

An Evaluation of Pilot Pepper Robot Program

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**Smithsonian Organization
and Audience Research**

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Executive Summary

The pilot Pepper Robot program by the Arts and Industries Building and the Office of Visitor Services seeks to explore how Smithsonian (SI) can utilize interactive robotic technology to enhance the visitor experience, among other uses. Since April 2018, several units have been experimenting with Pepper for this purpose. Between July and October 2018, Smithsonian Organization and Audience Research (SOAR) studied visitors' experiences with Pepper on the floor at four locations: the Smithsonian Castle; Hirshhorn Museum and Sculpture Garden (HMSG); National Museum of African American History and Culture; and the National Museum of African Art. The study employed a mixed-methodology that involved observations of visitor interactions with Pepper; qualitative interviews with visitors and SI personnel; and visitor surveys.

Across the studied Pepper projects, Pepper was popular, and though it especially attracted young children, visitors of all ages enjoyed their brief encounters. In general, the aim of the Peppers that were part of the study was to provide on-the-floor information and education. However, they succeeded better with entertaining visitors. Visitors were typically drawn to Pepper not as a potentially useful resource, but as something unique, different, and entertaining. They defined positive experiences primarily in terms of *fun*, rather than in terms of information they picked up. Some visitors saw the appeal of Pepper for children who had not yet become familiar with visiting museums.

The pilot appears to show that visitors are pleased to encounter robots within the museum context, though some felt Pepper was out of place at certain museums and suggested it would be more suitable for technology or contemporary-oriented museums like Air and Space and HMSG. However, in most instances, seeing a robot within the overall Smithsonian setting moved visitors to think beyond their existing "trusted authority" perception—they saw the museums as keeping up with the times and potentially leading the way to the future.

At the four locations SOAR studied, Pepper was deployed either as an *on-the-floor resource to welcome, playfully interact, and/or give informative or educational content to visitors*. The SOAR team also spoke with staff who programmed Pepper for an event at the Smithsonian American Art Museum where the robot was a *featured programmatic performer*. Across the uses, the evaluation indicates that Pepper's interactive limitations constrained its effectiveness as an information resource, perhaps with a few exceptions. For example, Pepper seemed to be of value as an attention-grabbing tool that could also broadcast simple messages to passing visitors. As for answering practical questions about orientation, wayfinding, accessibility, and so on, visitors could not reliably access that type of information given Pepper's current limited capabilities to react and interact. Pepper's value in this regard seems to be as a complement to human guides.

The current iterations of Pepper at the Smithsonian seem most appropriate for two non-interactive roles: using its eye-catching value to attract people to desired locations; to some degree making museums feel more accessible, and broadcasting simple, non-interactive information to visitors. Subsequent versions of Pepper with added reliability and functions might allow deeper, more compelling uses for the robots to enhance the visitor experience.



Introduction

The pilot Pepper Robot project, launched by the Arts and Industries Building (AIB) leadership team and managed by the Office of Visitor Services (OVS), seeks to explore how Smithsonian units can utilize interactive robotic technology to further their missions and improve the visitor experience. (For more background information on the project, see Appendix A: Pepper Pilot Overview.) Since early 2018, several units have been experimenting with one or more Pepper robot models—Promoter, Host, or Choregraphe.¹ This evaluation sought to get a sense of how visitors experienced Pepper and to explore Pepper’s potential to support education, visitor services, and other mission-related functions at the pilot units and beyond.

In April 2018, several units began Pepper pilot activities on the floor. From July through October 2018, Smithsonian Organization and Audience Research (SOAR) conducted a study of visitors’ experiences and interactions with Pepper at four units: Smithsonian Castle, National Museum of African Art (NMAfA), National Museum of African American History and Culture (NMAAHC), and Hirshhorn Museum and Sculpture Garden (HMSG). At the time the research for this study was conducted, Promoter and Host Peppers were employed by these units in the following ways²:

- OVS deployed a Host Pepper to support the visitor experience in the Castle Commons. The robot provided stories about the building’s past and objects in the Commons display cases.
- NMAfA utilized a Host in common areas to relate stories and facts about the African continent. A Promoter outside the *World on the Horizon: Swahili Arts Across the Indian Ocean* exhibition shared educational background information (such as basic phrases in Swahili) with interested visitors.
- NMAAHC used a Promoter to introduce visitors to less-visited galleries on the upper floors of the Museum, and a Host in the concourse to welcome visitors and provide basic orientation information.
- HMSG stationed a Promoter near the information desk at the Museum’s main entrance and a Host on the third floor. Both were programmed to promote HMSG’s in-gallery mobile web guide (hi.si.edu); the Host also offered background stories and information on the art.

Pilot Peppers were also deployed at the Smithsonian Environmental Research Center (SERC) in Edgewater, Maryland, and HMSG’s ArtLab+ youth center. Both used Choregraphe models as a resource

¹ The robotic equipment is the same for all three models; they differ only in their software. Both Promoter and Host are essentially “plug and play” models with pre-programmed templates that can be filled in with unit-specific content. The Promoter template is less complex, for example, allowing only basic binary (yes/no) decision-making in interactions with visitors. The Host model has more advanced capabilities such as telling a story, dancing, and answering FAQs, and allows visitors to decide which capability to choose. The Choregraphe software is a “blank slate” that allows much more flexibility in programming, but also demands a higher level of programming expertise to deploy.

² Each of the units received a Promoter Pepper and a Host Pepper. The units modified their pilot projects as they explored Pepper’s capabilities. OVS found the Host model it used at the Smithsonian Castle to be more reliable than the Promoter model, whereas NMAAHC found the Promoter Pepper was easier to manage for its purposes. As a result, OVS solely used the Host Pepper, and NMAAHC put out the Promoter Pepper most of the time during the period of this evaluation.



for teaching programming to young people. SERC also deployed a Host to capture visitor attention at public events. These applications were not part of the audience research for this study, but interviews with personnel in these units provided valuable information for moving forward.

The balance of this report describes the study methodology, and presents the findings, primary observations and takeaways, and thoughts on Pepper’s future use.

Methodology

SOAR employed a mixed-methodology approach to collect data for this evaluation. This included observations of visitor interactions with Pepper; qualitative interviews with visitors and Smithsonian personnel; and visitor surveys. Staff and interns from OVS, HMSG, and NMAAHC trained by SOAR in the relevant methodologies undertook most of the observation and survey data collection. SOAR staff, interns, and contractors completed the rest of the data collection. Most of the data collection with visitors took place in the summer of 2018.

Observations

The study conducted two types of visitor observation. First, for a total of 11 hours the study team counted both the frequency of visitor interactions with Pepper and the number of all visitors who walked in/by the place in the Castle Commons and area at NMAfA where Pepper was placed. Second was a structured observation of visitors’ interactions with the Peppers. SOAR prepared four similar but separate observation forms, tailored to each unit and Pepper model, to document visitors’ interactions. The team recorded the behaviors of 196 visitors/visit groups as well as their demographics.³ Table 1 presents the number of cases collected at each unit. See Appendix B for the data collection forms.

Table 1. Observation Count

	Promoter	Host	Overall
Castle Commons	n/a	48	48
NMAfA	27	15	42
HMSG	32	27	59
NMAAHC	47	n/a	47
Overall	106	90	196

Surveys

The study administered two types of visitor surveys. The first was a post-interaction survey with a common set of questions for all locations; the data collectors intercepted visitors immediately after their interaction with Pepper and invited them to take the survey. They got responses from 113 visitors across the units. Table 2 presents the number of completed surveys collected at each unit. The second type of survey was a museum exit survey specific to HMSG. Unlike the other locations where Pepper was

³ Demographics were determined by observation. SOAR developed observation protocols and data entry forms, and trained data collectors with them to minimize subjectivity in the observations. However, the information may not have been as accurate as that from visitors’ self-reporting. Throughout both observation activities, the data collectors watched and recorded visitors’ behaviors unobtrusively from a distance.



on the floor for a small number of scheduled hours on selected days,⁴ HMSG’s two Peppers were out every day during the hours the museum was open at locations that most visitors walked by. At HMSG, Pepper was part of the museum experience every visitor could have had. Visitors were intercepted as they were about to leave the museum.⁵ The HMSG survey invited 287 exiting visitors to take the survey, and 258 participated, for a response rate of 90%. See Appendix B for the survey questionnaires, and Appendices C and D for the frequencies of responses.

