have the intended impact.

### **HUB INTERACTIVE MAP**

The Hub Interactive Map was used to some degree by more than one-half of visitors. The placement of the interactive in relation to the other sections for testing purposes was unfortunate; that is, visitors had to pass by the interactive to move between the Hollywood and Hartford sections (which can enhance visitation), but the stanchion made this space feel like a corridor, which does not encourage visitation and dwell time. Of course, this is simply a challenge of the prototype. It is very likely that engagement with the interactive (visitation and dwell time) will be higher given the design proposed for the actual exhibition.

As was discussed before the testing as well as in debriefs, exhibits and experiences that are highly participatory or solicit visitor-generated material will be used in various capacities. Therefore, it is not surprising that visitors to the Hub Interactive Map were more likely to read comments and watch videos than they were to write comments and record videos. These findings parallel what we know about participatory experiences in general. In her book, *The Participatory Museum*, Nina Simon points out, “Only 0.16 percent of visitors to YouTube will ever upload a video. Only 0.2% of visitors to Flickr will ever post a photo” (2010, p. 2). These findings should not discourage the Lemelson Center and Roto. Visitors have the opportunity to engage with the interactive to the capacity they desire.

The biggest challenge to the interactive is in clearly indicating what type of content the Museum seeks through the Hub Interactive Map. For some, the instructions, “Share your place of invention” was not explicit enough to encourage them to do so. Suggesting specific categories for visitors in this regard, can help significantly. Filtering the comments and posting examples that demonstrate the categories of content the Museum seeks will also be useful, although filtering in particular, may be a time consuming task for the Lemelson Center staff. Additionally, defining “place of invention” is paramount. In interviews, visitors were split regarding whether they felt they knew enough about places of invention to share one. Potentially seeing the Hub Interactive Map in the larger context of the full exhibition as well as concrete concepts to spark their thinking may help visitors gain enough context to share a post.

As the Lemelson Center hopes, the Hub Interactive Map has great potential for tying together the various places highlighted in the exhibition and reinforcing the exhibition message. One potential barrier though is that the interactive reinforces the idea of place as in geographic sense. If the Lemelson Center wants to present “place” in a few contexts (e.g., geography, time, workspace) then the team will need to consider the conceptual framing of the interactive. Here again, providing a variety of specific options for the types of content being sought from visitors may allow for a broader interpretation of “place” despite the map.

### **VISITORS' INTERPRETATION OF PLACES OF INVENTION**

Based on their experience with the prototypes, nearly one-half of visitors spoke about “place” when describing the ideas behind the exhibition, which is encouraging. Ideas ranged in nature from saying that invention can happen anywhere to describing what makes a place of invention. While visitors are piecing together a range of ideas about place from experiencing the exhibition, the concern is that they are not gleaned one overarching idea. For instance, visitors provided examples from individual stories or prototypes but were not able to see the larger idea that these stories exemplified. This lack of clarity and consensus on what a place of invention is was further evidenced in visitors’ responses to specific questions. For instance, questions, “What does the exhibition show you about places of invention?” and “What do these two places have in common?” generated a variety of responses. Visitors often paused before responding to these questions, suggesting that the questions were potentially challenging their

assumptions about the exhibition. These findings imply that the Lemelson Center may need to further articulate the big idea and thread it through the exhibition.

## VISITORS' UNDERSTANDING OF THE RELATIONSHIPS AMONG PEOPLE-PLACE-INVENTION AND 21<sup>ST</sup> CENTURY SKILLS

Overall, visitors are not making connections between people-place-invention and 21<sup>st</sup> Century skills as a result of their experience with the prototype. When asked to think about characteristics of places of invention and of people in places of invention as highlighted in the prototypes, visitors generally fell back on their personal experiences rather than drawing on examples from the prototypes despite being asked to do so. This is not surprising, as areas like Skill Spots are superficially inserted in the prototypes although they are intended to be integrated into the exhibition more fully.

Yet, despite the fact that visitors are not connecting 21<sup>st</sup> century skills with the exhibition content as a result of their experiences with the prototypes, the fact that they were readily able to think about 21<sup>st</sup> century skills as related to their *personal experiences* is quite positive. This means that the skills resonate with them and that they have the potential to make connections between the 21<sup>st</sup> century skills, themselves, AND places of invention with some remediation of the prototypes. For instance, as described during the debriefs, highlighting these skills within the graphic panels and interactives versus segregating these ideas to the Skill Spots may help think about the exhibition content in this light.

## RECOMMENDATIONS

### OVERALL

- ◆ Consider how to introduce the exhibition so that the idea of “place” is clearly articulated through text and design. For instance:
  - ❖ Consider defining “place” in the introduction or elsewhere to indicate the complex meaning of *Places of Invention* that NMAH intends.
  - ❖ Consider reserving the word “place” to refer to the more complex idea of the exhibition and using the terms “time” and/or “location” as appropriate.
  - ❖ Since the map proved to be a strong indication of place as location, consider how to use maps or globes strategically to that end, as well as avoid such imagery when “place” is intended to represent a broader concept.
- ◆ In order to further articulate the idea of “place,” consider clarifying the big ideas in the graphic panels to address people, location, and invention, rather than people, place, and invention.
- ◆ Consider how to integrate 21<sup>st</sup> Century Skills into the rest of the exhibits versus confining them to Skill Spots.