Table 2. Post-Interaction Survey Count

	Promoter	Host	Overall
Castle Commons	n/a	29	29
NMAfA	n/a	6	6
HMSG	38	23	61
NMAAHC	17	n/a	17
Overall	55	58	113

Qualitative interviews

SOAR personnel initially visited each of the pilot units several times to conduct preliminary observations and meet with Pepper “parents” (unit staff) to discuss their experiences and goals. The discussions with Smithsonian personnel were a critical part of the evaluation. In addition to initial interviews with the Pepper parents at the four main units, SOAR conducted two telephone interviews with NMAAHC volunteers; held a discussion group with six visitor services and education staff at HMSG; and did one-on-one interviews with Pepper parents at ArtLab+ and SERC. SOAR personnel also talked informally with volunteers and staff on the floor with Pepper over the course of data collection.

SOAR staff and interns conducted qualitative interviews with visitors who interacted with Pepper to learn about their experiences, whether it influenced their decisions on what next to do in the museum, and whether it altered their perceptions of the museum or Smithsonian as a whole. SOAR spoke with 37 visitors/visit groups.

⁴ Peppers’ appearances at the other locations were limited: one to three hours at a time for one to four days in a week.

⁵ The HMSG Pepper project offered the evaluation a unique data collection opportunity that was not seen at the other locations. In addition to Pepper being part of the museum experience for all museum visitors, at the time of the data collection, both the Peppers were programmed to convey a very focused message: to promote the Hi app. These conditions enabled SOAR to conduct an efficient museum exit survey to measure: 1) levels of visitor interactions with Pepper, 2) visitors’ post-interaction feelings about Pepper, and 3) effectiveness of Pepper in engaging visitors with what it promotes.

Findings

Visitor Impressions, Reactions, and Experiences

Visitor impressions of and experiences with Pepper were diverse. The following sub-sections discuss several themes that came up frequently in open-ended inquiries with visitors, Pepper staff, and volunteers.

Appearance

Many visitors indicated that their initial reason for approaching Pepper was its appearance. Volunteers added that people were often drawn to the sound of Pepper's voice even before they saw it. Visitors were taken with its human-like appearance, voice, and movements:

It doesn't sound like a robot. It sounds like a person. Sometimes [a robot] will be, like, jerky words where it's just letters and "eh eh eh." [Pepper] sounds very smooth, very human-like.

Visitors spoke of Pepper as lifelike, easy to understand, and fun to speak with, and commented on its realistic eye contact. One person observed that Pepper looks at you and nods, which makes a connection. Visitors also indicated they found Pepper welcoming and approachable:

When you're experiencing [these museums] for the first time, they're a little overwhelming. [But with Pepper,] you're not afraid to walk up and see what's going on, and it's kind of a comfort when you're walking in. When she⁶ gives you the information, you feel a little more at ease. ... Now you have a few things to check out. It just helps things not seem quite so overwhelming.

When visitors were asked to sum up Pepper in a single word, one of the most common responses was "cute." Other responses alluded to Pepper's warmth— "friendly," "curious," and "happy" were mentioned multiple times. Other positive attributes included "accessible," "intelligent," "enchanted," "funny," "engaging," "intriguing," "entertaining," "dynamic," "mind-blowing," and "welcoming."

Not all visitors, however, found Pepper easily intelligible, noting, for example, that it spoke too fast or was not loud enough to be heard.

Appeal to Children

Visitors often spoke about Pepper's appeal to children. Many adults with children indicated that their kids loved Pepper and were eager to engage with it, and even those who were not with children commented about how kids flocked to and were fascinated by Pepper. Some noted that Pepper's height was perfect for face-to-face interactions with children, made reference to the comfort with technology

⁶ While many visitors used gender-neutral language to refer to Pepper, the vast majority who referred to Pepper with gendered pronouns used female ones.

many children displayed, and pointed to the benefits Pepper could have in engaging children or making them feel more comfortable in a museum setting:

I think kids would love to see something like [Pepper] because it's small. They feel like they can approach it, listen to it. So I'm sure little kids will instantly go over and see it.

[I think my kids were drawn to Pepper because of] her height and the fact that my kids are used to talking [to machines]. They use Siri all the time. They don't type. ... Definitely a younger demographic is going to feel more comfortable.

My five-year-old is obsessed!

On the other hand, observers noted that small children occasionally appeared to be frightened or intimidated by Pepper, and needed encouragement from adults to approach it. Volunteers at NMAAHC shared the same observation with SOAR.

The most frequent single-word description for Pepper was “fun”—an appealing trait not only for younger visitors, but also older ones. For example, one visitor remarked that all the text reading in museums can be a lot of work, so fun things like Pepper can be a welcome respite.

Confusion

Some visitors were confused about why Pepper was there and how they were supposed to interact with it:

I don't really get why it's here. ... It's just something that's a novelty. It seems like something I wouldn't want to go out of my way to see if I came to the Smithsonian.

I'm not sure what she has to do with the museum.

Puzzled visitors commented that they would appreciate more signage or information to explain Pepper's purpose, or to instruct them about how to engage with it. For example, a NMAAHC visitor said that Pepper needed a sign saying what it was there for, while a HMSG visitor suggested it should be made more obvious that visitors are supposed to interact with Pepper. Another NMAAHC visitor said it would be helpful to better connect what the robot does to the Museum's content, an opinion that was echoed by a volunteer at that museum.

Some visitors found Pepper distracting and out-of-place. More than one recommended placing it only in more tech-oriented museums, or at least in less-obtrusive areas of the museum:

[She's noisy.] I find her distracting. It takes away from the exhibits themselves.

I think it's a little scary. I'm not ready or interested in getting [acquainted with] a robot. Probably my grandchildren, but not me.

Novelty

On the whole, Smithsonian personnel who work with Pepper agreed that the *novelty* of robotic technology is the main driver of Pepper’s appeal at present. Visitors frequently commented that Pepper was “cool” and “new.” In some cases, they saw this as a positive reflection on the Smithsonian’s orientation toward the future:

The Smithsonian is changing for the better.

It felt like the future.

Fun to see new tech at work.

It’s way more advanced than I thought.

Purpose, Goal, and Use

Pilot units, for the most part, sought to use Pepper as an on-the-floor information resource for visitors, although there have been a few efforts to experiment with Pepper as a programmatic focus in itself.⁷ Some visitors noted they did pick up facts and information through their engagement with Pepper:

We did the “Did-You-Know? Game,” and we definitely learned. Pretty much everything she said, I didn’t know.

Most of the visitors who interacted with Pepper, however, seemed to regard it more as an end in itself than as an information resource per se. Some said they did not really learn much from it:

I wanted to learn, [but] they [other visitors] kept on making it dance.

Those completing the post-interaction survey were specifically asked what, if anything, they learned from their Pepper interaction. Many comments had little to do with education or information related to the museum or its exhibitions, collections, or content. Rather, they talked about awareness of Pepper itself and its capabilities.

When visitors discussed information that Pepper was programmed to deliver, it appeared that retention was best when Pepper offered simple information in a direct, concise way. For example, about half the responses from Commons visitors mentioned factoids about the Smithsonian itself, like the number of visitors or the fact that the first Secretary lived in the Castle. Many HMSG visitors who interacted with Pepper indicated that they learned about the existence and use of the Hi app (this does not necessarily mean they used this resource during their visit⁸). Observations of NMAfA visitors outside the *World on the Horizon* exhibit suggested that at least some followed along with Pepper’s mini-lesson in Swahili, which included pronouncing Swahili words aloud.

⁷ For example, Pepper’s appearance as a featured “performer” at SAAM Family Tech Day.

⁸ See the results from the HMSG exit visitor survey under Visitor Engagement further below.

Some visitors suggested ways to make Pepper more effective as an information resource—for example, different levels of programming for children and adults, better information on wayfinding and orientation, more background information on exhibits and objects, and multiple-language capability:

My mom doesn't speak English, so this is a challenge. Introducing more languages would be great.

Pepper's potential as a performer—that is, as a programmatic focus in its own right—is unknown, but potentially great, although so far, the Smithsonian pilot has not done much with Pepper in this regard. The use of a Pepper and programmer borrowed from ArtLab+ for the Smithsonian American Art Museum's (SAAM's) Technology Family Day is perhaps the best example. Staff interviewees mentioned possibilities as various as interpreting art images as sounds for visually impaired visitors, providing facts about specific objects on display, serving as the "life" model for a drawing class, taking visitors on virtual behind-the-scenes tours of collections, and formulating personalized recommendations based on visitor mood, as interpreted through facial features.

Technology in Museums

The relationship of technology to the museum was a recurring theme. Visitors sometimes brought up the contrast between unfamiliar, cutting-edge technology like Pepper and more traditional- or conservative-seeming museum spaces and exhibitions. For many, this contrast was a positive one that suggested forward thinking:

It's the only technology I really saw here. It did make me think that there was some new stuff going on. It's not just old and dusty exhibitions. There's a modern thing happening.

[Pepper brings] high tech to something that looks more antique and historical. It melds science stuff with the history.

Some visitors pointed to a sense of familiarity with Pepper, commenting on robots they had at home or robots in pop culture who reminded them of Pepper. This familiarity made them feel comfortable with Pepper and excited to see a robot in a museum:

Recently at my college they had Sophia the robot come and give a commencement speech, which was really bizarre. [Pepper] reminded me in little ways of that[.]

For others, the contrast was too stark, and they did not think Pepper fit into the space:

I don't want to go anywhere near her. I just find her annoying. I'd rather look at the art and the artifacts than talk to Pepper.

The question of Pepper technology fitting into a museum environment often came up when visitors were asked to envision Pepper at other Smithsonian locations. Those who answered the question often pointed to the more science- or technology-related museums as the most appropriate places. Many specified the National Air and Space Museum (NASM) as an ideal location:

I think it would go better in Air and Space. Futuristic airplanes, robots, space. I don't think you want to put him where Spanish galleons are.

We came from the Air and Space museum, I guess we were thinking that we might see the robot over there rather than here.

Functionality

Smithsonian personnel interviewed for this study universally agreed that Pepper is not yet reliable in a functional sense. Every pilot venue offered stories of crashes, some of which were unexpected and inexplicable to staff with limited technical understanding of Pepper's programming and workings. Interviewees noted that even after relatively short periods of intensive on-the-floor activity, Pepper occasionally shut down and slumped over. Sometimes a simple reboot was not adequate to revive Pepper, and it had to be removed from the floor for trouble-shooting and tinkering. Staff suggested that some crashes appeared to be the result of programming glitches, while others may simply have reflected excessive demands on Pepper's sensory and movement mechanisms.

This lack of reliability was a special concern in cases when Pepper was a focus of programmatic attention in itself, as with the Choregraphe Pepper at SAAM's Technology Family Day. The series of Pepper "performances" at this event was a mix of successes at the beginning and end, marred by malfunctions in the middle that could not be resolved in real time by the relatively experienced programmer managing Pepper.⁹

HMSG is now making an effort to keep Peppers on the floor on an ongoing basis, and has begun to grapple with an issue that will eventually arise for any unit that seeks to use Pepper as an on-the-floor information resource: maintenance. HMSG may find that as Pepper experiences cumulative mechanical wear-and-tear roughly proportional to its time on the floor and the degree of visitor interactivity to which it is subject, parts begin to malfunction or fail. It is not yet clear how the inevitable repairs and maintenance will be addressed.

According to Smithsonian interviewees, programming Pepper can be relatively simple or exceedingly complex, depending on the application-specific requirements for interactivity, movement, object recognition, and other processing, sensory, or mechanical variables. Even the relatively straightforward informational applications pursued by most pilot units presented some programming challenges for Pepper parents. At present, only one Smithsonian staff member working with Pepper has more deeply explored the Choregraphe model's functionality for more advanced applications, although efforts at both ArtLab+ and SERC are geared toward building Pepper programming skills in young people who could eventually assist these units as interns or volunteers.

⁹ This programmer suspected the problem was the result of bugs in a relatively complex program written on a very tight timeline. Given more time for programming and testing, he hoped such mysterious crashes could be avoided in future.



Visitor comments on Pepper’s functionality suggested desirable improvements such as more movement, louder voice volume, and a slower selfie option, since some were not ready to take photos by the time Pepper invited them to “Say cheese!” As mentioned above, some were hoping to communicate with Pepper in languages other than English.

Interactivity

While interactivity is potentially a big part of Pepper’s appeal, Smithsonian personnel, as well as observations on the floor, indicated that currently its capabilities are very limited for a museum environment.

Feedback from visitors indicated some disappointment at Pepper’s interactive shortcomings, such as poor speech recognition, slow response, inability to go off script, and problems with accents and background noise. At its best, Pepper’s speech recognition capability seemed to fall short of what visitors accustomed to Siri- or Alexa-level functionality expected, based on some comments. The public may have expected that Pepper should be able to reply to simple, free-form questions, rather than only to a small set of pre-set options. Successful verbal interaction with Pepper appeared to require interaction with only one person at a time who was speaking clearly and in unaccented English, with minimal background noise—a set of conditions rarely present in museums. Even then, Pepper was easily thrown off when visitors went even slightly off script (for example, asking a Pepper programmed to respond to queries about “restrooms” for the location of “bathrooms”). Some personnel expressed hope that upcoming software upgrades may address these shortcomings to some extent.

More broadly, Pepper’s interactive functions were easily overwhelmed by multiple users, excessive background noise, or even unfavorable lighting conditions. For example, its sensors had difficulty making out facial expressions in backlit subjects.

Another interactivity-related concern involved Pepper’s physical movements. Most pilot venues had stories about Pepper bumping or jostling visitors—a hand pinched in the crook of Pepper’s elbow, a child “clotheslined” by an expansive arm gesture, even a hoop earring ripped out during a selfie—albeit with no physical damage to the visitors. Host units have tried to manage the potential for mishap through some combination of restricting Pepper’s movements, on-the-floor Pepper chaperones, and management of physical access. For example, NMAAHC placed a hoop around Pepper’s base to delineate an area that visitors were not to enter except to engage with the touch screen, and SERC has placed Peppers deployed at events in places where they cannot be approached from the back or sides. Some Smithsonian personnel were generally wary of the prospect of greater mobility. They expressed a lack of confidence that the sensors Pepper has to prevent damaging mishaps with visitors, museum property, or the robot itself would function reliably enough in real-time museum-floor scenarios.

“She was fun, we just weren’t sure how interactive we were supposed to be with her. Were we supposed to go up and say hi? He [son?] was tapping the screen but it wasn’t doing anything.”

“[Visitor wanted] much more talking. Sometimes he doesn’t understand my talking because my pronunciation is not good.”



“[Wanted Pepper] to be able to have a voice exchange when you ask it questions. Something like Siri.”

Last, visitors were not sure whether Pepper offered voice interactivity, as opposed to just touch screen choices. Some noted that this made contact with Pepper feel rather disjointed and prone to lags or lapses.

Visitor Engagement: Results from Observations and Surveys

This section discusses results from the quantitative data collection with visitors.¹⁰

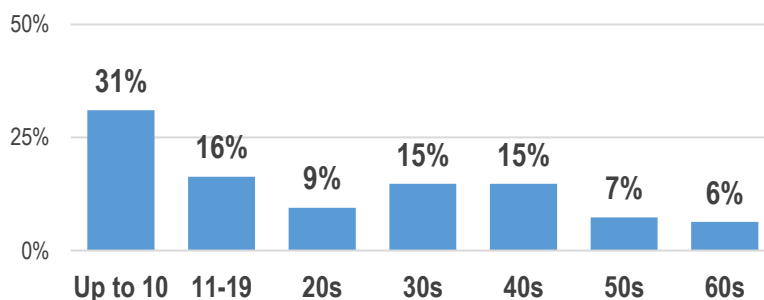
Demographics

The data from the observations provide a more comprehensive look at the demographics than the surveys and are reported here.¹¹ During the second observational phase, data collectors recorded estimated age, sex, visit group, and behaviors for visitors interacting with Pepper. See Appendix C for the demographic distributions from the observation as well as the surveys.