### TECHNICOLOR INTERACTIVE

- ◆ Rewrite Dorothy’s Ruby Slippers label to explicitly emphasize the role of Technicolor in the decision to change Dorothy’s slippers from silver, which is authentic to the book, to ruby, which was more visually appealing and took advantage of the development of Technicolor.
- ◆ Explicitly connect the Technicolor process and the three color transparencies on the lightbox. For instance, modify both the description of the Technicolor process on the instructions and the label for the Technicolor camera to clearly state:
  - ❖ The film is not colored.
  - ❖ The Technicolor camera filters the image onto three strips of film—one strip captures the blues, one captures the greens, and one captures the reds.

- ❖ The three strips were combined or layered to result in a color movie.
- ◆ Consider showing a video that depicts how the camera filters the light and combines the three images. Even something as simple as showing how the colors merge would be useful (see the video embedded in the blog: <http://io9.com/5904930/how-technicolor-created-ruby-slippers-without-using-color-film>)

### MANUFACTURING INTERACTIVE

- ◆ Consider simplifying the instructions.
- ◆ Consider refining the interactive so the process feels more akin to manufacturing. Selecting colors and other design features that make the interactive look like manufacturing may help visitors connect the interactive and mass production and precision tooling.
- ◆ Consider ways to exhibit the interactive so that as many visitors as possible can work at the interactive simultaneously.

### VIDEO NARRATIVES

- ◆ Consider your purpose for the video narratives. Are they available for visitors seeking more information in general? Are they intended to highlight people in the places of invention stories?
- ◆ Consider how to make the narrators seem less like “talking heads.” Potentially, show the historians talking about actual objects (e.g., them in the same space as the object). It is likely that the historians will speak more passionately if given something to focus their attention on, and at the very least, it will provide them something to which they can gesture. It also bolsters what is significant about these historians—they work with the Smithsonian’s collections.

### HUB INTERACTIVE MAP

- ◆ Consider rephrasing the direction “Share Your Place of Invention.” Potentially include multiple posting options like, “Tell me about a place where an important invention was created,” or “Tell me about a place where you invent.”
- ◆ Since the Hub Interactive Map will be a completely digitally media, consider how to respect the personalized feeling of written comments in the Hub Map Interactive. For instance, consider giving visitors the option of including a photograph or allow for the tagging of posts into more personalized categories.
- ◆ Additionally, since the Hub Interactive Map will be completely digital, consider how best to present the interactive to those visitors who may shy away from overly technological interactives.
- ◆ Consider how NMAH might filter comments and videos, both to ensure the content available in the Hub Interactive Map, but also as a way of keeping the content fresh and diverse.

### REFERENCES

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# INTRODUCTION

The Lemelson Center for the Study of Invention and Innovation at the Smithsonian's National Museum of American History contracted Randi Korn & Associates, Inc. (RK&A) to conduct a formative evaluation for *Places of Invention*, an exhibition funded by the National Science Foundation. For this first round of evaluation, the Lemelson Center and the exhibition design firm Roto mocked up a small portion of the exhibition, which include parts of the Hartford and Hollywood sections as well as the Hub Interactive Map. A second round of formative evaluation will be conducted later in 2013.

The objectives of the evaluation are to explore:

- ◆ How visitors use the prototypes;
- ◆ How visitors interpret the prototypes;
- ◆ Whether there are any barriers to visitors' use of the interactives;
- ◆ Whether visitors understand the relationships among people-place-invention and 21<sup>st</sup> century skills; and
- ◆ How visitors interpret what this exhibition, *Places of Invention*, is about.

## METHODOLOGY

As mentioned previously, the prototype area created by the Lemelson Center and Roto presented a portion of the Hartford and Hollywood sections as well as the Hub Interactive Map. It was displayed in the 1 West Corridor near the elevators. The space was stanchioned off to create a singular entrance into the prototype area where an introduction to the entire *Places of Invention* exhibition was displayed, which included a layout showing the exhibition's six places and the Hub Interactive Map. The photograph on the right depicts the entrance to the space and provides a general sense of its scale.



RK&A recruited walk-in adult visitors who were alone or with children 10 years and older to participate in the study. Most visitors were recruited from the central corridor near the prototype, although a few visitors were recruited on level 2. RK&A tried to recruit groups of no more than four individuals but made some exceptions.

Upon agreement, RK&A escorted visitors to the entrance of the prototype area and introduced the exhibition to visitors by name (e.g., *Places of Invention*). RK&A informed visitors that they would experience just a part of the larger exhibition, and it was created for preliminary feedback (e.g., not finished). RK&A pointed out the introduction to the exhibition and asked visitors to spend as much time as they would like in the prototype area. While visitors experienced the prototype area, RK&A

took open-ended, handwritten notes on visitors' behaviors and conversations. After visitors completed their experience, RK&A conducted an interview. All visitor groups were asked a general set of questions about their overall experience in the prototype area, and a set of questions about one of four specific components that they had used. These components include Video Narratives, Hollywood Technicolor Interactive, Hartford Manufacturing Interactive, and the Hub Interactive Map. See Appendix A for the interview guide. Following the interview, RK&A recorded demographic information, including gender, age, and first-time/repeat visit to NMAH. As a token of appreciation for their participation, each visitor received a Lemelson Center pencil.