Pepper attracted children and groups with children. As shown in Figure 1, results from the observation suggest that Pepper was most appealing to young children. Roughly one-third of visitors who engaged with Pepper were 10 years old and younger (31%); each of the age cohorts 11 years old and above appeared to interact with Pepper less often (between 6% and 16%). Moreover, Pepper disproportionately attracted groups with youth: more than half the visitors who engaged with Pepper were in groups that included youth under 18 (57%).

More women. About two-thirds of visitors who interacted with the Peppers were women (63%).

Figure 1. Pepper Interaction by Age Cohorts



¹⁰ The study conducted two types of observations and as many types of surveys. The data collection tools and protocols were designed to maximize the data collection for each Pepper project, thus, were not uniform. See the Methodology section for details.

¹¹ Children under 13 were not eligible to participate in the surveys, whereas the observation data collection covered all ages. The review of the results from the observation, post-interaction survey, and HMSG exit survey revealed that the observed visitors included more young children (estimated ages under 14) than those who took the surveys and that the other demographics were essentially the same across the different methods. Therefore, the observation results only are reported for the demographics.



Overall Engagement with Pepper

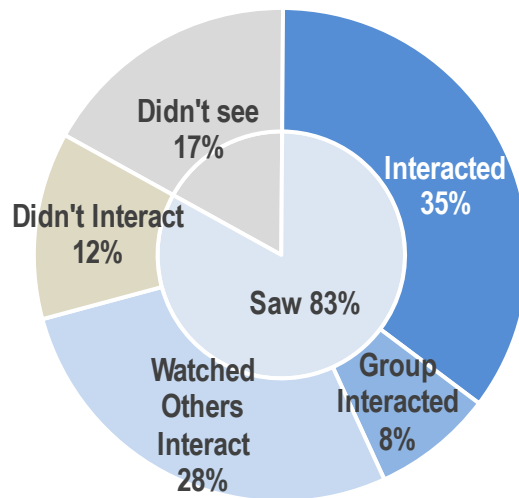
Engagement with Pepper was high. At the Castle and at NMAfA, half the visitors who walked in the vicinity of Pepper interacted with it (50%).¹²

Results from the HMSG museum exit survey also show high interaction with Pepper. As seen in Figure 2, over two in five visitors indicated that they themselves or someone in their group interacted with Pepper during the museum visit (43%—35% interacted, 8% someone else in the group interacted). Almost three in ten visitors said they watched others interact (28%). The remaining three in ten did not engage with Pepper (29%—17% didn't see Pepper, and 12% didn't interact).

The median age of visitors at HMSG was 25.¹³ Visitors under 25 years old were more likely to stop at a Pepper (81%—50% interacted and 31% watched others, as compared to 61% of older visitors—36% interacted and 16% watched).

At HMSG, two in five visitors who engaged with Pepper stopped at the Pepper on the first floor (41%), and a similar proportion of visitors did so on the third floor (38%). One in five stopped at the Peppers at both locations (21%). The visitors on the third floor were more likely to interact directly with Pepper than the visitors on the first floor (72% interacted vs. 54% on 1st floor).¹⁴

Figure 2. Pepper Engagement at HMSG



¹² From the first observation method where the frequency of visitor interactions with Pepper was recorded. Note that these Pepper locations were relatively quiet; the study was unable to obtain data at a location with heavy visitor traffic.

¹³ Children under 13 years old were not eligible to participate in the HMSG survey.

¹⁴ In general, visitor flow was lower at the Pepper location on the third floor than on the first floor in the entrance lobby. There was more opportunity to interact directly on the 3rd floor.



Median engagement time was 1 to 2.5 minutes. The second phase of observation timed the length of each Pepper interaction. The interaction time with the Host Pepper, which has the more advanced interactive capabilities of the two Pepper models, was more than twice as long as with the Promoter Pepper. The overall median interaction times across the locations were:

- Promoter: Median 1.1 minutes (63 seconds)
- Host: Median 2.4 minutes (144 seconds)

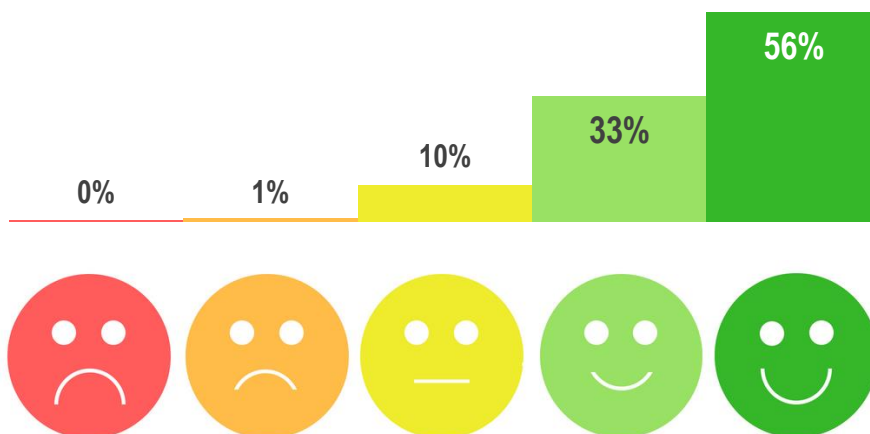
Among the three locations that deployed Promoter Peppers, the median engagement time was longer at NMAfA (1.7 minutes/99 seconds) than at HMSG and NMAAHC (1.0 minutes/60 seconds and 1.1 minutes/63 seconds, respectively).¹⁵ See Table 3 for the times for each location by Pepper type.

Table 3. Pepper Engagement Time (minute)

	Pepper Promoter				Pepper Host			
	NMAfA	HMSG	NMAAHC	Overall	OVS	NMAfA	HMSG	Overall
Median	1.7	1.0	1.1	1.1	2.4	3.0	1.8	2.4
Mean	2.3	1.0	1.4	1.5	2.9	3.0	2.1	2.7
Shortest	0.3	0.0	0.3	0.0	0.6	0.3	0.3	0.3
Longest	7.0	4.5	4.5	7.0	10.0	5.4	4.0	10.0

Pepper experience ratings were very positive. More than half the visitors who interacted with Pepper (themselves or someone else in their group) chose the highest rating on the five-point-smiley-face scale¹⁶ (56%)—see Figure 3.¹⁷

Figure 3. How would you rate your experience with Pepper overall?



¹⁵ Each unit programmed its Pepper differently and offered different Pepper experiences. The NMAfA Promoter seemed to offer a longer activity sequence than elsewhere. Additionally, traffic was slower at the NMAfA Pepper location, enabling visitors to interact without other visitors waiting for a turn. As such, it is unclear if the programming or the greater access to Pepper at NMAfA accounted for the longer time of engagement.

¹⁶ SOAR used the face-mark rating scale to obtain feedback from visitors who included small children; it is not comparable to data from other SOAR studies.

¹⁷ Results from the surveys combined.

Reactions of visitors who only watched other visitors interact with Peppers¹⁸ were less positive, but over half of them still selected either of the two highest ratings on the scale (57% for the two shades of green combined—21% the highest and 37% the second highest).

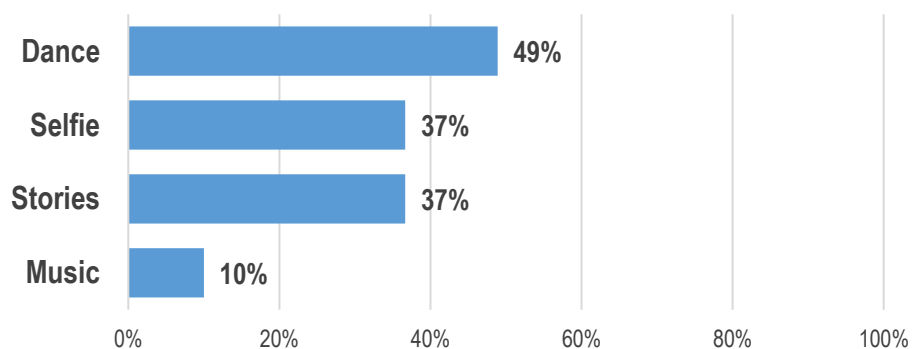
Interactions with Pepper¹⁹

Most used the touch screen to interact with Pepper. Visitors could interact with Pepper via the touch screen on Pepper’s chest and/or by talking to it. Overall, most observed visitors used the touch screen (82% across all four locations). At NMAAHC, where a volunteer was present with Pepper all the time and encouraged visitors to talk to it, visitors were less likely to use the touch screen (49% vs. 93% at the other three locations combined). A small number of visitors touched Pepper’s body (13%, four locations combined). This occurred more often with children under 10 (27% vs. 5% of older visitors).

The programming impacted whether visitors talked to Pepper. Overall, one in three visitors talked to Pepper (35%). Visitors were more likely to talk to the following three Peppers than to the others: Promoter Pepper at NMAfA (48%), Promoter Pepper at NMAAHC (55%), and Host Pepper at HMSG (48%). These results suggest that when encouraged, visitors were more likely to talk to Pepper and that the encouragement could come directly from Pepper (i.e., programmed scripts that Pepper spoke to visitors) or the staff with Pepper.

Dancing attracted children. Pepper programs varied by location and Pepper type. In general, the Host Peppers in this study offered a default set of activities for visitors to choose from. Among the activities, the dance option was selected most often, with half the visitors choosing it (49%), followed by the selfie and stories options, chosen by over one third of visitors (both 37%) (Figure 4).

Figure 4. Host Pepper activities selected by visitors



¹⁸ From the HMSG survey. The post-interaction survey intercepted only visitors who interacted with Pepper (or their guardians when the visitors were under 18 years old).

¹⁹ Results from the second phase observation of visitors, in which their behaviors interacting with Pepper were recorded.



The dance option was especially popular among youth under 18; nearly two in three chose it (63% vs. 37% of older visitors). After selecting this option, youth were also more likely to dance along with Pepper (37% vs. 8% of older visitors). Just under one in five visitors interacting with a Host Pepper took a selfie (19%); fewer of those who chose the selfie script actually took a selfie.

In addition to the selfie option with the Host model, some units programmed Promoter Peppers to invite visitors for a selfie (i.e., Pepper told visitors to take a selfie with it). Visitors enjoyed photo opportunities when they stopped at Pepper: overall, one in three observed visitors took a photo with or of Pepper (37%).

Pepper as Promoter

Pepper as promoter not successful at HMSG. HMSG programmed Pepper to promote the Hi app. The vast majority of exiting visitors reported that they did not use the app (90%), and the respondents who did use it most often said they learned about it from museum staff (41%) and signage/displays in the museum (31%). Fewer people reported learning about the app from Pepper (15% of those who used the Hi app; 2% of all exiting visitors). As noted, it was not feasible to assess the effectiveness of the other Peppers at this role.

Awareness of Pepper

Most visitors had been unaware of Pepper at the Smithsonian. Most visitors had not known before their visit that the Smithsonian had Pepper (92%). Among the few respondents who had known, some were aware that Pepper would be in that particular museum/building.

Preliminary Observations and Takeaways

Please keep in mind when reviewing the following that this study was a small, first-line investigation to gather visitor reactions and initial experiences with Pepper robots in a few museum contexts. Rather than producing definitive results, this report should be used to point the way for future inquiry about robot use at SI units.²⁰

Overall, a Positive Experience for Visitors

Across the Pepper projects in this study, Pepper was popular. Visitors of all ages enjoyed their brief encounters with it. In general, Pepper succeeded with visitors better as an entertainment than as a source of information/education. Visitors were drawn to Pepper because they perceived it as something unique, different, and entertaining. For the most part, visitors defined positive experiences with Pepper primarily in terms of *fun*, rather than in terms of information they may have picked up. Most visitors didn't require Pepper to provide information and educational content in order to feel they'd successfully interacted with Pepper. Some visitors saw the appeal of Pepper for children who had not yet become familiar with a museum visit structure and expectations. This finding indicates the value of finding an appropriate balance between meeting visitors' appreciation for entertainment and the museums'—and many visitors'—educational objectives.

The Peppers appear to add value to visitor experiences in the several ways outlined below. However, the limitations noted at the end of this section should be taken into account when considering future use and activation of Peppers in unit gallery spaces or museum settings.

Pepper as “Ice-Breaker”

Providing a light, fun experience on the museum floor can be valuable, and this is clearly a function at which Pepper excels. Pepper can be an approachable entity that provides information in a less intimidating way, free from reading lengthy texts and requiring formal knowledge about topics. For example, HMSG personnel indicated that their museum gets many visitors who have little interest in contemporary art, such as tourists doing the rounds of Mall museums. A warm welcome by a cute robot may make the difference for some between turning away and staying to check out the unfamiliar art. Becoming more at ease at the start of the museum visit likely helps visitors get more out of the rest of their visit. Equally important, this “introduction” with Pepper offers education or visitor services personnel an excellent opening to follow up with the visitors.²¹

²⁰ These observations are specific only to the Peppers within the study and do not take into account the capabilities of more advanced robots that may exist or become available. These observations do, however, suggest what capabilities a robot requires to provide satisfying experiences for visitors of different ages and interests.

²¹ Personnel at NMAAHC noted that the museum draws new visitors who may be uncomfortable with museums generally. A Pepper parent at SERC commented that she was not too concerned about whether Pepper succeeded as a platform for conveying information in itself.

Pepper as Informational Resource

As an informational resource, Pepper can be used either as a **broadcaster** of messages to passing visitors, or as an **interactive presence** that provides visitors with information in response to questions about the host unit and its offerings.

Pepper as Broadcaster

The information that current Peppers delivered in broadcast mode was quite basic, at a level that even the simplest Pepper (the Promoter) could handle. This level of use did not raise big challenges with respect to programming, interactivity, or reliability.²² Continuing or expanding this basic broadcast role will require investment in staff on the floor with Pepper and behind the scenes for maintenance. It may also require upgrading Pepper's capability to remain operational on the floor for longer than is the case now.

The value of Pepper in its broadcast application may be sensitive to a possible loss of the robot's novelty appeal. When the novelty wears off, will Pepper as a broadcaster simply blend into the background? On the other hand, this possibility may be offset by the fact that a high percentage of SI visitors are first-time and from outside the DC area. Additionally, as different units develop their fluency with programming and deploying their Peppers to coordinate with other activities, they have the opportunity to keep Pepper content fresh for those locals who may see unit Peppers more frequently.

Pepper as Interactive Presence

Many of the Smithsonian personnel interviewed for this study saw Pepper's long-term usefulness primarily as an interactive source of information that responds to visitor questions about the museum and its facilities, collections, exhibitions, and other programs. In this role, Pepper has value beyond the appeal of the platform technology itself.

The main problem with this application at present is Pepper's limited interactive capability. Based on what visitors expressed in this study, they were looking for the type of conversation they are used to having with an Alexa or Siri. The current Peppers have a way to go to meet that expectation.

Developing that capability may be important in light of the feedback from some interviewees. They could see Pepper serving as a beneficial complement to human guides, fielding questions that visitors might be hesitant to ask a person. In general, this audience would include visitors who are not regular museum goers and who feel intimidated by museums or unfamiliar content. For example, Pepper might be stationed near entrances to provide answers for visitors who are unacquainted with, say, African art at NMAfA or contemporary art at HMSG.

²² The simplicity of the programming and absence of intensive interaction mean Pepper is less likely to crash. Even if it does, the consequences are minimal. (Some visitors, obviously, will miss the broadcast message while Pepper is down, as compared with the consequences if Pepper is the featured performer at an advertised program that draws a 100 visitors and crashes.)