## **DATA ANALYSIS AND REPORTING METHOD**

Observations and interviews produce descriptive data that are analyzed qualitatively, meaning that the evaluator studies the data for meaningful patterns and, as patterns and trends emerge, groups similar responses. Both observation and interview data are presented as narrative bullets within themed sections versus by methodology. Keep in mind that the sample size for the component-specific interviews is smaller than the overall sample since groups were not specifically asked about each component; for the component-specific interviews, the size of the sample is described in a footnote. Where possible, participants' verbatim language (edited for clarity) is included to exemplify trends.

### **SECTIONS OF THE REPORT:**

1. Overall Experiences
2. Video Narratives
3. Manufacturing Interactive
4. Technicolor Interactive
5. Hub Interactive Map
6. Understanding of Exhibition Messages

# PRINCIPAL FINDINGS

## INTRODUCTION

The *Places of Invention (POI)* prototype area was tested during three weekdays in January. RK&A approached 79 groups of visitors at the National Museum of American History (NMAH), and 46 groups agreed to participate, for a participation rate of 58 percent. The 46 participating groups consisted of 137 visitors. Groups ranged in size from individuals to as many as six visitors; the median group size was three visitors. One-half of groups consisted of adults and children, and at least one-third of participants were in town for March for Life.

Of individual respondents:

- ◆ Nearly two-thirds are female, and one-third are male.
- ◆ More than one-half are adults, and almost one-half are children.
- ◆ Adult ranged in age from 18 to 76 years, and the median age of adults is 41 years.
- ◆ Children ranged in age from 6 to 17 years, and the median age of children is 14 years.
- ◆ Two-thirds are first-time visitors to NMAH, while one-third have visited NMAH previously.
- ◆ Most are United States residents (see Appendix B for Zip Codes of US residents and countries of non-US residents).

## OVERALL EXPERIENCES

In this section, we summarize visitors' general behaviors in the prototype area as well as their initial opinions of their experiences. This section is intentionally general (top-line summary) since the next few sections provide a detailed description of specific prototype components.

### OBSERVATIONS

- ◆ All observed groups visited the Hartford section. Within the Hartford section:
  - ❖ The majority used the Manufacturing Interactive.
  - ❖ Most looked at the Graphic Panel.
  - ❖ Most looked at the Object Photos and Labels.
  - ❖ Many visitors watched at least one Video Narrative.
  - ❖ A few visitors looked at the Flexibility Skill Spot.
- ◆ All groups visited the Hollywood section. Within the Hollywood section:
  - ❖ Almost all used the Technicolor Interactive.
  - ❖ Most looked at the Graphic Panel.
  - ❖ Most looked at the Object Photos and Labels.
  - ❖ Most watched at least one Video Narrative.
  - ❖ About one-quarter looked at the Collaboration Skill Spot.
- ◆ More than one-half of groups looked at the Hub Interactive Map. At the Hub Interactive Map:
  - ❖ Many read the comments posted by others on Post-it notes.
  - ❖ About one-quarter posted their own comment using a Post-it note.
  - ❖ A few watched videos shared by others.

- ❖ Two recorded videos.
- ◆ A few looked at the introductory panel.

## INTERVIEWS

Most enjoyable aspects of the prototype area:

- ◆ More than three-quarters of interviewees talked about the interactive elements of the experience. The majority talked about a specific interactive that they liked most, with nearly two-thirds describing the Technicolor Interactive and almost one-half describing the Manufacturing Interactive. Some also talked generally about the hands-on or interactive aspects of the prototype area.
- ◆ More than one-quarter said they liked the exhibition topic the most. In this regard, the majority talked about aspects of the Hartford story that they enjoyed, including its focus on Samuel Colt and his role in the development of mass production, as well as the fact that Hartford was an unexpected place of invention. Several talked about aspects of the Hollywood story, with many talking generally about an interest in movies.
- ◆ Several enjoyed the Hub Interactive Map, with many talking about the fact that it allowed them to “put forth something [they] are working on or thinking about,” and that the map showed where others visitors came from.
- ◆ A few described the Video Narratives, often specifically referring to videos they had watched (e.g., “the first video says you have to have the support of community to do things.”).

Least enjoyable aspects of the prototype area:

- ◆ More than one-third talked about the Video Narratives in either the Hollywood or Hartford section. Specifically, some said the videos were boring or did not hold their attention, while some said it was difficult to hear the videos given the other noise in the area. A few said the videos were too long, and two interviewees said the videos were least interesting because they were not interactive.
- ◆ Almost one-quarter said that the Manufacturing Interactive was the least interesting part of the prototype area; the majority said this was because the interactive was confusing, and one said the connection between the interactive and the information about Hartford was unclear.
- ◆ Several said they least liked the Hartford story. Some of these visitors did not like the focus on guns, while the remaining interviewees said they were not interested in the Hartford story in general (e.g., “I’m not really interested in technical inventions and things.”).
- ◆ Several said their least favorite part of the prototype area was the large amount of text included.
- ◆ A few said that the Hub Interactive Map was their least favorite part of the prototype area, although there was no single reason for their opinion other than personal preference (e.g., “I don’t want to see what other people invented”).
- ◆ A few interviewees said the Hollywood story was the least interesting part of the prototype area; these reasons were also tied to personal preference.