Pepper As Featured Performer

As noted, the Pepper parent that assisted with the technology program at SAAM discussed the use of Pepper as a programmatic performer with the SOAR team, who did not see Pepper play this role first-hand. It is difficult to generalize about the potential and limitations of this application based on the team's limited information. It seems that when Pepper is functioning as intended, it has potential to handle this role effectively. However, extensive use of Pepper in this capacity will require resolution of issues with programming, reliability, and maintenance that are discussed in the following section.

Pepper's Limitations

Even for the basic uses of the pilot Peppers in this study, maximizing their value will require upgrades to address limitations identified by both visitors and staff:

- Limited **interactive capabilities**
- Lack of functional **reliability** on the floor
- **Safety concerns** related to Pepper's physical movements
- Likely long-term **maintenance** and repair needs
- Lack of in-house **programming** expertise

Pepper's interactive capabilities are too limited currently. Pepper also fades out as often as every two hours. Additionally, though no major incidents have happened at the pilot venues, Pepper's movements could cause physical damage to visitors. On the flip side, staff noted damage to some Peppers caused by visitors. That means that all Peppers will eventually require some maintenance and repair, but that support has yet to be established. In terms of programming, while it may be relatively simple for some Pepper applications, more creative ones will be challenging and require Choregraphe (or other upgraded) robots. The more sophisticated the programming, the more the Smithsonian likely will need to augment the staff available for this function.



Thoughts on Pepper's Future SI Use

The initial goal of the Pepper pilot program was to gain a sense of what value it could offer the Smithsonian. This study provides many useful insights about beneficial uses and limitations on effectiveness. It raises the next question— *“Now that we have some sense of what Pepper can do, what needs can it effectively help the museums address?”*

Judiciously Deploy “Broadcast” Peppers

At this time, the most feasible application of the current Peppers seems to be “broadcast” messaging, preferably in situations where visitors may be actively seeking the information being provided. For example, it may be helpful to station Pepper outside a temporary exhibition to provide a brief introduction to the show, or at some point along a long security line to explain to waiting visitors why security measures are needed and how they can expedite the security check.

Control on-the-Floor Access

Pepper is fragile, and its interactive functions are easily overwhelmed in uncontrolled situations. Both of these considerations argue for carefully controlling physical access to Pepper. For example, inviting one child at a time to come up and talk to Pepper is likely to produce better results than the typical on-the-floor scenario in which Pepper is mobbed by chattering, jostling kids on all sides. Unfortunately, this may limit the potential to deploy Pepper as a free-ranging curiosity in some of the more crowded, popular museums.

Consider Venue Appropriateness

Pepper unavoidably conveyed a sense of fun to many visitors, but others found that to be inappropriate in certain venues. Museums will need to consider whether making all venues feel more accessible to more people is worth the cost of possibly alienating others. Brand is also a part of this discussion—how important is it to portray the Smithsonian as keeping up with the times?

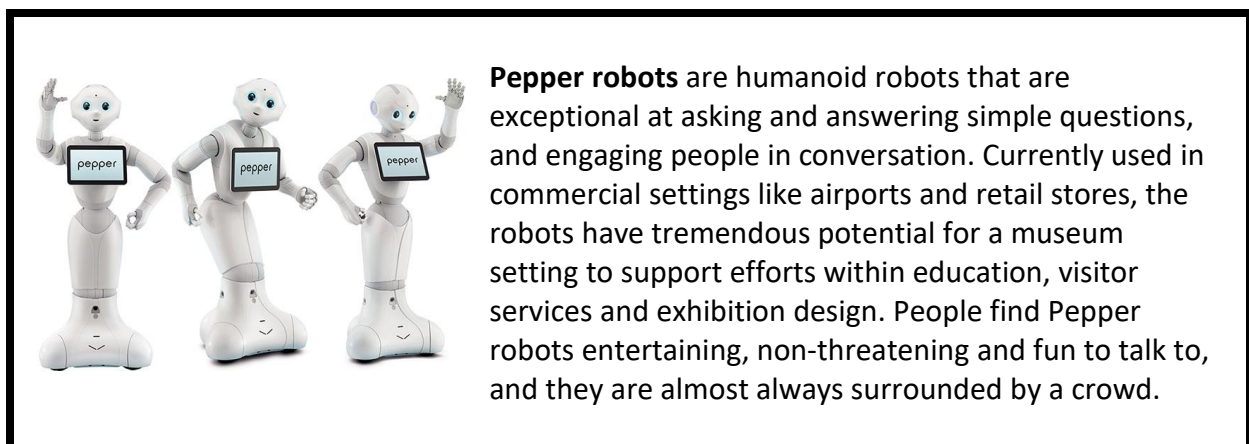
Continue Exploration of Pepper's Programmatic Potential with Creative Applications

As noted, the potential of Pepper as a programmatic “performer” in its own right has not been explored in depth at the Smithsonian to date. It might be worth engaging in an incremental process that begins with simple programmatic applications. Those would be evaluated and the lessons learned shared. Subsequent iterations could involve increasingly complex programming, following the same process.

Appendix A: Pepper Pilot Overview²³

A major donation of interactive humanoid robots to the Smithsonian will be used by the Institution to explore new ways to use technology to engage visitors, provide information and delight and surprise. The donation from San Francisco-based Softbank Robotics -- up to 100 robots for a gift of over \$2.5M – will be rolled out in phases across multiple museums and departments in the next year. At each location, from the Office of Visitor Services in the Smithsonian Castle to the new National Museum of African American History and Culture, to the teen-based Art+Lab program at the Hirshhorn Museum, museum staff will experiment with the robots in different ways. Peppers may be utilized to direct visitors through buildings, work with students in computer programming, answer FAQs and perhaps even teach visitors phrases in Swahili. In each of these pilots, the museums will explore how to best use this new technology to further their mission, give their docents and educators news tools, and create playful and memorable interactions for the millions of children and adults that come through our doors each year.

With this project, the Smithsonian will be one of the first amongst its peers to explore the use of robots in a museum setting for education and visitor engagement. It is an exemplar of the core of the Institution’s new strategic plan, “One Smithsonian,” networking multiple museums and units with new and innovative resources. The project is being helmed by the Arts & Industries Building leadership team, which will act as a central coordination and communication hub to deploy the robots, document best practices, liaison with internal departments, and support colleagues as they test out new ideas to use Pepper in museum galleries and spaces. This is a natural extension of the mission of the Arts & Industries Building, to explore big questions about the future through the lens of creativity and solutions, and to nurture innovation across the Institution.



²³ This document was created by Arts and Industries building staff.



PROJECT OBJECTIVES:

- Showcase the Smithsonian as an innovative, creative, and visitor-centered Institution;
- Support the creativity and professional development of Smithsonian staff by providing tools, resources, and infrastructure to take risks, learn through iteration, and document best practices;
- Incubate and model a successful, collaborative, pan-Institutional Smithsonian project;
- Enhance our educational and visitor services offerings;
- Amaze and educate our visitors.



PILOT SITES

UNIT/CONTACT	CONTEXT	USE
<p>OVS/Castle Sherri Wheeler</p>	<p>The Office of Visitor Services (OVS) recruits and trains all volunteer staff for visitor services desk across the Smithsonian. OVS is based in the Castle where volunteers provide tours of Castle exhibitions and answer questions to visitors about Smithsonian Museums. In addition, OVS supplies volunteers to Units across the Institution.</p>	<p>OVS will explore ways Pepper can:</p> <ul style="list-style-type: none"> - Tell stories about objects on view at the Castle. - Support a teen docent program and allow teens to handle Pepper during summer months. - Support Castle volunteers with tours and FAQ's. - Collect information that helps improve visitors' interaction with volunteers. (i.e., how many times a floor plan for a museum is requested, FAQ's)



<p>National Museum of African Art</p> <p>Michelle Edwards</p>	<p>The National Museum of African Art houses the Smithsonian’s collection of objects and artworks from the African continent. NMAA is very excited to use Pepper to attract more visitor attendance to the museum and to utilize Pepper to help with visitor services initiatives.</p> <p>An overarching question for NMAA is “How can we give Pepper a uniquely African identity?” (have an artist design her clothing, have Pepper speak Swahili)</p>	<p>NMAfA will explore ways Pepper can:</p> <ul style="list-style-type: none"> - Teach people basic phrases in Swahili. - Display African performance to contextualize performance objects on view. - Promote upcoming events. - Support docents with tours. - Supplement signage and help direct and orient visitors.
<p>National Museum of African American History and Culture</p> <p>Jennifer Dubina</p> <p>Esther Washington</p>	<p>The newest museum to open on the National Mall, the National Museum of African-American History and Culture seeks to teach American History through the lens of the African-American experience. Recently turning 1-year old, the Museum has seen staggering attendance numbers, with individuals requiring timed passes booked in advance to access the Museum.</p> <p>The Museum is excited about the potential for a Pepper Robot to help with visitor services, wayfinding, and education programs.</p>	<p>NMAAHC will explore ways Pepper can:</p> <ul style="list-style-type: none"> - Orient visitors who get confused by museum layout. Pepper could be strategically placed throughout the Museum to assist with wayfinding. - Offer a crowd control solution at high volume times. To draw visitors to floors and help disperse crowds, Pepper could attract visitors to visit less-trafficked areas. - Assist docents with providing tours. - Be used in education programs with schools and teachers.

<p>Smithsonian Environmental Research Center</p> <p>Allison Cawood</p>	<p>Located 25 miles from the National Mall on the Chesapeake Bay, the Smithsonian Environmental Research Center serves as a natural laboratory and place for learning about ecological research. The 2,650- acre campus houses a Platinum LEED-certified laboratory, education space, and dock.</p> <p>The education center is open Monday – Saturday, 8:30am -6pm and is staffed by volunteers during the week, with no staff available on Saturdays. In addition to the education center, SERC runs school programs, a yearly Open House event, and a citizen science initiative.</p>	<p>SERC will explore ways Pepper can:</p> <ul style="list-style-type: none"> - Be used to launch a partnership with a local STEM high school to connect students to natural and computer sciences. - Support volunteers in the education center throughout the week with visitor FAQ’s and wayfinding. - Communicate research happening in the SERC laboratory. - Show hiking trails or identification guides.
<p>Hirshhorn Museum and Sculpture Garden</p> <p>Ashley Meadows</p>	<p>As the national museum for modern and contemporary art, the Hirshhorn Museum and Sculpture Garden is world-renowned for the depth and breadth of its collection: a remarkable representation of international modern and contemporary art in all media. The Hirshhorn seeks to redefine the 21st-century museum experience by introducing millions of visitors to emerging ideas in art and technology.</p> <p>The Hirshhorn uses innovative practices to ignite dialogues with visitors in galleries. Gallery Guides are trained educators who roam galleries and ask questions to help visitors connect to artworks, interpret ideas, and see themselves reflected in the work. A Pepper robot could support the</p>	<p>HMSG will explore ways Pepper can:</p> <ul style="list-style-type: none"> - Ignite conversations with visitors by serving as an engaging hook - Help to contextualize art history by providing video, gif, or audio to support gallery guide discussions - Be used in family programs to help connect inter-generational learners

	role of the Gallery Guide by supplementing the experience with a new technology.	
<p>Hirshhorn Museum and Sculpture Garden – ARTLAB+</p> <p>Ian McDermontt</p>	<p>ARTLAB+, housed in the Hirshhorn’s Sculpture Garden is an innovative, award-winning digital learning lab and a free afterschool education program that provides disadvantaged youth, ages 13-19, hands-on experiences with art and technology. The program operates year-round, serving 1,500 unique participants throughout the Washington, DC metropolitan area totaling 3,700 visits annually. The program offers a key outlet for creative expression and has been recognized by the White House.</p> <p>A Pepper robot will help artist educators mentor youth on how to code, program, build apps, and learn computer sciences.</p>	<p>ARTLAB+ at HMSG will explore ways Pepper can:</p> <ul style="list-style-type: none"> - Be used as a teaching tool to help teenagers learn computer sciences

Appendix B: Data Collection Instruments

Pepper Interaction Observation Forms, Different Units:

OVS Observation Form		
Form ID: _____	Duration: ____:____ (min/sec)	
DC Initials: _____	PI Approx. Age: Adult _____ Youth under 7 7 to 10 11 to 14 15 to 17	
Pep-Location: Commons Other: _____	Gender: Male Female Other	
Pep-Type: Host (stories) West wing Rose window Joseph Henry Panda 30 million	Visiting with: Kids _____ Adults _____ Alone	
Date: / / 2018 Shift: _____	Group Total: _____	

Primary interactor	Other interactors	Observers
Touch: Pep body Pep Screen	Touch: Pep body Pep Screen	Take photo: Just P P+self P+other(s) P+S&O Comments Heard: Reactions Seen:
Screen choice: Dance Music Selfie Story Other _____	Screen choice: Dance Music Selfie Story Other _____	
Interaction: Talk to P Ask ? of P Dance with P Watch dance Make music Watch story	Interaction: Talk to P Ask ? of P Dance with P Watch dance Make music Watch story	
Take photo: Just P P+self P+other(s) P+S&O	Take photo: Just P P+self P+other(s) P+S&O	
Comments Heard:	Comments Heard:	
Reactions Seen:	Reactions Seen:	

Other Interesting Observations:

Circle correct choices and fill blanks with numbers.

NMAfA Observation Form

Form ID: _____	Duration: ____:____ (min/sec)
DC Initials: _____	PI Approx. Age: Adult _____ Youth under 7 7 to 10 11 to 14 15 to 17
Pep-Location: Street level Sublevel 3 Other: _____	Gender: Male Female Other
Pep-Type: Promoter (Y/N) Host (stories) _____ Welcome 3D	Visiting with: Kids _____ Adults _____ Alone
Date: / / 2018 Shift: _____	Group Total: _____

Primary interactor	Other interactors	Observers
Touch: Pep body Pep Screen	Touch: Pep body Pep Screen	Take photo: Just P P+self P+other(s) P+S&O
Screen choice: Y N Dance Music Selfie Story Other _____	Screen choice: Y N Dance Music Selfie Story Other _____	Comments Heard:
Interaction: Talk to P Ask ? of P Dance with P Watch dance Make music Watch story	Interaction: Talk to P Ask ? of P Dance with P Watch dance Make music Watch story	Reactions Seen:
Take photo: Just P P+self P+other(s) P+S&O	Take photo: Just P P+self P+other(s) P+S&O	
Comments Heard:	Comments Heard:	
Reactions Seen:	Reactions Seen:	

Other Interesting Observations:

Circle correct choices and fill blanks with numbers.

HMSG Observation Form

Form ID: _____	Duration: ____:____ (min/sec)
DC Initials: _____	PI Approx. Age: <i>Adult</i> _____ Youth under 7 7 to 10 11 to 14 15 to 17
Pep-Location: Lobby 3 rd floor <u>Other</u> _____	Gender: Male Female Other
Pep-Type: Promoter (Y/N) Host (stories) _____	Visiting with: Kids _____ <u>Adults</u> _____ Alone
Date: / / 2018 Shift: _____	Group Total: _____

Primary interactor	Other interactors	Observers
Touch: Pep body Pep Screen Screen choice: Y N Dance Music Selfie Story Other _____ Interaction: Talk to P <u>Ask 2 of P</u> Dance with P Watch dance Make music Watch story _____ Take photo: Just P <u>P+self</u> <u>P+other(s)</u> P+S&O Comments Heard: Reactions Seen:	Touch: Pep body Pep Screen Screen choice: Y N Dance Music Selfie Story Other _____ Interaction: Talk to P <u>Ask 2 of P</u> Dance with P Watch dance Make music Watch story _____ Take photo: Just P <u>P+self</u> <u>P+other(s)</u> P+S&O Comments Heard: Reactions Seen:	Take photo: Just P <u>P+self</u> <u>P+other(s)</u> P+S&O Comments Heard: Reactions Seen:

Other Interesting Observations:

Circle correct choices and fill blanks with numbers.