Aspects of the prototype area that are confusing or hard to understand:

- ◆ More than one-third of interviewees said nothing was confusing or hard to understand.
- ◆ More than one-third described the Manufacturing Interactive, often saying they had trouble following the directions for the interactive.

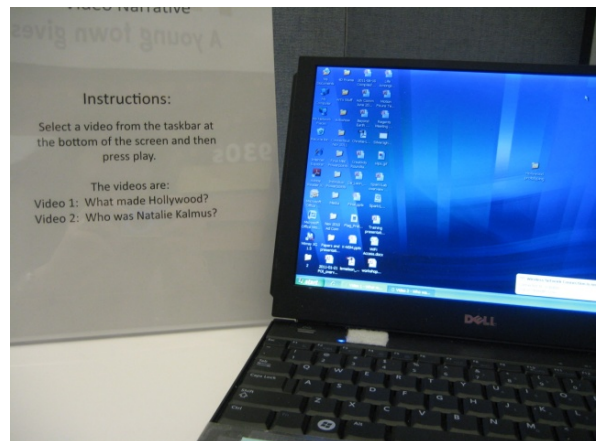
- ◆ A few indicated that the Hub Interactive Map was confusing, citing a variety of reasons including the intent of the interactive (e.g., what visitors were supposed to do and what the “Share your place of invention” prompt meant).
- ◆ Two interviewees said the explanation of the Technicolor film process was unclear (e.g., “The explanation of the Technicolor filming process. I would want a cartoon diagram explaining how it works below the picture of the camera.”)
- ◆ One interviewee was unsure where Hartford was located.

Exhibits or ideas that are intriguing/piqued visitors’ interest in the prototype area:

- ◆ More than one-half of interviewees talked about the Technicolor Interactive and the process used to create color film.
- ◆ Almost one-fifth talked about the invention theme, with the majority talking about the fact that invention can happen anywhere or be anything.
- ◆ One-fifth talked about an idea from the Hartford story, with the majority of these interviewees talking about the mass production process introduced by Samuel Colt.
- ◆ Several talked about an idea from the Hollywood story, with several mentioning the fact that the ruby slippers in *The Wizard of Oz* were originally meant to be silver.
- ◆ Several said the Manufacturing Interactive piqued their interest because it is interactive and they made something they could take with them.

## VIDEO NARRATIVES

This section describes visitors’ experiences with the Video Narratives in both the Hartford and Hollywood sections. A total of four videos were available: “What is the essence of a place of invention?” “Who was Samuel Colt?” “What made Hollywood?” and “Who was Natalie Kalmus?” The videos were displayed on laptops, which the evaluator told visitors they were allowed to use; instructions for playing the videos were displayed nearby. On the first day of testing, the “What is the essence of a place of invention?” video was available on both laptops. However, on the second day of testing, it was only available on the laptop on the Hartford section. Also on the second day, the instructions were amended to include the list of available videos at each laptop (see photograph above).



## OBSERVATIONS

- ◆ Almost all groups watched at least one video. More than one-half watched more than one video, with several visitors watching all four videos.
- ◆ Of the videos in the Hollywood section, more than one-half watched “What made Hollywood?”; almost one-third watched “Who was Natalie Kalmus?”
- ◆ Of the videos in the Hartford section, almost one-half watched “Who was Samuel Colt?”; more than one-third watched “What is the essence of a place of invention?”
- ◆ Most visitors who started watching a video watched the entire video before moving on.

- ◆ Overall, adults were more likely to watch videos than children; adults were also more likely than children to watch multiple videos.

## INTERVIEWS<sup>1</sup>

Most enjoyable aspect of the Video Narratives:

- ◆ Almost two-thirds of interviewees talked about the information provided in the videos. Specifically, the majority talked about specific pieces of information they learned from the videos (e.g., “I liked the specific example . . . in Hollywood, the need for collaboration and John Barrymore looking for a house and realizing the area could be developed [more].”), while some referred generally to the history presented in the videos.
- ◆ Several said they did not like anything about the Video Narratives.
- ◆ A few said they liked the pictures included in the videos.

Least enjoyable aspects of the Video Narratives:

- ◆ One-third of interviewees said at least one of the videos was difficult to hear.
- ◆ Another one-third talked about aspects of the video presentation as what they liked the least. The majority of these interviewees said they did not like the “talking head” or “lecture” narration style of the videos.
- ◆ Almost one-third said the videos were dry and did not draw their attention.

Confusing or unclear aspects of the Video Narratives:

- ◆ Almost all interviewees said that nothing was confusing or unclear.

Opinion of the video length:

- ◆ Two-thirds of interviewees thought that the clips were a good length.
- ◆ A few felt that the videos were too short; however, some of these interviewees suggested creating more videos instead of creating longer videos, saying that longer videos are “more apt to lose people.”

How the ideas in the videos compare with other information in the prototype area:

- ◆ Most interviewees said the stories in the Videos Narratives aligned with information presented in the rest of the prototype area. However, some of these interviewees commented on the amount of information provided in the Video Narratives, with interviewees generally split on whether they took more information away from Video Narratives or other parts of the exhibition like the graphic panels.