NMAAHC Observation Form

Form ID: _____	Duration: _____:_____ (min/sec)
DC Initials: _____	PI Approx. Age: Adult _____ Youth under 7 7 to 10 11 to 14 15 to 17
Pep-Location: 3 rd floor 4 th floor <u>Other:</u> _____	Gender: Male Female Other
Pep-Type: Promoter (Y/N) <i>List exhibits Likes specific Simon says</i>	Visiting with: Kids _____ Adults _____ Alone
Date: / / 2018 shift: _____	Group Total: _____

Primary interactor	Other interactors	Observers
Touch: Pep body Pep Screen	Touch: Pep body Pep Screen	Take photo: Just P <u>P+self</u> <u>P+other(s)</u> P+S&O
Screen choice: Y N	Screen choice: Y N	Comments Heard:
Interaction: Talk to P <u>Ask ? of P</u> Dance with P Watch dance Make music	Interaction: Talk to P <u>Ask ? of P</u> Dance with P Watch dance Make music	Reactions Seen:
Take photo: Just P <u>P+self</u> <u>P+other(s)</u> P+S&O	Take photo: Just P <u>P+self</u> <u>P+other(s)</u> P+S&O	
Comments Heard:	Comments Heard:	
Reactions Seen:	Reactions Seen:	

Other Interesting Observations:

Circle correct choices and fill blanks with numbers.

Post-Interaction Survey, Front Side: (interviewer-administered)

Pepper the Robot Survey Summer 2018

Prior to your visit today, were you aware that the Smithsonian had Pepper robots?

No Yes



Did you know Pepper would be at this museum today? No Yes

How would you rate your experience with Pepper overall?

1 2 3 4 5
red green

What did you learn from your interaction with Pepper?

What one word or phrase best describes your experience with Pepper?

What would you change about Pepper to make your experience better?

Form ID

Principal Interactor
 PI's guardian

OVS Commons
 HMSG Lobby
 HMSG 3rd floor
 NMAfA Street
 NMAfA S3
 NMAAHC 3rd floor
 NMAAHC 4th floor



Post-Interactive Survey, Reserve Side: (filled out by respondents)

What is your gender?

- Male
- Female
- Identify differently

What is your age? _____

With whom are you visiting this museum today? [Mark one or more]

- I am alone
- Other adult(s)
- Youth under 18

Where do you live?

- United States. ZIP Code: _____
- Another country. Specify: _____

HMSG Exit Survey:

Q1 Did you see Pepper the Robot?

- Yes
- No

If Did you see Pepper the Robot? = Yes

Q2 Did you interact with Pepper? Select all that apply.

- Yes
- No, but someone else in my group did
- No, but I watched others interact
- No

If Did you interact with Pepper? = Yes
Or Did you interact with Pepper? = No, but someone else in my group did
Or Did you interact with Pepper? = No, but I watched others interact

Q18 How would you rate your experience with Pepper overall?



If Did you interact with Pepper? Select all that apply. = Yes

Q17 Where did you interact with Pepper?

- First floor
- Third floor
- Both locations

If Did you interact with Pepper? = No, but someone else in my group did

Q21 Where did your group interact with Pepper?

- First floor
- Third floor
- Both locations

If Did you interact with Pepper? = No, but I watched others interact

Q22 Where did you watch others interact with Pepper?

- First floor
- Third floor
- Both locations

Q3 Did you use the hi.si.edu web app?

- Yes
- No

If Did you use the hi.si.edu web app? = Yes

Q4 How did you learn about the app? Choose all that apply.

- Signage/displays in museum
- Museum staff
- Hi business card
- Pepper told me about it
- Smithsonian website
- Social media
- Other: _____

Q13 Where do you live?

List of countries

If Where do you live? = United States

Q9 What is your ZIP code?

Q5 What is your gender?

- Male
- Female
- Identify differently

Q6 How old are you?

List of ages between 13 to 100+

Q7 With whom are you visiting this museum today?

- I am alone
- Other adult(s)
- Youth under 18

End of survey

Post-Interaction Interview Guide:

POST-PEPPER INTERACTION—EXPLORATORY INTERVIEW GUIDE

**Note age, gender, activity thru observation.*

Tell me about your experience with Pepper.

Do you remember how you felt when you first saw Pepper?

Why did you decide to approach Pepper?

How did Pepper make you feel?

How does having Pepper in the museum affect your experience?

Have you ever interacted with technology like this before?

What do you think Pepper’s goal is?

Was Pepper helpful for you? How so?

Did Pepper change your plans for your museum visit?

Castle

If you had any questions, how did Pepper answer them?

NMAAHC

Where were you going before you saw Pepper?

African Art

What do you expect to see in the museum now?

Anything specific you look forward to seeing?

Anything specific you’d skip?

Hirshhorn






What do you think about the “hi” webapp Pepper talked about?

Appendix C: Visitor Demographics

		Observation	Post- Pepper- Interaction Survey	HMSG Exit Survey
Age	<i>n</i>	190	87	216
	Under 7	12%	7%	n/a
	7-10	19%	7%	n/a
	11-14	8%	1%	6%
	15-17	7%	5%	7%
	18-20	1%	3%	13%
	20s	9%	16%	32%
	30s	15%	10%	16%
	40s	15%	11%	11%
	50s	7%	20%	10%
	60s	6%	9%	4%
	70+	0%	10%	2%
	Gender	<i>n</i>	172	110
Female		63%	67%	56%
Male		37%	33%	41%
Identify differently		0%	0%	4%
Group Composition	<i>n</i>	182	111	240
	Alone	10%	11%	18%
	Adult group	32%	49%	63%
	Adult with youth group	57%	41%	19%
Residence	<i>n</i>	n/a	106	246
	United States	n/a	82%	87%
	Another country	n/a	18%	13%
	<i>Metro Washington</i>	n/a	30%	22%
	<i>Southeast</i>	n/a	16%	16%
	<i>Mid Atlantic</i>	n/a	21%	15%
	<i>Midwest</i>	n/a	2%	6%
	<i>New England</i>	n/a	2%	5%
	<i>Mountain Plains</i>	n/a	0%	2%
	<i>West</i>	n/a	8%	6%
	<i>Unspecified U.S.</i>	n/a	4%	15%
	<i>Another country</i>	n/a	18%	13%

Appendix D: Post-Interaction and HMSG Exit Surveys Response Frequencies

How would you rate your experience with Pepper overall?

		<i>n</i>					
Post-Pepper Interaction		104	0%	1%	9%	29%	62%
HMSG Exit	Interacted	85	0%	1%	9%	36%	53%
	Group interacted	18	6%	0%	17%	44%	33%
Overall (Interacted)		207	0%	1%	10%	33%	56%
HMSG Exit	Watched others interact	63	5%	2%	37%	37%	21%

Post-Pepper Interaction Survey

Prior to your visit today, were you aware that the Smithsonian had Pepper robots?

<i>n</i>	106
Yes	8%
No	92%

[Among who were aware]

Did you know Pepper would be at this museum today?

<i>n</i>	9
Yes	67%
No	33%

HMSG Exit Survey

Did you see Pepper the Robot?

<i>n</i>	254
Yes	83%
No	17%

[If Yes] Did you interact with Pepper?

<i>n</i>	210
Yes	42%
No, but someone else in my group did	9%
No, but I watched others interact	33%
No	15%

[Among all visitors]

<i>n</i>	254
Interacted	35%
Someone in group interacted	8%
Watched others interact	28%
Didn't engage with Pepper	12%
Didn't see Pepper	17%

[Asked of those who engaged with Pepper]

Where did you/your group... with Pepper?

	Interacted	Group interacted	Watched others interact	Overall
<i>n</i>	85	19	66	170
1st floor	34%	47%	48%	41%
3rd floor	48%	32%	27%	38%
Both	18%	21%	24%	21%

[Asked of all visitors]

Did you use the hi.si.edu web app?

<i>n</i>	252
Yes	10%
No	90%

[If used the Hi app]

How did you learn about the app?

<i>n</i>	24
Museum staff	54%
Signage/displays in museum	33%
Pepper told me about it	17%
Hi business card	8%
Smithsonian website	8%
Social media	0%
Other	4%

[Among all visitors]

<i>n</i>	252
Museum staff	5%
Signage/displays in museum	3%
Pepper told me about it	2%
Hi business card	1%
Smithsonian website	1%
Other	0%