Opinions about how the stories were told:

- ◆ More than one-quarter of interviewees said that the “talking head” narration style of the video was boring. One-fifth said the video needed animation or additional pictures.
- ◆ Almost one-quarter said they wanted more information in the videos, with one interviewee saying the information in the videos should be more specific to an event or person. Another interviewee said, “Show the process of mass manufacturing and Technicolor.”

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<sup>1</sup> RK&A interviewed 15 groups consisting of 40 individuals.

- ◆ Two interviewees said that the people included in the videos should be part of the industry on which the video is focused rather than historians.
- ◆ Slightly more than one-third did not have any comments about how the stories were being told or about the storytellers.

Expectations of historians:

- ◆ Almost three-quarters of interviewees said the staff were similar to what they would expect of historians. Specifically, the majority said the staff were very knowledgeable about the subject on which they spoke.
- ◆ Several said the staff did not seem like historians. A few said the staff in the videos spoke more factually than passionately, whereas they thought historians would show more passion.

## MANUFACTURING INTERACTIVE

The Manufacturing Interactive was displayed on a table on the left side of the Hartford section and consisted of four wooden jigs which were labeled with station numbers. An introductory panel described the overall purpose of the interactive (“mass produce” and “innovate”), and, if the visitor chose to mass produce a cardholder, a series of labels with written instructions and pictures described what the visitor is supposed to do at each station. Also, behind each jig was a manipulated wire as an example of what the cardholder should look like after each station; by the second day of testing, these were clearly labeled as examples. The photograph on the right shows the prototype on the first day of testing.



## OBSERVATIONS

- ◆ Many groups used the Manufacturing Interactive, and the majority of individuals within these groups used the interactive in some way.
- ◆ Children and young adults were more likely than adults to manipulate the wire, while adults often took on a supervisory role or simply observed.
- ◆ Most individuals who started manipulating the wire completed the activity by following the steps.
- ◆ Most individuals seemed to read the instructions and look at the pictures. The evaluator often observed visitors looking back and forth between the instructions and the jigs. The evaluator also observed some adults reading the instructions aloud to their children or paraphrasing the instructions for them.
- ◆ The majority of visitors encountered difficulty at Station 2. Visitors tended to place the wire into the vertical slot instead of the horizontal one as the instructions intend. Some of these visitors eventually used the horizontal slot as intended, but some did not. However, the addition of the label “↑ CIRCLE” to the Station 2 jig on the second day seemed to reduce the amount of help visitors needed to use the station as intended.

- ◆ The majority of visitors also encountered difficulty at Station 3. Visitors tended to have difficulty understanding how to line the wire up with the slider. The addition of the instruction “line up straight wire here” on the Station 3 jig seemed to help slightly. Visitors eventually used the jig correctly, although visitors still spent a significant amount of time at this station.
- ◆ More than one-half of visitors, the majority of which used the interactive on the first day of testing, did not take their cardholder with them.<sup>2</sup>

### INTERVIEWS<sup>3</sup>

#### Visitor behaviors:

- ◆ Most either described the step-by-step process of making the cardholder holistically (e.g., “We used wooden blocks and followed instructions to manipulate wire into a business card holder”) or talked through the steps (e.g., “I took wire and spun it around, took it out, put it in a new one [jig] and bent it. . .”).
- ◆ All groups said they followed the step-by-step instructions versus making their own product. When asked how they decided to do this, most said they followed the instructions because they would not know what to do without the instructions, while one said she did not know that she could do something different than follow the step-by-step instructions.

#### Most enjoyable aspects of the Manufacturing Interactive:

- ◆ About one-half liked *making* the cardholder, describing the process as fun, hands-on, and even surprising (e.g., were surprised to see how the final product turned out).
- ◆ About one-half liked how the cardholder looked or liked that they could take it home with them.

#### Least enjoyable aspects of the Manufacturing Interactive:

- ◆ Most said that what they least liked about the interactive was the difficulty they encountered when making the cardholder.
- ◆ Two interviewees raised safety concerns, with one requesting safety glasses and another saying that the wire pricked her a couple times.

#### Confusing or unclear aspects of the Manufacturing Interactive:

- ◆ Many interviewees said that the pictures were hard to follow, with one saying that they looked complicated or were not clear enough to see what was happening.
- ◆ About one-half said the written instructions were difficult to follow.
- ◆ About one-half said the jigs were difficult to use, particularly the slider on the Station 3 jig.
- ◆ One interviewee said the instruction on the Station 3 jig, “line up straight wire here,” was not explicit enough because nothing indicated the precise location of “here.”

#### Purpose of the Manufacturing Interactive:

- ◆ A few said that it was about “manufacturing” or “mass production.” In addition to using the words “manufacturing” and “mass production,” these interviewees described the essence of

<sup>2</sup> Visitors who did not take their cardholder left it on the end of the table near Station 4. On the first day, the evaluators were not as diligent in clearing the excess cardholders, which may have suggested that visitors could not take them home.

<sup>3</sup> RK&A interviewed 8 groups consisting of 30 individuals.



these ideas, saying “There’s a step-by-step process in manufacturing to get consistency and less variation,” and “Manufacturing is a lot of simple steps [that are] easily repeatable.”

- ◆ Two interviewees described something about invention that fell outside the realm of manufacturing. These responses include: “You can make something out of anything,” and “You can invent something to make it easier. [You can] invent something to draw attention to yourself and your home town. How new technology can benefit a people locally, nationally and even later.”

Learning about precision tooling:

- ◆ More than one-half provided an accurate and specific description of precision tooling, such as that it is a “repeatable process” that makes parts that are all the same. While two of these interviewees weren’t as specific, they talked about precision tooling in terms of following steps or “creating precision with fairly simple tools.”
- ◆ A few others did not know what precision tooling was or provided a miscellaneous response.

Opinion of creating more than one cardholder at the Manufacturing Interactive:

- ◆ The majority said that creating more than one wire object would allow them to “improve,” “get better,” or learn the process, although it was not clear whether visitors thought completing the process more than once would support their understanding of precision tooling.
- ◆ A few others said they would not want to use the interactive a second time if they had completed the card holder correctly the first time.
- ◆ Two interviewees specifically understood that making more than one copy of the card holder would support their understanding of precision tooling, although they did not express whether they thought it was a good idea.

## TECHNICOLOR INTERACTIVE

This section describes visitors’ experiences with the Technicolor Interactive, which was displayed on a table on the right side of the Hollywood section and included explanatory text. After the first day of testing, the Object Photos for the Hollywood section were displayed above the interactive (see photograph on the right).

### OBSERVATIONS

- ◆ Almost all groups and almost all individuals in the groups used the Technicolor Interactive.
- ◆ The interactive was used alone and in groups with one or more individuals watching one visitor manipulate the transparencies.
- ◆ Several visitors stacked the transparencies multiple times in different orders when using the interactive.
- ◆ Some visitors, particularly children, returned to use this interactive multiple times.
- ◆ A few visitors were unsure how to proceed with the interactive if the transparencies were already on the lightbox when they approached the station. These visitors often looked at the image for



several seconds before touching the lightbox, although all visitors ultimately realized they could remove the transparencies.

## INTERVIEWS<sup>4</sup>

Visitor behaviors:

- ◆ All interviewees talked about stacking the three transparencies on the lightbox. Specifically, some talked about creating or enhancing the scene from *The Wizard of Oz*, while some others talked about how the colors changed when the transparencies were stacked.

Most enjoyable aspects of the Technicolor Interactive:

- ◆ More than one-half talked about the colors changing and enhancing the scene from *The Wizard of Oz* as the transparencies were stacked.
- ◆ Several liked that the interactive was easy to use.
- ◆ Several liked the scene itself (e.g., the fact that it was a familiar scene from a popular film).
- ◆ A few also liked seeing how the order of the three transparencies (cyan, magenta and yellow) affected the colors in the final picture. It is unclear whether these visitors thought the order of the transparencies altered the final result.

Least enjoyable aspects of the Technicolor Interactive:

- ◆ One-half of interviewees said that they liked everything about the interactive.
- ◆ Several said there should be additional scenes available to use or the interactive should somehow be augmented with more content such as video of the scene.
- ◆ Several provided idiosyncratic responses (e.g., the transparencies did not always line up exactly; it was unclear how the interactive related to the real Technicolor process which included black and white film).

Confusing or unclear aspects of the Technicolor Interactive:

- ◆ Two-thirds of interviewees said that nothing was confusing or unclear.
- ◆ Several cited information from the directions as unclear or suggested information they thought was missing from the directions. For example, one visitor said, “You have to line them [the transparencies] up. You have to understand that.” Another visitor found the use of the word “cyan” instead of “blue” to be confusing.
- ◆ One interviewee said the connection between the interactive and the actual Technicolor process was unclear.

Opinions of the explanatory text/instructions:

- ◆ One-third of interviewees said the text was fine, saying that it gave “enough information,” and “didn’t make [them] lose interest.”
- ◆ Several said they did not read the text.
- ◆ Several said that a demonstration of the interactive or a photograph of the final product (such as *The Wizard of Oz* photograph on the back wall of the prototype space) would be helpful in understanding the process.

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<sup>4</sup> RK&A interviewed 12 groups consisting of 32 individuals.

- ◆ One interviewee recommended adding questions and suggestions to the instruction text to encourage more experimentation within the interactive.

#### Purpose of the Technicolor Interactive:

- ◆ Almost one-half said the interactive was trying to show visitors the Technicolor process, however, only a few of these interviewees expanded on the idea. For example, one visitor said, “[The interactive was trying to show visitors] how the film became Technicolor. It wasn’t [possible to] just take a picture and [have] it happen.”
- ◆ Several said it was trying to show how color film was made.
- ◆ Several talked about the progress of film over time (e.g., the addition of sound and color, as well as the transformation to digital film).

## HUB INTERACTIVE MAP

This section describes visitors’ experiences with the Hub Interactive Map. The interactive was set up between the Hartford and Hollywood sections. A map of the United States was displayed under the title, “Share Your Place of Invention.” A small table with one chair was displayed in front of the map; it contained instruction for the interactive, a laptop on which visitors could record or watch recorded videos, a pack of Post-it notes, and a pencil holder with pencils. On the first day of testing, the prototype was set up as depicted in the photograph on the right; on the second day of testing, the table and chair was moved to the right side of the prototype.



## OBSERVATIONS

- ◆ More than one-half of observed visitors read comments posted by other visitors.
- ◆ About one-quarter posted a new comment to the map.
- ◆ Several watched the videos recorded by other visitors.
- ◆ Two recorded videos.
- ◆ A few visitors had trouble switching from video-watching to video-recording mode.

## INTERVIEWS<sup>5</sup>

#### Visitor behaviors:

- ◆ Reading comments posted on the map – All interviewees said they had done so.
- ◆ Watching videos posted by other visitors – Almost two-thirds said they had done so, often saying the videos were interesting, while one-third said they did not watch the other videos. Of those who chose *not* to watch the videos:
  - ❖ The majority said they skipped them because they were not interested.
  - ❖ Some said that the interface for watching videos was not user-friendly.
  - ❖ One interviewee said it was unclear that one could watch videos in addition to recording a video.

<sup>5</sup> RK&A interviewed 10 groups consisting of 33 individuals.

- ◆ Posting comments on Post-it notes – One-half of interviewees said they had done so, while the other one-half had not. Of those who chose *not* to post a comment:
  - ❖ The majority said they could not think of anything to write.
  - ❖ One interviewee said s/he was not from the United States and therefore did not have a place to contribute within the confines of the map.
- ◆ Recording a video – Only two interviewees did so. Of those who did *not* record a video:
  - ❖ The majority said the recording option did not appeal to them personally, with some of these respondents mentioning that they are camera shy.
  - ❖ Several said they could not think of anything to share in a video.
  - ❖ One interviewee was unaware it was possible to record a video.

Most enjoyable aspects of the Hub Interactive Map:

- ◆ Almost three-quarters of interviewees said they liked the stories that people shared; several of these interviewees specifically mentioned that the stories were personal, which attracted their attention.
- ◆ A few liked that the interactive highlighted the idea that “people invent all over the world.”

Least enjoyable aspects of the Hub Interactive Map:

- ◆ One-half of interviewees talked about presentation-related items, such as the one-dimensional map, or the size and temporary quality of the Post-it notes. Specifically, two interviewees talked about the fact that the large Post-it notes made it difficult to post a new idea in a densely populated area, such as the Northeast where many Post-it notes were already in place.
- ◆ Several said they did not like the video component of the interactive because they did not think people would take the video seriously.
- ◆ Several said they liked all parts of the interactive.

Confusing or unclear aspects of the Hub Interactive Map:

- ◆ More than three-quarters of interviewees said there was nothing confusing or unclear about the Hub Interactive Map.
- ◆ One-fifth of interviewees said the intent of the interactive was unclear. For example, one visitor said, “Are you supposed to brag about your hometown invention? Your invention? Have you created something there? I wasn’t sure what to share.”

Presence of sufficient context about place of invention to post a comment or make video:

- ◆ Almost three-quarters of interviewees said they had sufficient knowledge. These interviewees offered a variety of explanations, although most were idiosyncratic. For example, one interviewee said a place of invention could be physical or mental, while another said that many things could qualify as an invention.
- ◆ More than one-third of interviewees said they did not know enough about a place of invention to post a comment or make a video (e.g., “I know [Thomas] Edison was from our area, but I didn’t get that connection. . . . I don’t think about place that way, don’t have those connections.”). However, one interviewee said the fact that she did not feel informed enough did not stop her from posting something.

Purpose of the Hub Interactive Map:

- ◆ Many talked about the fact that an invention could be anything, could happen anywhere, and can involve anyone. For example, one interviewee said, “Invention can happen anywhere [and] occurs more often than you think, like in Montana, [I] don’t think about mining.” Another interviewee said, “Inventions can be anything and can come from anywhere. They can be big like guns or small like Maryland crab cakes.”

## UNDERSTANDING OF EXHIBITION MESSAGES

Exhibition message (unprompted):

- ◆ Nearly one-half mentioned something about place. For instance, several talked about America as a place of invention (e.g., “inventiveness of the states,” “invention happened all over the country”). A few also described generally thinking about how or why a place becomes a place of invention.
- ◆ About one-quarter talked about the process of invention. For instance, some talked about the invention process (e.g., “breakdown how things are invented or made”). A few talked specifically about the Hartford story and the step-by-step process of manufacturing.
- ◆ Another one-quarter talked about people or inventors, describing the “people behind the inventions we commonly use” and even “how a person inventing something can make a place famous.”
- ◆ Several others talked about invention generally (e.g., “ideas put into practical use,” “how things work,” and “different ideas about different things being invented.”).

What the prototype area shows about places of invention:

- ◆ More than one-third said that the prototype area showed them invention can happen anywhere. While many talked about this generally (e.g., “It can happen anywhere. You can invent anywhere.”), several indicated specific Post-it notes on the Hub Interactive Map (e.g., “They [inventors] are all over the place, [you] expect them to be just in places like New York, but they are in Montana with mining.”).
- ◆ Almost one-fifth said that conditions in the specific location played a role in the invention, both generally (e.g., they created what was necessary) and specifically in the Hartford and Hollywood stories (e.g., conditions in the cities were right for the invention to take hold). For example, one group talked about the physical conditions in Hartford and Hollywood, saying, “[The] light in Hollywood, [there was] more light there and better climate. Hartford wouldn’t have become a metropolitan area without the river.”
- ◆ Another almost one-fifth talked about the need for people in the invention process, with the majority of these interviewees specifically mentioning collaboration.
- ◆ Several talked about the influence of the invention on place (e.g., the cities grew because of the invention).
- ◆ Several expressed surprise about the locations, suggesting visitors do not readily associate invention with Hollywood or Hartford.

### Commonalities between Hartford and Hollywood:

- ◆ More than one-third of interviewees talked about the fact that the inventions created in Hartford and Hollywood had vast influence. Many visitors spoke of this influence in general terms; however, several of these interviewees talked about the influence inventions had on the cities themselves, turning small towns into bustling cities. For example, one group said, “The growth, it [the invention] helped the cities grow. \*There wasn’t much there. The inventions created the cities.”
- ◆ Almost one-fifth spoke generally about the fact that invention happened in both places.
- ◆ Another almost one-fifth talked about the “creative” and “driven” people who populated Hartford and Hollywood.
- ◆ A few did not see any commonalities between the two locations.

### Characteristics necessary for a place to become a place of invention:<sup>6</sup>

- ◆ Almost two-thirds of interviewees talked about people. Many of these interviewees talked about the need for a workforce, although several also talked about the need for people with “good minds” and “creativity.” These visitors indicated that both the Hartford and Hollywood stories talked about the importance of people, with a few mentioning Colt specifically.
- ◆ More than one-third of all interviewees also talked about need as a key characteristic of a place of invention. For example, one interviewee said, “You have to invent something substantial that has an everyday use.”
- ◆ Less than one-third talked about the capacity of a place. Specifically, several of these interviewees said that natural resources, such as water, were a key characteristic of places of invention, while several others talked about the need for space to expand over time.

### Skills or characteristics of people in places of invention:<sup>7</sup>

- ◆ Overall, more than three-quarters of interviewees talked about the need for creative, questioning minds, saying words like “curious,” “innovative,” and “imaginative,” in addition to “creativity” and “think outside the box.”
- ◆ More than one-third talked about the need for hard work and determination, using words such as “dedication,” “persistence,” and “initiative.”
- ◆ Another one-third talked about the need for intelligence, with some of these interviewees mentioning specific types of knowledge such as engineering skills or math skills.
- ◆ More than one-quarter of interviewees spoke about the need for passion and desire, using words such as “ambition” and “drive.”
- ◆ Several interviewees talked about confidence, bravery, and the willingness to fail.
- ◆ A few mentioned collaboration, saying people needed to be able to work with others
- ◆ A few said people had to be open to new ideas.
- ◆ A few said leadership and entrepreneurship were important skills.

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<sup>6</sup> Although the interview question was framed to encourage visitors to draw on their experience in the exhibition when thinking about the characteristics necessary for a place to become a place of invention, many visitors spoke from personal experience.

<sup>7</sup> Again, although the interview question was framed to encourage visitors to draw on their experience in the exhibition, most visitors spoke from personal experience.

Relationship between skills and characteristics of people in places of invention and skills necessary to be successful in life and work today:

- ◆ More than three-quarters of interviewees felt that the skills were still the same, potentially owing to the fact that the characteristics they named were largely based on personal experience versus the prototypes specifically. However, a few of these interviewees talked about the fact that the “instant gratification” culture of today has caused skills like patience to be less common, but these interviewees reinforced the importance of these skills, and a few said that the degree to which different skills matter may have changed over time.
- ◆ A few said that people need different skills to be successful in life and work today; however, these interviewees did not articulate the differences that exist.

# APPENDICES

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## APPENDIX A: OBSERVATION AND INTERVIEW GUIDE

REMOVED FOR PROPRIETARY PURPOSES



## APPENDIX B: RESIDENCE

**TABLE A**

**US RESIDENTS' ZIP CODE OF RESIDENCE**

ZIP CODE	<i>n</i>	ZIP CODE	<i>n</i>	ZIP CODE	<i>n</i>
22003	5	44833	2	33511	1
23238	4	44904	2	33559	1
29710	4	48035	2	44802	1
33186	4	53216	2	44820	1
90035	4	63038	2	46514	1
98105	4	63069	2	46614	1
07039	3	67108	2	46616	1
20002	3	68434	2	46617	1
23323	3	01887	1	48197	1
30328	3	05495	1	50321	1
30349	3	06903	1	50322	1
48732	3	08723	1	53151	1
68521	3	19026	1	59937	1
68632	3	20877	1	68626	1
90814	3	20906	1	74145	1
95749	3	22150	1	84707	1
02130	2	29745	1	97029	1
30327	2	30316	1	97701	1
35057	2	30809	1	98038	1
44420	2				

**TABLE B**

**US RESIDENTS' STATE OF RESIDENCE**

STATE	<i>n</i>	STATE	<i>n</i>	STATE	<i>n</i>
Virginia	13	Indiana	4	Maryland	2
Nebraska	11	Missouri	4	Oregon	2
California	10	New Jersey	4	Connecticut	1
Georgia	9	DC	3	Mississippi	1
Ohio	8	Massachusetts	3	Montana	1
Florida	6	Wisconsin	3	Oklahoma	1
Michigan	6	Alabama	2	Pennsylvania	1
South Carolina	5	Iowa	2	Utah	1
Washington	5	Kansas	2	Vermont	1

**TABLE C****NON-US RESIDENTS' COUNTRY**

<b>COUNTRY</b>	<b><i>n</i></b>
United Kingdom	7
Australia	4
Brazil	4
Panama	4
Argentina	1